DEPARTMENT OF THE ARMY
UNITED STATES MILITARY ACADEMY
West Point, New York 10996
July 13, 2000

REPLY TO
ATTENTION OF

Department of Civil and Mechanical Engineering

2000 Premier Award c/o NEEDS
3115 Etcheverry Hall
University of California at Berkeley
Berkeley, CA 94720-1750

I respectfully submit my engineering courseware, the West Point Bridge Designer, for consideration for 2000 Premier Award. Enclosed are 12 copies of the application package.

Thank you for your consideration, and thank you for your support of this award program. It is a superb incentive for promoting excellence in educational software development.

Stephen J. Ressler, P.E., Ph.D.
Lieutenant Colonel, U.S. Army
Professor and Deputy Head

Cover Letter

The West Point Bridge Designer

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The West Point Bridge Designer is a computer-aided design (CAD) software package developed to introduce students to engineering through the design of a steel highway bridge. The software provides an engaging, hands-on civil engineering design experience that demonstrates how practicing engineers design real structures. Given a realistic set of design specifications, the user models a bridge, tests it for structural adequacy, and optimizes it to minimize cost. Version 4 of the software requires an IBM-compatible personal computer running Windows 95 or better; Version 3 requires Windows 3.1 or better.

This courseware has been added to the NEEDS database. It can be downloaded from the USMA web site at http://www.dean.usma.edu/cme/outreach/WPBD/download.htm. The size of the zipped setup file is approximately 5 megabytes.

Stephen J. Ressler is the sole author of the West Point Bridge Designer. He is authorized to submit the software for the Premier competition.

Ressler is employed by the United States Government, and the West Point Bridge Designer is considered to be a product of the Government. Therefore, it is considered to be in the **public domain** and cannot be copyrighted. The software has been distributed as "freeware" for the past three years and has already achieved wide dissemination.

Stephen J. Ressler authorizes NEEDS to become a non-exclusive distributor of this courseware as submitted.

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The West Point Bridge Designer

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Background

About six years ago, I attended a balsa wood bridge-building contest that was run by our Student Chapter of the American Society of the American Society of Civil Engineers. The participants were all undergraduates, and quite a few were not engineering majors. Prior to the event, each participant had designed and built a balsa bridge. During the contest, we loaded all of the bridges to failure in a testing machine, and the bridge with the highest strength-to-weight ratio was declared the winner. We all had a great time. The students thoroughly enjoyed the hands-on experience and, based on my conversations with them, many left with a heightened level of interest in structural engineering.

But did they really *learn* anything about structural engineering through their participation in the contest? The implications of this question are significant, because many K-12 and undergraduate engineering programs use similar bridge-building projects as integral components of their curricula. After some reflection, I reluctantly concluded that the learning value of our own contest was minimal at best. Indeed, if our students *did* learn anything, what they learned was probably wrong. In practice, the balsa bridge-building experience bears little resemblance to the process that practicing structural engineers use to design real bridges. In my view, the inconsistencies are quite significant:

- *Engineering design is an inherently iterative process.* The bridge-building project necessarily involves only a single iteration.

- *Engineering design should be a creative process.* In my experience, the competitive format and load-to-failure assessment of the completed balsa bridges seems to encourage an excessively conservative, non-creative approach to design. Students are afraid to take risks, for fear of being embarrassed in the competition.

- *Engineering design is founded on the application of math and science to problem-solving.* But in our bridge-building contest, the non-engineers did not have the tools to apply math and science to their designs; instead, most of them found a picture of a bridge and attempted to replicate it as a balsa wood model. The bridges that performed best were constructed by students who had some model-building skill, not by those who followed a rational process or who had developed an appreciation for structural behavior. A few of the engineering students tried to apply their knowledge of mechanics to their designs but, for the most part, they were frustrated by the experience. The behavior of balsa wood structures is extremely difficult to predict analytically—much harder than steel or concrete ones—so the engineering students found that the design tools they were learning in class did not seem to work on a "real" project.

- *Structural engineering generally involves designing a structure to carry one or more code-specified loadings. Success is achieved if the structure carries the load safely, at minimum cost.* In the balsa bridge contest, students design for maximum strength-to-weight ratio—thus, the loading is variable—and success can only be determined by breaking the bridge. But engineers *never* design structures to fail; they design structures to stand up!

Balsa bridge-building is fun. But from an educational perspective, it may be counter-productive—at least when implemented in the flawed format we used for our contest.

As a direct result of this observation, I decided to develop a computer software package that would use the power of *simulation* to address the inconsistencies cited above, while retaining the obvious benefit of the balsa bridge-building project—its ability to motivate students toward further study of engineering. I began work on the West Point Bridge Designer in 1995 and used it for the first time in our undergraduate statics course in 1996. In 1998 I placed an updated version on our web site[1], for free distribution to students and educators. The response has been quite positive. I know of 28 colleges and universities that have used the software in their courses in the past two years. Hundreds of middle schools and high schools are also using it, though it has long since become impossible for me to keep track of them all. Since 1998 I have received over 500 unsolicited e-mail messages providing positive feedback and suggestions for further improvements to WPBD. Largely as a result of this input, I have just released the fourth major version of the software this month.

Target Audience

The West Point Bridge Designer was originally targeted toward two different student populations:

- High-school and middle-school students, and
- First-year undergraduate engineering students.

These students remain the principal audience for the software. However, since its dissemination began in 1998, WPBD has found a much broader audience, including:

- Students in upper-division undergraduate and graduate civil engineering courses,
- Engineering practitioners, who use the software in support of career guidance and outreach programs, and
- Non-profit organizations that promote the advancement of science and technology education.

In response to the needs of this broader audience, I have included some enhancements to the engineering content in the most recent revision of WPBD. The instructional objectives, however, remain focused on the original audience of secondary school and first-year engineering students.

Objectives

The four principal educational objectives of the West Point Bridge Designer are as follows:

- To introduce students to engineering and the engineering design process;
- To provide a realistic, engaging, hands-on civil engineering design experience that demonstrates how practicing engineers design real structures;
- To demonstrate how engineers use the computer as a tool to improve the effectiveness and efficiency of the design process; and
- To provide a tool for visualizing structural behavior.

The software has one additional, non-instructional objective: To honor the United States Military Academy at West Point—the first school of engineering in the United States.

[1] http://www.dean.usma.edu/cme/outreach/WPBD/download.htm

Description of the Software

When a student uses the West Point Bridge Designer, she will experience this sequence of events:

- At startup, the student is presented with a choice of seven different design projects, all of which involve the design of a truss bridge to carry a two-lane highway across a river. Each project represents a set of pre-defined site constraints—span length, support conditions, maximum height, and minimum clearance over the river.

- Once the student has selected a project, she can immediately begin creating her design. She creates a *structural model* by drawing *joints* and *members* on the screen with the mouse. Templates and sample designs are available to help the new user create a stable structure. The site constraints—span, supports, and height restrictions—are built into the user interface for each design project. Thus it is virtually impossible to violate the design specifications. Even users with limited computer skills have little difficulty achieving a successful first design iteration.

- Once this first attempt at a structural model is complete, the student clicks a button to initiate a simulated *load test*. During the load test, the student's bridge is subjected to the weight of the truss itself, the concrete bridge deck, the asphalt road surface, and a standard, code-specified truck loading (amplified by the appropriate load factors).[2] WPBD automatically calculates the maximum internal force, tensile strength, and compressive strength for every member in the structural model. Each member is then checked for structural adequacy.

- As soon as these computations are complete (normally in just a few seconds), WPBD displays a full-color, 3-D animation of the load test. The student's bridge is shown deflecting, first under its own weight, then under the weight of the truck as it drives across the span. The actual computed displacements are shown, but they are exaggerated by a factor of ten. This feature helps the student see how member *deformations* result in global *displacement* of the structure. As loads are applied, the members of the truss change color—blue for tension and red for compression—and the intensity of color is directly proportional to the magnitude of each member's force-to-strength ratio. Thus the user can see vividly (1) how the truss carries load and (2) how heavily each member is loaded, just by carefully observing the variation of colors in the animation. If all members in the truss are strong enough, the truck successfully crosses the span. But if any member is inadequate, it "fails" at the appropriate point in the animation, and the structure collapses into the river.

