



TIM LAMORTE/RIVERTOWNS ENTERPRISE

J.P. Kaminski works with eighth-graders on Jan. 25.

8th-graders test bridge-building lessons

By Kris DiLorenzo

Ordinarily, the sight of a bridge falling apart isn't a fun experience, but over the past two months, eighth-graders at Dobbs Ferry Middle School have taken another view.

In design teacher J.P. Kaminski's four classes, 50 pairs of students built their own truss bridges — out of Popsicle sticks — and then tested them to rate their efficiency in withstanding the weight of traffic. A pizza awaited the pair whose bridge demonstrated the most efficiency, which occurred last Thursday, Jan. 25.

Truss bridges are familiar to Westchester residents: the original Tappan Zee Bridge, opened in 1955, and the Bear Mountain Bridge, opened in 1924, are examples. The sides of all truss bridges are composed of triangles in various configurations, because the triangle is the strongest geometrical shape.

Using AutoCAD (computer assisted drawing) Inventor software, students chose from a half dozen templates to design their bridges. For construction, they were limited to specific materials, such as water-soluble glue (no epoxy or resin-based glue), and had to stay within a \$2,000 fictional budget. The bridges also had to meet stringent standards: no more

than 100 Popsicle sticks, 16 inches to 20 inches in length, and a roadbed at least 3.5 inches wide. Any height was acceptable.

Kaminski also encouraged decorating. On Jan. 25, one pair of students presented a deep-blue bridge, another a silver-coated one, and Thalia Levine and Chloe Lebreton showed up with a Day-Glo orange span.

Levine explained their arresting color choice. "I wanted it to stand out. Before,

it was tall, but it was a bit generic. I spray-painted it at night in the yard, wearing a headlamp."

The girls chose the "Warren with verticals" style, which had vertical sticks interspersed in the latticework of triangles. They added a crosspiece in the middle of the bridge for extra support

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Bridges

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on the sides, and "to do something a little different," Levine said.

Kaminski, who also teaches design to the sixth and seventh grades, tested the bridges with a homemade contraption, refined during his 16 years at the school. On a tabletop, two blue bins filled with water flanked an oblong hole cut out in its center, where each bridge was placed. A 6-inch-long piece of wood, representing a car, rested on the bridge's roadbed.

Each blue bin was rigged with a spigot at the bottom, attached to hoses that poured water into a green trash bin positioned near the table. A screw hook through the center of the car was attached to a second hook below it. A jump rope attached to the second hook was tied around the ends of a 2-by-4-inch piece of lumber that rested across the top of the green bin, and around its two side handles. In effect, the green bin was suspended from the car.

As the water level rose in the green bin, its weight exerted tension on the bridge. When a bridge couldn't take any more weight, it broke down.

The bin full of water was then weighed to see how much weight the bridge had tolerated, after which a sump pump returned the water from the green bin to the blue ones.

The snazzy paint job didn't help the Day-Glo span. It reached its limit at 60.5 pounds, then splintered. The blue bridge crashed through the hole in the table at 66 pounds. Another lost its roadbed.

The amount of weight a bridge supported didn't decide which pair won the pizza. The winning bridge was determined by its efficiency ratio, established by dividing the water's weight by the bridge's weight.

Jacob Sellitti and Adam Schwartz, both



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Students add weight to a bridge by adding water to a green bin.

of Dobbs Ferry, fared better than many of their classmates. Their "Warren with verticals" bridge withstood 106.2 pounds, and achieved an efficiency rating of .309. "We wanted a bridge that wasn't too tall, so it had a lower center of gravity," Schwartz said.

"Vertical supports with diagonal focal points make it stronger," Sellitti explained, demonstrating with two sticks. "It's a lot harder to break a Popsicle stick if it's vertical rather than horizontal."

"We've used 13,000 sticks so far this year," Kaminski noted. "I go on my lunch hour to Michael's craft store."

Besides the efficiency of their bridges, students were graded according to several other criteria: staying on task, cleaning up, not wasting material, planning their drawings, and aesthetics. A bridge that withstood 120 pounds of pressure, as indicated by a yellow line painted inside the green bin, earned an "A". If the water level in the bin rose above the line to 130 pounds, its builders were rewarded with an "A+".

Dylan Klein and Aaron Morgounovski were the eighth grade's high scorers. Their

"Warren with verticals" bridge withstood 190 pounds of stress and weighed .35 pounds, giving it an efficiency rating of 543.

They chose their design "because it looked sturdier than the others," Klein said. "We added a horizontal beam on the bottom, because that's where all the weight is," Morgounovski explained. "The center is the weakest point of a bridge; you need to splint that area as much as possible," Kaminski elaborated, "and they're only allowed three layers of sticks on the bottom."

The winning pair was "super-precise and particular about following the design to the letter," he said. "Their bridge was so even and symmetrical — it was just terrific."

Kaminski has appended an extra element to the bridge project: time for students to reflect on what they've accomplished, and respond to a question of the day focused on bridges.

"This project couldn't be more relevant," he said. "I try to get through to my students that in our lifetime, I don't know if we will see a larger bridge construction project than the Tappan Zee Bridge."