- Once the simulation is complete, the student returns to the "drawing board" to continue her design. If any members have failed the load test, their properties can be changed to increase their strength. The designer can choose from three materials (three different grades of structural steel), two cross-section types (solid bars and hollow tubes) and 35 different member sizes. After changing member properties, she can run the load test again to determine whether or not the changes are adequate.

- Once the design passes the load test, its is *successful* but not *optimal*. To optimize her design, the student must *minimize the total cost*. WPBD automatically calculates and cost of the truss and displays it in real-time. The cost algorithm is a reasonably realistic one that accounts for the contributions of material, fabrication, and construction cost.

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[2] American Association of Highway and Transportation Officials, *1994 AASHTO LRFD Bridge Design Specification (SI Edition)*, 1994.

- In seeking an optimal design, the student has complete freedom to modify the shape and configuration of the truss. She can also run the load test at any time, to ensure that the strength is still adequate for each new design iteration. The variation of color in the load test animation provides a powerful visual tool for guiding the structural optimization process. When the color of a loaded member is intense red or blue, but the member does not fail, it is optimized (or very nearly so).

- It is possible for the student to work through the design process entirely in a trial-and-error mode. After she gains experience, however, she will find that she can get better results if she takes advantage of various numerical data—load test results, mechanical properties of members, and detailed cost calculations. All are available at the click of a button.

- WPBD also includes an extensive Help utility that integrates two distinctly different pedagogical functions—informing the student on how to use the software, and teaching her about the engineering design process.

- Once the student has completed her design, she can access a "Best Scores" web site,[3] to see how her performance compares with WPBD users from all over the world. If the cost of her design ranks in the top ten for any of the design projects, she can e-mail a copy of it to the webmaster and have her name posted on the scoreboard.

WPBD and its supporting help file are intended to be self-contained. There are no supplemental user's manuals or instructor's guides. Many teachers who use the software have developed their own supporting lesson plans and web sites, tailored to their specific courses and objectives. A number of these are referenced in the discussion below.

Instructional Strategy

The instructional strategy on which the design of WPBD is based includes the following elements:

- The software attempts to achieve educational *depth*, at the expense of *breadth*. The scope of the problem-solving experience is intentionally narrow; but the simplicity of the user interface allows the student to carry her design to a very high level of refinement in a relatively short period of time. Substantive engineering content is readily available (in Help) to further enrich the largely qualitative design experience.

- The software is designed to provide an *inductive* learning experience—one that introduces engineering concepts through a very specific application, but leads the user to a more general understanding with continued use.[4]

- The software is designed to appeal to *visual* learners, who are often ignored by traditional engineering instruction.[5] Creation of the structural model is accomplished entirely in a graphical mode—the user never needs to touch the keyboard. The load test animation also provides rich graphical feedback on the performance of the design. (However, appropriate numerical feedback is also readily available for *verbal* learners.)

[3] www.dean.usma.edu/cme/outreach/WPBD/best.htm
[4] Felder, Richard M., "Reaching the Second Tier—Learning and Teaching Styles in College Science Education," *Journal of College Science Teaching*, 23 (5), 286-290.
[5] Felder, 287.

- The simulated load test and real-time cost calculation provide rich, accurate *performance feedback* on demand. In a larger sense, availability of the "Best Scores" web page provides users with normative feedback, with respect to a large, diverse population of bridge designers.

- The software attempts to establish a *high-challenge, low-threat* learning environment. The design experience is *low-threat* because even new users can achieve a successful design—one that passes the load test—with little difficulty. The experience is *high-challenge* because it is impossible to create a truly optimal design without studying the Help utility, doing lots of design iterations, and carefully analyzing the cause-effect relationships between design modifications and structural performance. New users often think WPBD is a video game; but as they continue working with the program, they discover that they cannot earn a spot on the "Best Scores" page without rolling up their sleeves and learning some engineering.

- To prevent learner frustration, WPBD attempts to eliminate all of the features that so often make industry-standard computer-aided design (CAD) software so intimidating to new users. The WPBD drawing space is automatically scaled for each design project; the drawing grid is fixed, and there is no scrolling. "Snap to grid" is always on. Also WPBD uses "bounded input" wherever it is feasible to do so. To the greatest extent possible, the program prevents input errors that would result in the creation of a problematic structural model or a violation of the design specifications; e.g., it is impossible to draw a joint above the maximum allowable height, and it is impossible to draw a member without "attaching" it to a joint.

How the Software is Used

At USMA

At USMA, we use the West Point Bridge Designer for an out-of-class project in our introductory Statics and Dynamics course, taken by approximately 200 students per semester. The students are sophomore engineering majors and junior humanities students, taking the course as part of a mandatory core engineering requirement. In the project, students are required to:

- Analyze a truss bridge using classical manual methods.

- Create a model of the same truss in WPBD, and run the load test.

- Compare the manual and computer results, and explain any differences.

- Optimize the WPBD design, with bonus credit awarded for achieving certain performance standards.

- Answer a series of "critical thinking questions," designed to assess students' understanding of truss analysis and design.

Outside of USMA

In the past three years, I have corresponded with hundreds of WPBD users—teachers, students, and engineering practitioners—in the U.S., Canada, Australia, Germany, England, New Zealand, India, Indonesia, Mauritius, and Hungary. For this broader and more diverse population of users, it is difficult to characterize the full scope of successful educational applications of the software. A small but representative sample follows:

- Dr. Forrest Holly, Professor of Civil Engineering at the University of Iowa, uses WPBD as part of a homework project in his undergraduate statics course. He asks his students to develop and submit three alternative designs for a particular bridge, along with an essay describing the process they used to develop their designs. (A copy of one such student essay is provided in the Appendix.)

- Lieutenant Colonel Bill Sowry, a civil engineering professor at the Australian Defense Force Academy, uses WPBD in an introductory engineering course taken by arts and sciences students. "They find it terribly enjoyable," he says, "and it has had a positive impact."

- Bill Freudenberger, a physics teacher at Nakomis Regional High School in Newport, Maine, asks his students to develop bridge designs in WPBD as a prelude to a bridge construction lab in his applied physics course.

- Angelo DeCarli, a teacher at Stafford High School in Stafford Springs, Connecticut, uses WPBD as part of his course in architecture and construction technology. His students design bridges with the software, then the entire class works through a manual solution of the structural analysis.

- Bill Blankenagle, the technology teacher at Bountiful Junior High School in Bountiful, Utah, used WPBD for a project in his course. Several of his students continued to use the software long after the course was over and, ultimately, submitted several superb designs to our "Best Scores" web site. They received formal School District and School Board recognition for their efforts.

- Larry Riccardo, a technology teacher at Belvidere Junior High School in Belvidere, Illinois, uses WPBD in the computer lab in his introduction to technology course. "My students love it!" he reports. "What a great teaching tool for covering both engineering concepts and the design process."

- For a typical example of how WPBD is used in a 9th grade technology course, see the Bishop O'Neill Technology Education web site at http://www.k12.nf.ca/bishoponeill/TECH.htm

- Ceil Hunt, the Technology Coordinator at Fair Haven Grade School, uses WPBD with students in Grades 3 to 6. They design and test a bridge, print it, copy the design onto graph paper, then use these "plans" to build a bridge out of pasta.

- Christine Balonek, an 8th grade student, was building a wooden bridge for her technology class project. She discovered WPBD on the Internet, downloaded it, and used it on her own initiative to learn about more about structural behavior. She subsequently won the bridge-building competition with a structure that held 296 pounds. "Thank you for such a wonderful, educational, and helpful tool," she writes.

- Several students told me they used WPBD as the basis for their self-initiated science fair projects. These students typically studied the influence of various bridge configurations on cost.

- Dr. Loren Zachary, Assistant Dean of the College of Engineering at Iowa State University, used WPBD as part of a training program for pre-service elementary school teachers.

- A team of engineers from Steinman, a major bridge design firm, used WPBD as a "Take Your Child to Work Day" activity. One of the team members writes, "A

couple of 9 year olds figured out all by themselves that they could only make the bridge work if it was all triangles!"

- Mr. Michael J. Jelen, P.E., a bridge engineer, uses WPBD as part of his training program for new engineers who are learning bridge inspection and rating. "The software has been the source of some productive discussions," he reports.

- In 1998 the West Point Bridge Designer was featured as part of an exhibit called "Breaking Through: The Creative Engineer" at the National Building Museum in Washington, D.C. The Curator, Dr. Robert Friedel, was introduced to the software by one of his interns, a graduate student from Rice University. The software is currently in use in a number of other museums and science centers across the U.S.

Assessment of Effectiveness

Feedback from Users

In assessing the effectiveness of the West Point Bridge Designer, first consider an indirect but important measure—the widespread use of the software and the consistently positive feedback from a broad spectrum of users, from third graders though engineering practitioners. Of over 500 unsolicited e-mail messages and letters I have received about WPBD, there were only a handful of complaints—all about the lack of a Macintosh version of WPBD. A few asked technical questions. All of the remaining messages were positive, and many provided useful suggestions for improving future versions. Such feedback certainly does not establish that the software is contributing to *student learning*, but is does demonstrate that WPBD is *valued* by students and educators alike. (See the Appendix for a summary of user comments.)

Much of this feedback also helps to validate the educational strategy on which WPBD is based. For example, Dr. Terry Miller from the University of Tennessee contributed the following:

> *I think this is the best software in engineering that I have seen. The program presents a challenging task, it is engaging (especially the truck loading test graphics), it presents a lot of analysis data in a concise format, and it provides the student with an excellent example of how engineering design improvements often come about through an iterative process. You obviously have thought through the process nicely, providing a means for the student to try out different ideas, obtain 3 useful printouts of results, and a drawing of the bridge….*

Endorsements by Professional Societies

In the spring of 2000, the Educational Activities Department of the American Society of Civil Engineers (ASCE) formally endorsed WPBD as an educational tool. The ASCE announcement reads,

> *The Educational Activities Department of the American Society of Civil Engineers (ASCE) proudly endorses the West Point Bridge Designer program. This nationally acclaimed software provides students with an exciting and engaging learning experience, based upon completely authentic engineering design and analysis procedures. ASCE, America's oldest national professional engineering society, commends USMA, the nation's first school of engineering, for providing students with this superb tool for exploring the creative world of engineering.*

Furthermore, in 1999, the Steel Structures Education Foundation of the Canadian Institute of Steel Construction publicized WPBD to all Canadian schools of Civil Engineering and promoted it as a valuable educational tool.

Direct Assessment of Student Learning

When we use WPBD as part of our course project in Statics and Dynamics at USMA, we routinely survey our students to determine the learning value of the intervention. The results of this survey for the Spring semester of 1999 are shown below:

Question	***Average Response*** *1 (not at all)-5(very well)*
How well did WPBD…	
…help you understand the engineering design process?	3.89
…help you understand how a truss works?	4.09
…stimulate your interest in engineering?	4.41

These results are quite positive, especially considering that many of these students are non-engineering majors taking a mandatory engineering course. The survey also asked students to provide any additional comments about the learning experience. Many of their responses provide strong evidence that the learning objectives of WPBD are being achieved. Two typical examples:

> *I better understand how varying the thickness, placement, and length of members influences the price and strength of the structure.*

> *If you just messed around on the program, you could figure out some basics about trusses and bridges. But the "Help" was a godsend! Under "Help" you could work at your own pace, and figure out all sorts of neat things.*

Feedback from users outside of USMA provides some powerful indicators that use of the software is positively affecting student learning, performance, and motivation. For example, John Driscoll, an 8th grade technology teacher in Rochester, New York, wrote me to provide feedback on the software. He concluded his message with, "We are going to build models of the bridges and enter a state competition through Technology Student Association. I will contact you after the competition to let you know how we fare." A few months later, this follow-up arrived:

> *I sent an e-mail to you this past winter thanking you for the bridge builder program. In my letter I explained that I hoped that the program would develop skills that my students could use when they built their bridges for the state competition. Thanks in part to your program, Alan Mattice of Rochester NY is the New York State Technology Student Association State Champion for bridge building. Thank you again.*

Jim Hayes, an engineer for Kvaerner Metals also describes some very positive learning outcomes at an engineering outreach event:

> *The annual National Engineers' Week Presentation at the Carnegie Science and Technology Center was held in Pittsburgh this weekend. Once again, your program was a great success for the children, students, parents, and volunteers…. We had tons of positive feedback from everyone regarding the Bridge Designer program. Some of the unique, workable designs the kids came up with were remarkable. Many of the kids also went beyond the basic workable solutions. They were able to comprehend the aspects of structural optimization of the fabrication and construction costs. It was a joy to see the smiles on their faces when they printed a copy of their final design and their name appeared on the drawing as the designer.*

WPBD also has changed some students' attitudes. For example, a high-school senior named Mark Deeter wrote, "This program has helped influence my decision to go into electrical engineering."

Summary of How WPBD Addresses the NEEDS Courseware Criteria

Instructional Design

Interactivity

WPBD facilitates learning about design by providing the learner with the opportunity to *do design*—not just to read about it or watch someone else do it. The design problem is realistic, but sufficiently narrow in scope to be achievable in a single sitting. The learner is entirely in control of the pace and process of the problem-solving experience. In the course of designing a bridge, *every* choice the learner makes has an impact on the quality of the design. The user can obtain immediate feedback at any time in the design process, via automatic cost calculation and the simulated load test.

Cognition/Conceptual Change

Assessment data indicate that students who use WPBD acquire high-quality insights about the design process and about structural behavior. Students who use WPBD subsequently perform better on projects involving the design and construction of physical model bridges, even when the project requirements differ substantially from the WPBD scenarios. Students who use WPBD report that the experience substantially increased their interest in engineering.

Content

The scope of the content is intentionally narrow, in order to achieve greater depth in the learning experience. The WPBD Help utility is built around a graphical *design process model* that serves as a framework for learning. (See "How to Design a Bridge" in the WPBD Help file.) The elements of this model are linked to in-depth explanations and supplemental information elsewhere in the Help file.

Multimedia Use

The graphical "drawing board" on which the user creates a structural model uses carefully designed colors, lines, and shapes to communicate information clearly and efficiently. For example, the *color* of a member represents its *material*. The *weight of the line* represents the *member size*. *Solid lines* represent *solid bars*; *double lines* represent *hollow tubes*.

The "drawing board" is divided into two panes, one showing a picture of the truss and one showing a list of its components. The split screen allows for simultaneous display of graphical and alphanumeric representations of the design. The two panes are linked together for all aspects of model creation and optimization; e.g., clicking a member in the list also selects (and highlights) that member on the picture.

The load test animation provides a rich, graphical representation of the simulated performance of the bridge design. The continuously changing colors of the truss members illustrate how the structure carries load and provide immediate visual feedback about both structural safety and optimization.

Instructional Use/Adaptability

To promote effective instructional use, the extensive WPBD Help utility informs users how to use the software and also provides in-depth instructional material about engineering design. The adaptability of the software to different learning environments is clearly demonstrated by the widespread use of WPBD by a broad spectrum of students, educators, and engineering professionals. The software continues to evolve, based on the many suggestions provided by users.

Software Design

Engagement

WPBD presents an interesting problem that requires total user involvement to solve effectively. The challenge of minimizing cost has proved effective in retaining users' interest. The "Best Scores" web page provides a powerful incentive for users to pursue higher levels of performance.

Learner Interface and Navigation

The design of WPBD Version 4 was heavily influenced by Alan Cooper's superb book on user interface design.[6] The interface includes numerous aids for inexperienced users—a "wizard" to initiate a new design, sample designs, templates, tool tips, and a design process model ("How to Design a Bridge") in the WPBD Help file. WPBD also provides hints to help intermediate users find and use the program's advanced features. Hints are provided in both the Help file and a "Tip of the Day" dialog box. WPBD also provides 3-level undo/redo, and a "Go Back" feature that allows users to revert to any previous design iteration. This unique feature greatly enhances the structural optimization process and provides a readily accessible "history" of the evolution of a design.

Technical Reliability

WPBD 3 (the previous 16-bit version of the software) has been in use for over two years and has demonstrated very high reliability. It has been used successfully on PCs from 386 to Pentium III, and on operating systems from Windows 3.1 to Windows 98 and NT 4.0.

WPBD 4 (the new 32-bit version) has only been available on the web for one month. Thus I am somewhat less confident in its reliability, though no significant problems have been reported to date.

Neither version has been tested in Windows 2000.

Engineering Content

Accuracy of Content

The technical content of WPBD is embedded in (1) the nature of the engineering design process experienced by the user, (2) the structural analysis methodology, which is an implementation of the standard Direct Stiffness Method, and (3) the loads, load combinations, and member strength models, which are taken directly from the AASHTO Bridge Design Specification. For the sake of simplicity, however, the provisions of the AASHTO Specifications are not fully implemented in WPBD; e.g., earthquake, snow, and collision loads are not considered in the simulated load test.

In the spirit of full disclosure, all deviations from a fully authentic structural design methodology are explained in the Help file, under the heading "What is Not Realistic About WPBD".

Organization of Content

The WPBD Help file provides a complete Table of Contents, a comprehensive index, and a Glossary of key terms. Related topics are appropriately hot-linked together.

Conclusion

The West Point Bridge Designer is a well-established, high-quality educational software package that has already made substantial contributions to K-12 and undergraduate engineering programs worldwide. But the best is yet to come. Currently, the United States Military Academy and the American Society of Civil Engineers are co-sponsoring a project that will use WPBD as the vehicle for a nationwide engineering design contest for K-12 students, to commemorate the Bicentennial of West Point and the 150th Anniversary of ASCE in the year 2002. Through this ambitious venture, we hope to further exploit the value of the West Point Bridge Designer as an educational tool.

[6] Cooper, Alan, *About Face: The Essentials of User Interface Design*, IDG Books, 1995.

Appendix

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Appendix 1. Student essay, submitted by Scott Therkelsen as part of a Statics project at the University of Iowa (provided by Dr. Forrest M. Holly)

Scott Therkelsen
#6-0668
Section 32

BRIDGE DESIGN COMPETITION – A Narrative Story

I started my design process by just diving in, the program seemed simple enough. I put joints in places that seemed to make mathematical sense, and to me, they looked like they would afford could support. Speaking of afford, let me reassure you that I spared no expense on my first design. Thus, it was gratifying to have my trial run support the truck load – but at a whopping $6000!

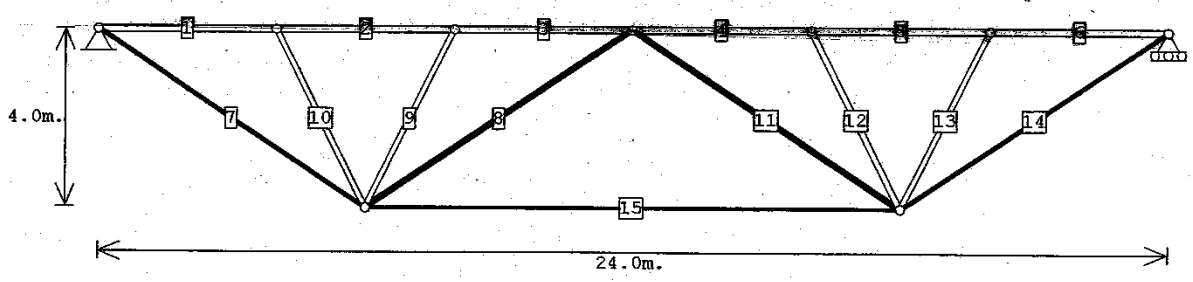
So I decided I needed a little more method to my madness, I needed a better plan. I read through the demo and help information in order to find the added tips I would need to succeed. My new goal, far from my original dreams of shattering the posted records, was to at least halve the cost of my original design (this turned out not to be too challenging). After reading some help materials, I decided I needed to design a bridge with good symmetry. This would lead to more identical size/shape members which drastically cut down my costs. After almost every change, I would rerun my design to make sure it still worked; if it didn't, I would unchange my adjustment. So next, after I came up with a more symmetrical rough draft, I decided that an important choice in my bridge would be the choice of materials. This is when I discovered I could get the details of tensile strength, etc, for each type of member. As I suspected, the aluminum alloy proved most worthy for use as a tensile member. It's still a toss up as to which of the other two is the better compressive member – it's largely dependent on the situation. Anyway, I played with my design for a long time, ultimately deciding not to quit until I got the cost down under $2500. After 68 iterations, I was successful and decided to take a break and plan an attack for my next design.

My logic for the next design goes as follows: Probably this guy named Howe and others who have bridge designs named after them knew more about bridge designing then I am currently aware of. So I decided to take a big step and "stand on the shoulders of giants;" more precisely, I decided I would rip off the general idea and fine tune it to my own liking (I don't think this violates copyright laws or anything). Either way, the ethical dilemma was short-lived and I proceeded to make a very sturdy, expensive outline of a famous bridge type. I then quickly tested it to make sure it worked. Also, although I suspected which members were in tension already, the test helped to confirm which members I should be using aluminum alloy on. It then consisted of a lot of "playing" and fine-tuning on my part. I'm still not to happy with the materials I had to use for "ground level" on my second bridge, as they seem to be very expensive. Yet I played for 53 iterations and just could not find anything that worked for cheaper. Bridge #2 was my most successful bridge, as it had the lowest cost and did the job. COST: $2,091.24
Compared to the records of around $1600, this isn't bad for my first day!

I was a little upset that the assignment required only solutions for one of the five types of bridges, because I'm interested in the other problems though probably not enough so to do them on my own time anytime soon without them being assigned. So I decided to figure out a question I've had for some time: How can a bridge support weight from above – what's pulling up? It always seemed counter-intuitive to me to build a bridge with supports above instead of below. I wondered how this worked and what tensile and compressive forces were in action? So I got a rough design and played around another 27 times until I got my bridge to around $2200, then I was just stumped as to how to get it cheaper and said, "good enough!" It was very educational to see how this particular design type worked, and though I enjoyed my second design more, I feel I may have learned more through this variation.

Hopefully my little narrative has been sufficient (both for its entertainment value and my grade). I think this project was very much worth the time and effort and would encourage any classes covering related material to get hold of this simple, yet addictive "game." I know it proved very instructional to me, and I shall continue to better my current record (whenever I get some free time from my Statics Essay)!

Appendix 1 (continued). Student bridge design, submitted by Scott Therkelsen as part of a Statics project at the University of Iowa (provided by Dr. Forrest M. Holly)



TRUSS MEMBERS

#	Member Size (millimeters)	Matl	Length (meters)	#	Member Size (millimeters)	Matl	Length (meters)
1	140 x 140 x 7	HSS	4.00	9	120 x 120 x 6	CS	4.47
2	140 x 140 x 7	HSS	4.00	10	120 x 120 x 6	CS	4.47
3	140 x 140 x 7	HSS	4.00	11	120 x 120	CS	7.21
4	140 x 140 x 7	HSS	4.00	12	120 x 120 x 6	CS	4.47
5	140 x 140 x 7	HSS	4.00	13	120 x 120 x 6	CS	4.47
6	140 x 140 x 7	HSS	4.00	14	60 x 60	Al	7.21
7	60 x 60	Al	7.21	15	60 x 60	Al	12.00
8	120 x 120	CS	7.21				

NOTES:
(1) All member sizes in millimeters.
(2) All member lengths in meters.
(3) CS = Carbon Steel
HSS = High-Stength Steel
Al = Aluminum Alloy

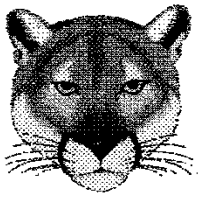
Herman Haupt Memorial Bridge
Main Truss Elevation

Cost: *$2,492.15* | *04-20-1999* | *#68*

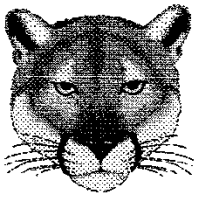
Designed By: *Scott Therkelsen*
Project ID: *2*

1

Appendix 2. Letter from Benny R. Justice, Middle School Technology Teacher



Evans Middle School
1 Evans Drive
Newnan, GA 30269
770-254-2780
FAX 770-254-2783



Department of Civil and Mechanical Engineering
LTC Stephen J. Ressler, P.E, Ph.D.
or his replacement
United States Military Academy
West Point, New York 10996

Dear Dr. Ressler,

My technology lab uses your software program, West Point Bridge Designer Version 3.01, as a part of our problem solving classes. The students thoroughly enjoy the program. Even my unenthusiastic students work hard on the bridge competition.

Some of my students are asking for a copy of your program. I understand that it is not copyrighted, but a sentence does contain the words: "Intended solely for educational use." I am asking permission to make a copy of your program for any student who asks for a copy.

If you need any additional information, you may call the school at 770-254-2780, send a fax to 770-254-2783, or send an e-mail to my school: bjustice@coweta.k12.ga.us or e-mail to my home Brjustice@aol.com.

Thank you in advance.

Sincerely,

Benny R. Justice
Technology Teacher

Appendix 3. Letter from Robert A. McRae, High School Technology Instructor

DEAR LT. COL. RESSLER,

SEVERAL MONTHS AGO I WAS GIVEN A 3.5" COMPUTER DISK CONTAINING THE "WEST POINT BRIDGE DESIGNER" SOFTWARE. I WOULD LIKE TO THANK YOU FOR PROVIDING IT TO US FOR USE IN OUR TECHNOLOGY CURRICULUM.

I TEACH INTRODUCTION TO TECHNOLOGY AT THE DODGE COUNTY HIGH SCHOOL IN EASTMAN, GEORGIA. WE HAVE A QUARTER of A MILLION DOLLAR TECHNOLOGY LAB WHERE IN STRUCTURAL ENGINEERING IS ONE of OUR WORK MODULES.

THE ADDITION of YOUR SOFTWARE HAS ENHANCED THE LEARNING SITUATION IN THE AREA of BRIDGE DESIGN PRIOR TO USING YOUR SOFTWARE ALL WE COULD DO WAS DESIGN OUR BRIDGES ON PAPER THEN CONSTRUCT THEM OUT of 1/8" SQUARE BALSA WOOD STICKS. I HAD A SPARE COMPUTER W/ 4 MB RAM SO I INSTALLED ANOTHER 4 MB RAM & SET IT UP FOR USE IN OUR STRUCTURAL ENGINEERING MODULE.

THE STUDENTS LOVE YOUR SOFTWARE & ITS DIFFICULT TO GET THEM TO SHUT DOWN AT THE END of THE CLASS PERIOD. I HAVE THEM CREATE THEIR DESIGN ON GRAPH PAPER THEN AFTER MY APPROVAL THEY ENTER IT INTO THE COMPUTER. STUDENTS ARE FASTENATED BY THE EASE AT WHICH THEY CAN BUILD THEIR BRIDGE ON THE SCREEN. THE EDITING CAPABILITIES ARE VERY WELL DONE AND ARE A VITAL PART of THE SOFTWARE. THE LOAD TEST IS GREAT AND IT ALLOWS THE DESIGNER TO DROP BACK & RE-STRUCTURE — — LOOKING FOR WEAK POINTS IN HIS DESIGN.

THE TRUCK DRIVING ACROSS THE BRIDGE IS VERY UNIQUE AND INTERESTING ESPECIALLY WHEN THE BRIDGE FAILS. THE RED MEMBERS HELP

THE BEGINNING DESIGNER LOCATE HIS PROBLEM AREAS. WE USE THE PRINTER TO PRINT OUT THE DESIGN & DATA FOR THE SUCCESSFUL BRIDGE.

AS THE INSTRUCTOR I USE THE PRINTOUTS AS ILLUSTRATIONS IN OUR DAY BY DAY ASSIGNMENT ACTIVITIES. I WILL DESIGN A BRIDGE THAT HAS SOME FLAWS IN IT, THEN PRINT OUT A COPY OF IT & USE THE PRINT OUT AS A PROBLEM SOLVING ACTIVITY.

THE MATERIALS COST FEATURE IS ANOTHER GREAT FEATURE. I USE IT TO PLACE A MONETARY RESTRICTION ON A BRIDGE. STUDENTS HAVE TO DESIGN THEIR BRIDGE TO STAY UNDER A PARTICULAR COST CEILING. THIS IS A DETERMINING FACTOR IN THE DESIGN PROCESS

ALL THE HELPS PROVIDED & THE GLOSSARY MAKE THE WEST POINT BRIDGE DESIGNER A FIRST CLASS PIECE OF ENGINEERING SOFTWARE. THE DESIGN PROCESS IS WELL SERVED AND THE LEARNER IS A HAPPY CAMPER. EXCITED ABOUT WHAT HE CAN ACCOMPLISH IN ONE OF HIS TECHNOLOGY EXPERIENCES.

AGAIN THANK YOU FOR PROVIDING US WITH SUCH A FINE PIECE OF SOFTWARE.

SINCERELY

Robert A. McRae

TECHNOLOGY INSTRUCTOR

DODGE Co. H.S.

EASTMAN, GA.

Appendix 4. E-mail message from Dr. Terry L. Miller, University of Tennessee

Ressler, S. LTC C&ME
From: tlmiller@utkux.utcc.utk.edu [SMTP:tlmiller@utkux.utcc.utk.edu]
Sent: Friday, April 17, 1998 1:01 PM
To: is8874@trotter.USMA.EDU
Subject: Bridge Design Software

LTC Ressler:

I wish to extend my compliments on the excellent job you did in writing the software," West Point Bridge Designer". I think this is the best educational software in engineering that I have seen. The program presents a challenging task, it is engaging (especially the truck loading test graphics), it presents a lot of analysis data in a concise format, and it provides the student with an excellent example of how engineering design improvements often come about through an iterative process. You have obviously thought through the process nicely, providing a means for the student to easily try out different ideas, obtain 3 useful printouts of results and a drawing of the bridge with minimal effort. The student can learn many important concepts through trial and error while minimizing the need for a lot of tedious calculations (better done by the computer). Well Done!!

I do have 1 suggestion for improvement. In your Load Test Results table you have 2 columns for "Status". If the member fails you show the mode of failure: "Yields" or "Buckles" and an "OK" if the member does not fail. I suggest that you replace the "OK" with a ratio of the strenth of the member divided by the applied force as given in the 2 preceeding columns, for each case of compression and tension. This ratio would be equal to the safety factor in the design. At the bottom of the table you could report the lowest safety factor in the design. This would allow students to quickly find oversized (large safety factors) members and establish an overall minimum safety factor for each design. Providing the safety factors, (especially the minimum value at the end of the table) would allow professors like me to use your program as a homework problem while constantly changing the problem statement using different minimum safety factors in their design. I hope you agree with the merits of this suggestion and add the safety factor calculation. The students could do the calculation with the data the program provides, but with 75 members in a bridge, the calculation would be tedious and slow down the learning process.

Just so you will know that I have spent some time using your program, I have attached 3 files which show designs that would qualify for your "Best Designs" listing as of 4/17/98. The designs are for the Casey Bridge and the Meigs Bridge. The file SARC4536.BDF is a particularly weird design which is a combination suspension bridge with arch spans. PLEASE DO NOT INCLUDE MY DESIGNS ON THE "BEST DESIGNS" PAGE. LEAVE THIS FOR THE STUDENTS.

I hope you will continue to develop design/education software. You are obvious good at it. Maybe you could add a bridge crossing configuration that would be good for a suspension bridge design. Also if you ever decide to make the Visual Basic code available to others, I would like to get a copy. It might make a good basic starting point for the development of other design/education software for things like buildings (test for wind load or earthquake load).

Thank you again for making this program available (on the web and at no cost) so students and faculty may benefit.

Dr. Terry L. Miller, Ph.D.,P.E.
Associate Professor
Civil and Environmental Engineering
University of Tennessee
Knoxville, TN. 37996-2010
tmiller3@utk.edu

Appendix 5. Summary of Feedback from Users of the West Point Bridge Designer

I recently used your program, WP Bridge Designer, in two workshop sessions, each with twenty 9^{th}-11^{th} graders. The workshop was part of the Explorations in Science, Math, Engineering, and Technology program which was sponsored by the Wisconsin Center for Academically Talented Youth (WCATY). In this workshop we discussed trusses, equilibrium of forces, material strengths, and costs. We then used WP Bridge designer to develop a stable truss, then had a competition to design the cheapest long span arch truss. The students enjoyed working with WP Bridge Designer. Everyone was able to develop a stable bridge quickly and were soon working on optimizing for cost. A few of the more advanced students even used the member property tables to choose their members. In fact, the largest complaint of the students was that they wished they had more time to use the program.

Tony Lamanna

The West Point Bridge Designer program is awesome. When I arrived at my office, I had several people download it. We will all spend the weekend playing with it.

Dr. Charles Thornton, P.E.
Thornton-Tomasetti Engineers

[My students] have already learned more about truss designs, buckling, yielding, compression, tension, and loads than I could have gotten them to learn otherwise.

John E. Pollock
Middle School Technology Teacher,
Oklahoma

Pretty good site, man. The bridge maker thing is something we did in class, and they told us where to download it from. I just downloaded it, and it is very cool, and fun to play around with. Keep up the good site, dude!

Farmyard2@aol.com

I want to thank you for putting together a program which meets all of the basic criteria I have for educational computer programs. Too often, educational programs are just problems with solutions and offer no substantive advantage over just using problems in a textbook. Your program is fun (my 9 and 12 year old boys have been having a ball with it!), encourages creativity, and has enough hidden information that it really encourages questions (Why are some of the members blue and some red when the truck drives over it?). As a teacher of engineering mechanics, a public school science and math program volunteer, engineering merit badge counselor, and enthusiastic mechanical engineer, THANK YOU!

J.R. Zaworski P.E., Ph.D.

I run the Boston Society of Civil Engineers outreach program, sending engineers to schools to talk about our profession. I am thrilled to have your program available to our engineers and students.

Lisa Ackerman, P.E.
Boston, MA

Your program is great and it is doing its job….teaching us about principles and problems of bridge construction…. Your program is probably the best program of its kind I have seen.

Barry Blutreich
Computer Teacher, Yonkers, NY

I am Vice President of the Oklahoma Technology Education Association. I also write curriculum for the Oklahoma Department of Vocational-Technical Education on occasion. I'd like to redo our state Structural Engineering curriculum to use your software, if that's OK.

John E. Pollock
Technology Teacher, Oklahoma

I am the curator for an exhibition that the National Building Museum in Washington is preparing, entitled Breaking through: The Creative Engineer. One of our interns, a graduate student at Rice University, sent us a copy of the West Point Bridge Designer, and we are very impressed! Indeed our momentum toward finishing the exhibition has been visibly slowed by our tendency to spend too much time improving our bridge designs! Congratulations on a fine and accessible program…. Might we have your permission to make this program available to our museum visitors on [our computer workstations]?

Robert Friedel
Exhibition Curator

I would like to obtain permission to add a direct link to the WPBD Home page from The North Carolina Department of Public Instruction web site. I have been using the WPBD software with my middle school Exploring Technology classes and would like to include a link with a short lesson plan that will be on the NC DPI site. Thanks for the wonderful software. The students love it. So do all the teachers who have seen it being used.

Michael Kelley
Wake Forest-Rolesville Middle School

My students love your software, and it's difficult to get them to shut down at the end of the class period…. The West Point Bridge Designer is a first-class piece of engineering software. The design process is well served, and learner is a happy camper—excited about what he can accomplish in one of his technology experiences.

Robert McRae
Technology Teacher, Eastman, GA

As a practicing professional engineer designing bridges on a full-time basis, I can appreciate what you have put together. I am proud to see West Point contributing to the influence of future engineers by producing such a program.

Bob Parker
Burgess & Niple, LTD

My students have enthusiastically received this software. I used it on an 8th grade orientation night recently. It made quite an impression!

Greory Quaglio
Technology Teacher, Chester, NJ

I made [the West Point Bridge Designer] available to two of my nephews, who stopped using their Super Mario and Whack-a-Mole software for several days, in an attempt to out-design each other.

Michael Kane, P.E.
Riverside Technology

I have gotten down to a design for $1684 on my 113th iteration. My students are having a lot of fun trying to beat me. The competition is a good motivator for their learning.

Dr. Jim Smoot, P.E.
Professor, University of Tennessee

I have played with your program and enjoyed it. I plan to pass your letter on to several key contacts in the local engineering community.

Bob Johnson
PR Chair
Structural Engineers Assoc. of Illinois

My nieces (10 and 11 years old) experimented with their designs for hours and came up with some very interesting and structurally sound—if not very practical—bridges. I was a little surprised how quickly they started to recognize where the problems were and what to change to stabilize the design.

Glenn Champion
Georgia Tech Research Institute

We used your Bridge Designer for last week's Engineer's Week Open House. The kids loved it, and we gave them all copies to take home with them. A co-worker announced the other day that his son liked the Bridge Designer better than Nintendo. Great praise, I'd say.

Rob Field
Structural Engineer, NY

Before this we had been using an old DOS-based bridge design program. Your program is so much better and more realistic. The students are more enthusiastic and enjoy using the software very much…. You have made an investment in the youth of Georgia.

Michael Scoggins
Technology Teacher, Trion, GA

I really like this program, and I think I will get a lot out of it. I plan to make bridges at home and save them to disk and bring them to my teacher for extra credit.

Brian (pSyChO KiD)

Thanks for showing that engineering can be fun.

Derek L. Rhodes
Structural Engineer, Pennsylvania

I attended a county bridge seminar at Purdue, and your program was shown as part of the course. I find this program very entertaining. My 12 year old and 8 year old enjoy it also.

Todd Leinbach
Superintendent,
Starke County Highway Dept., IN

My junior high students are enjoying the program and learning valuable skills while they work.

Danny Yates
Technology Teacher, Guthrie, OK

[Your software is] especially useful for outreach efforts to local schools that our Section does once or twice a year.

Peter Perry
Secretary, ASCE National Capitol Section

Although the *ASCE News* said that your bridge package is for high school, I find it a refreshing break using it at BSGU.

Stephen J. Krone, D.Sc., P.E.
Bowling Green State University

I've only had a short time to play with the program, but from what I can see it is FANTASTIC.

Mark Mincieli
Technology Teacher, Suffolk Co., NY

I am a civil engineer and was looking for something to do with a local grade school to introduce them to engineering. This is it.

Mike Deer
Civil Engineer

Great heuristic learning experience. Wish they had stuff like this when I was an undergrad.

Tim

My structural design class will use your Bridge Designer program for a design competition…. The students will be rewarded with extra credits for the course and a pizza for the winning team.

Dr. Karen Chou
University of Tennessee

My students are continuing to flock to our computer lab and have fun trying to beat each other (and all outside competition) in having the lowest-cost bridge…. Several have expressed to me how much they have learned about the influence of geometry and material properties on structural design, resulting from the iterative use of the WPBD software.

Dr. Jim Smoot, P.E.
University of Tennessee

I teach technology education classes in the middle school, and I know our students will benefit greatly from this program.

Greg Smothers
Technology Teacher, Missouri

This is a wonderful program and I am lost for words to describe the enthusiasm that it has created. I have made this part of my course this year and announced it as a competition…. I have been teaching structural analysis for 26 years and your program has truly been a breath of fresh air. Congratulations on providing such a brilliant program. You have made a great contribution to education

Jeffrey P. Laible
Professor, University of Vermont

Just wanted to say thanks for developing the bridge designer software. I am a civil engineer myself and this is very interesting and a lot of fun, not to mention educational. My 7 and 9 year old boys have been playing with it all weekend. They are learning a lot from this. This is great!!

Kenneth Odom

This program is a great tool. In my Physics class (High School). We are building Balsa Bridges, and this simulator has provided a great deal of information on bridge design and stresses. Thank You.

Ken Fodero

I am a civil engineering student from Hungary at the University of New Hampshire.
The reason I am writing to you is because there is a bridge design simulation program called 'Westpoint Bridge Designer'. I have just played with it at an exhibition and I loved it.

Tamas Horvath

I love your program. I downloaded it and have spent countless hours trying to best the top scores. I have yet to make it on the list. Everyday I get a few dollars closer, however.

Matt Baker
University of Kentucky, CE major

Students have been fascinated with the software. Thank you for making it available over the network.

Dr. Abhijit Nagchaudhuri
Associate Professor
University of Maryland Eastern Shore

I am a student in Luxembourg, Europe who recently downloaded the West Point Bridge Designer from your website. As I will shortly begin an Engineering course at university in England, I find it very interesting.

Oliver Wright

Thank you so very much for your motivational web site!!! Junior high students get SUCH a CHARGE out of seeing their names posted at your site!!!! Last year Andrew Garcia and Matt Ruma both received School District AND School Board recognition along with a nice award for doing so well on your competition! This competition had made a life change for both of them! Both their parents could be no more pleased!
Thank you for keeping this page active for all to enjoy!

Bill Blankenagle

Love your West Point Bridge Designer. Very easy to use and does a great job. I use it in my Statics class. Thanks for your effort and the excellent price.

Alex Beattie
Modesto Junior College

I just looked at your best scores page for your bridge designer software. Wow!! The competition has gotten pretty stiff. I will have to try to get some of our students to spend some time and see if we can get University of Tennessee higher on the list. The junior high and high school students on your list might make good future recruiting candidates. It looks like your software is getting good use as intended.

Dr. James L. Smoot, PE

I think your software is excellent and educational on so many levels

David Fraser

Your bridge building program and offer to post scores has created a great deal of excitement in my class. My students are working towards beating the bridges listed on the scoreboard. We hope to contact you soon with a winning design. Thanks again for taking time to encourage my kids.

Anita Wells
Technology Instructor

I am currently student teaching at Litchfield High School in Litchfield CT. I had heard about WPBD from a friend at the local college. We loaded it at the school for one of the middle school classes which shares our lab. When my Engineering Graphics students found it they immediately started trying it out. I ended up giving them a design challenge and a day to work with the software. It was a great success. It is a great piece of software. I spent a few years in the computer field before finishing my teaching degree. I have seen some very good software and some very bad software. Much of the software geared for education falls on the bad side of the spectrum. Your software is miles ahead of most of the commercial software sold for education. Thanks for making such a great product for free.

Andrew Staves

Please allow me to thank you for the creation of CME-Truss, West Point Bridge Designer, and Trebuchet. After spending several days on and off playing with them, I have found them to be excellent educational programs for young and old engineers. I was very impressed with the real world look and feel of the programs. If anything, the programs in current professional use are not as advanced in their visual impact.

R. Kenneth Wassall, PE, LS
Town Engineer, Canton, CT

I am a high school computer teacher at the Elizabethtown-Lewis Central School. I use you bridge program in my 7th grade computer class. I think that it is a really great program.

Jason Colby

I just wanted to drop you a note that we will be featuring your software in our learning center at www.bridgesite.net. We are very impressed by it.

Shane Rixom
Bridgesite.net

Tonight, I found the Bridge Design Software site by chance while mu ddling around on the USMA server and I wanted to say that I greatly enjoyed it a great deal. In fact, I made sure to publicize it's existence to the newsgroups of 'misc.transport.road' and 'sci.engr.civil', so as to encourage other psuedo (and real) engineers to try their luck with bridge design. Perhaps this software will be re-distributed (freely and without any copyright infringement) on several bridge related sites soon. Great job with the software

Rush Wickes

I've been using the program for two years in my middle school Technology Education classes as a Technology Learning Activity (TLA). My students really enjoy building and testing the bridges. They are required to build one of each type/size and to build one at the lowest cost.

George Beaver
Whittier Middle School

Thank you for writing this wonderful software. I use it with my technology education students at Belvidere Jr. High School (Belvidere, IL). It is being used in a computer lab situation. My students love it! What a great teaching tool for covering both engineering concepts and the design process. I was asked to put on a presentation at the Illinois Technology Education Conference this November in Peoria, IL. With your permission, I would like to present on using WPBD in the jr. high classroom. I would explain the software, go over how I use it in my classroom, and inform participants about your web site. Thanks again.

Larry Riccardo

I teach High School Civil Engineering at Sickles High School in Tampa Florida. This is a great program for use in the classroom, I introduced the program on Thursday the first day of school and there is more interest in this than in SimCity that I also use as a reward in the Program.

Tom Wakeland
Sickles High School

I am a program area assistant at COSI Toledo, a body's-on science museum in Toledo, Oh. I am in the engineering section of the museum, and I just downloaded your bridge building design program. WOW! We really love it.

Sarah Weis bach

I just wanted to offer a quick thank you for the Bridge Designer. I am the Visiting Military Fellow in the Civil Engineering School at the Australian Defence Force Academy and have now used WPBD for a couple of assignments for my students. In particular I use it in a 'general education' subject for arts and science students to give them a little background into engineering. They find it terribly enjoyable (the adverse side effect is that they spend too much time playing this rather than their other work) and it has had a positive impact. I hope you believe imitation is the sincerest form of flattery, it is a great product and a great contribution to engineering education. Your recent award was well deserved.

Bill Sowry
LTCOL, Royal Australian Engineers

Your software, WPBD, is quite good, in fact I prefer it to some of the commercial programs. I want to thank you for producing such a quality instructional program. Some of my other colleagues in Georgia public education have requested the program.

John Carver

On behalf of the Department I want to congratulate you for developing Bridge Designer. Is being used here as the prime example of what civil engineers can do and junior high and high school students love using it! Very quickly (after obtaining a successful design) they compete for the cheapest version. Once again congratulations on developing a very good teaching tool.

Juan B. Valdes
Professor and Department Head
University of Arizona

I've got another bridge for you! It's not a top three, so I wouldn't normally bother sending it in, except it was designed by a girl in one of my Grade EIGHT (13 year olds!) classes, and it looks like the top scores list could use a couple of female names on it!

Jason Brett
David Thompson Secondary School
Vancouver, British Columbia

I work for the Iowa Department of Transportation, in the Office of Bridges & Structures. I am very impressed with your truss bridge program and I would like to link to it from our office homepage if that is agreeable to you.

Stuart Nielsen

Your very fascinating bridge building and testing simulation program has come to our attention from Dr. Mike Bartlett of the University of Western Ontario…. The Steel Structures Education Foundation, of which Dr. Bartlett is a member of the Board of Governors, is interested in making the program known to instructors at Canadian schools of Civil Engineering.

Mike Gilmor, P.Eng.
Manager of Operations,
Canadian Institute of Steel Construction

Thank you very much for the bridge design software. It is indeed very informative, interactive, and a must tool for younger students to explore more on civil engineering. My son finds it very interesting. Your effort is very appreciative and would like to express my sincere thanks.

Shilak Shakya, PE

I am a Technology Teacher Education student at BCIT in Vancouver, BC. I recently came across your WPBD program searching the web while attempting to create a class program that incorporates both material testing and bridge designing for an upper level high school class. It is far and away the best bridge designing program I came across.

Tyler Bradford

I recently found and downloaded the *West Point Bridge Designer, Version 3.0* from the Internet to aid me in my 8th grade technology class project of designing and constructing a wooden bridge…. My bridge, with the help of your bridge designer, held up 296 pounds, which was the most weight out of all the participants in the 8th grade…. I would like to sincerely thank you for such a wonderful, educational, and helpful tool that you made available through the Internet. I will continue to use it as a learning tool and am very positive many others will, too.

Christine Balonek

Last quarter I used your program in a senior engineering drafting class at the high school level. I found it fun and interesting, and also challenging at the same time. Even after we have turned our bridges in for grades I still find myself interested in the program and how to achieve a very low cost.

Steven Smith

Yesterday's "Take Your Child to Work Day" at Steinman was a complete success. We had 15 kids, age 5 to 13, and we set up a computer in the area where we were building a suspension bridge model, so that they could take turns and switch back and forth between activities. They all had a great time playing with your Bridge Design program, and a couple of 9 year olds figured out by themselves that they could only make the bridge work if it was all triangles! I was impressed by how easily they learned to use the program, with almost no direction from the adults. By the way, my own 3½ year old loves it too and was making his own (all garbled) bridge too, although, of course, for him the best part is when the bridge breaks under the truck !

Maria Bruschi

I have also used the Bridge Designer to introduce freshman engineering students to the design process and the benefits of teamwork. A colleague used it this semester for the senior capstone design course as a semester kickoff project. It's a great tool, and speaking for those of us with limited resources at SUNY, thanks.

Douglas J. Daley, P.E.
Assistant Professor
Environmental Engineering

I am the technology teacher of Matt Ruma and Andrew Garcia, two 9th grade students that recently made your best scores list for a 44 meter bridge using Bridge Designer. I want to thank you for the effort you put forth in maintaining the web page honoring the people that excel with your bridge designer application! These two students are beyond excited, as are their parents, by seeing their names posted on the Web! Thanks for the great program and providing it at no cost for education!

Bill Blankenagel
Bountiful Junior High School

I have been experimenting with the 3.0 Bridge Designer program. It is very motivating. I would like to use it with my physics students. I run a Bridge Building Contest for physics 11/12 students here in Vancouver BC. It has run for almost twenty years (and several hundred students!) and recently won an award from the Prime Minister of the country for excellence in science and technology.

Peter L. Vogel
Notre Dame Regional Secondary School

We got to use this program at our local children's museum here in Indianapolis. It was being demonstrated along with other civil engineering related booths but this one grabbed my six year old's attention. He just loved it so much that I just wanted to thank you for making this available and who knows what impression this program of yours might have had.

Donald Schweitzer

The bridge building software that you people designed is marvelous.... it has been both a valuable learning experience and a lot of fun for my physics class. Posting top designs on the web site is also rewarding, as it offers the student quantitative design goals to work towards.

Ted Rupe
Physics Teacher, Maplewood High School

We are technology teachers from West Babylon Middle School and High School on Long Island. We are quite pleased with the Bridge Designer.

Dom and Patt Squicciarini

I teach 8th grade Technology at Gates Chili Middle School in Rochester N.Y. Most of what I teach follows an Engineering approach. The West Point Bridge Designer fits perfectly into my educational goals. Most of the computers that I have in my Technology lab are 486's with about 16 meg. All of which were donated from businesses that I approached. All of the software and hardware that I find must be shareware or very inexpensive. I have seen programs that are similar to your bridge designer that sell for over $2000.00 for a lab pak of fifteen, the West Point Bridge Designer is over all a far superior program. I would like to thank the people involved for producing a great program that benefits education and the children of our nation. The students cannot get enough of the program. We are going to build models of the bridges and enter a state competition through Technology Student Association. I will contact you after the competition to let you know how we fair. As a former Marine, I am proud to use a program that was developed by the first school of engineering - The United States Military Academy at West Point.

John Driscoll

I sent an e-mail to you this past winter thanking you for the bridge builder program. In my letter I explained that I hoped that the program would develop skills that my students could use when they built their bridges for the state competition. Thanks in part to your program, Alan Mattice of Rochester N.Y. is the New York State Technology Student Association State Champion for bridge building. Thank you again for the use of your program.

John Driscoll

I think my favorite thing about the program was that it has a really strong appeal for many of my students who are not as academically gifted as Bernard. The immediate feedback and graphic display of data got many of the less gifted students excited as well. We installed the program on the library's network, and the librarian reported that students who had almost never set foot in the library before were coming in at lunch and after school to use the program. Some of them weren't even in my classes... they just thought the program was cool. The program has also got staff and administration coming by to ask about it (and give it a try!) From my point of view it got the students talking about compression, tension, buckling and yielding. They were forced to consider that different materials had different properties, and that different shapes had to be used for different applications. This is coming in very useful, as we are now doing a traditional bridge building contest using wood and welding rods. I've done this project with students in the past, and I can already see that this year's designs (after working with WPBD) make a lot more sense than in other years. Anyway, I really appreciate the work you've put in to this program. It's a great teaching tool, and has opened many of my student's eyes to the basics of structural design. It was especially nice to be able to give them a copy of the program to take home and put on their home PC, as well as to have a program that worked on the old 386's in my lab. I've been busy passing your web site out to technology teachers across B.C. A few have already downloaded it and are quite excited by it. Thanks again... I've had a lot of fun with WPBD too... even though my personal best of $1711 got whupped by my students!

Jason Brett
David Thompson Secondary
Vancouver, BC

I heard of the West Point bridge design software from, Neil Kay, who is a lecturer at the Department of Civil Engineering, the University of Hong Kong. I am having interest in your design and hope very much we can have the software downloaded. We intended to select a software for structural analysis purpose as a teaching tool for a group of students who are shortly to be surveyors. Thank you so much.

Stella W. J. Luk
The University of Hong Kong

I am a Middle School Technology Teacher at El Segundo Middle School in California. I teamed up with another local tech teacher and worked on a collaborative class project with her. We incorporated your Bridge Builder software into the design brief. Thank you for making your software accessible for all. My students LOVED it! Here is a link to our bridge project website.
http://www.bnet.org/hvsd/bridges/ http://www.bnet.org/hvsd/bridges/

Thank you again,
Paola Hellwig
ESMS Technology Teacher

I have recently discovered your program WPBD3, and am most impressed with it.
I'd like to use it as part of my course on introduction to computers at the Grade 10 level.

Dr. Dallas Hinton
Computer Science / Career Preparation

I am a Brazilian exchange student living in Bakersfield, CA. The Bridge Designer is very good, even better because it is freeware, and I am using it on a Science project: Toothpick bridges. We are using the software to design ours that support the truck and are the less expensive.

George

Thanks for making WPBD 3.0 available on the web! A student told me how much he enjoyed the program and encouraged me to try it. I've enjoyed it, but more important, many students have, too. Some have been inspired to spend hours aiming for a functional low-cost design on the 24-meter trusses, and have had fun doing it. The quality of the program is so impressive, I'd like to hear a little bit about how it was developed, so I can do more than guess at the great amount of work that it represents.

Alan W. Rice, Ph. D., P.E.
Professor of Mechanical Engineering
Grove City College

Thanks very much for access to this program. The use of this program is a terrific enhancement to the Bridge Design and Construction activity that I put my 7th grade Technology Education classes through.

A. Fusco

I heard about your web site from an engineer friend of mine who lives in Boston. My daughter had a project in her high school physics class to build a spaghetti bridge, so we downloaded your software. It was SO helpful to her!! She learned so much from trying different designs, recognizing the effects of tensile and compressive stresses, and understanding loading forces. Her project isn't due in her class until tomorrow, but I told her that regardless of how much weight her bridge holds until it breaks, she has learned so much by using your software that the project has been a success for her. I just wanted to write you and tell you how much we appreciated being able to have access to your software. Thanks for making it available! P.S. Our whole family has had fun designing bridges all weekend!!

Mary L. Mercer

Hi. I'm a computer engineering student at the University of Toronto. Here, the Civil Engineering department has incorporated your program into assigned problem sets for its first year statics class. My personal opinion is that your program is outstanding.

Sergio Valle

I want to personally thank you for the use of this software. I teach Technology Education at Putnam City West High School in OKC, OK. This web site was given to those of us that teach Tech. Ed. in OK. My students really enjoy designing bridges in class. After they do a few, they like competing/comparing their bridges with each other. Presently we build bridges out of balsa or pine strips. In the future I am going to have everyone design one on WPBD, Print it then build it. Thanks again.

Artie Lowery

I teach CAD at the Sound School Regional Vocational High School in New Haven, CT. Many of my students have done great designs on your Bridge Designer - Thank You.

Ned Costello

Some time ago, I downloaded the West Point Bridge Designer. Many of my engineer friends and I have been fascinated and educated by this program. I have used it in my dealings with some of the young people in this community (Baton Rouge).

Stephen Spohrer

I just wanted to take a minute to express my sincere thanks for such an excellent opportunity -- the opportunity to provide my students with the excellent software you and your team have included on this site. I am very excited to learn of this site, and to be able to provide my students with the much needed skills embedded in this software. Keep up the great work!

James Burris, Technology Education
Modular Technology Lab Facilitator

I just discovered your wonderful program at a tech-lab instructors workshop that I attended last week. I plan to use the program with my technology students this year. I have found it to be a tremendous program that is very user friendly. You have done an excellent job with it.

Mark Cheesbrough
Frederick Middle/Senior High

I'm planning to use WPBD this fall in an introductory course targeted at freshman engineering majors and non-engineers interested in engineering... it's the best way I've found to illustrate the iterative nature of design. I'll let you know how it goes. The course homepage is: www.ruf.rice.edu/~spieler/RICH200)

Christof Spieler
CE Graduate Student
Rice University

This is a good chance to tell you how much I have enjoyed playing with the bridge design program you developed. The local chapter of ASCE has given scores of copies on disk to local schools. My nine year-old daughter enjoyed making bridges and watching them fail. The program is a wonderful tool for catching the imagination and teaching basic structural skills and, I must admit, I have spent hours optimizing different configurations. It is an excellent program. Thanks.

Jeff Keating

My children and I are captivated by your bridge design program. I am a PE, however, my background is environmental, not structural. I comprehend very little about structural design, however, your program has opened my eyes to what is actually happening as a load is placed on a bridge. It is intriguing to me to see the results of strengthening or weakening a member or changing the design (I always liked what if? analysis). And the added dimension of cost is very eye-opening. We live in Pittsburgh, a Mecca for bridges. I have tried to point out various aspects to my children as we travel over bridges. Your program has helped me understand and therefore explain better. My children also are enjoying your program. It is a great stimulation to their minds and their interest in the field of engineering. Thanks for developing your program and making it accessible to the masses!

John M. Quinlisk