

Believe in Your Ideas and Have Faith in Success.

By Corporal Willy 5/28/2012

Question first; Can you come up with a crazy idea and make it work even though you might have had several failures along the way? The Answer; Yes, you can.

This is what happened to me about six months back when I was asked to do the “Introduction to Engineering” at our University for a whole bunch of young people that were invited guests for the day. I did this at the University of Nevada Las Vegas or UNLV. I had to come up with ideas that would start the young people into thinking about technical careers and eventually study at our University. I had to use cardboard and Elmer’s Wood Glue to make structures that the students would test and record the results. There was an amazing amount of cooperation from the young people and the results that were obtained were startling. In fact, one of my test structures produced a World Record in a New Category. In brief, it was a little stool weighing only 9.5 ounces that was able to resist an astounding static force of 1,113 lbs of weight before yielding to this load.



This started a whole new round of planned projects to get young people in the middle school years interested in engineering. (seed planting) Now that little stool would be hard to top as a world record so I had to come up with something else and try to be inventive and creative to capture their imaginations with. Hhhmmmm! It wasn't too long afterwards when I came up with an idea about having the next group I was going to introduce to engineering, build a bridge. This group would be all young girls who aren't normally given much inspiration to become engineers. Federal mandates are creating the atmosphere for

increasing the numbers of women engineers. Okay, so what I needed is something pretty spectacular, interesting to do and on a grand scale. I got to work on the thought I had and got my best creative partner to help me; SolidWorks. Early ideas and designs proved to be either too complex or costly and since I am on a retirement pension, keeping things cheap is a very big part of what and why I do things the way I do. So here is my bridge.



Working in the hot desert sun is challenging to say the least, but this bridge that was using the Warren Truss Design was too unstable. It was no fault of the design which I did not invent, but one I adopted to bring this to the school so that the girls could assemble it. The struts were made out of a material that was too thin; but which I selected to keep costs down and weight to a minimum. This has to be assembled and disassembled in order to transport it home in that Jeep Liberty that you see next to it. In retrospect I should have used $\frac{3}{4}$ inch or even 1 inch plywood, but these struts were made out of $\frac{1}{2}$ inch thick redwood plywood, four feet long and only three inches wide. It went together okay but even the desert winds made it sway like a bowl full of jello. It needed bracing. So I went to

my favorite store and bought a hundred feet of $\frac{3}{4}$ inch EMT pipe. (Electrical Metallic Tubing) I had to cut them into the proper lengths and then flatten out the ends for about 2.5 inches, then cut out $\frac{3}{4}$ inch holes in the ends, put in the proper angles so they would match the axle pins to stiffen things up. This is not an easy build but it had to be able to be taken apart and then reassembled.

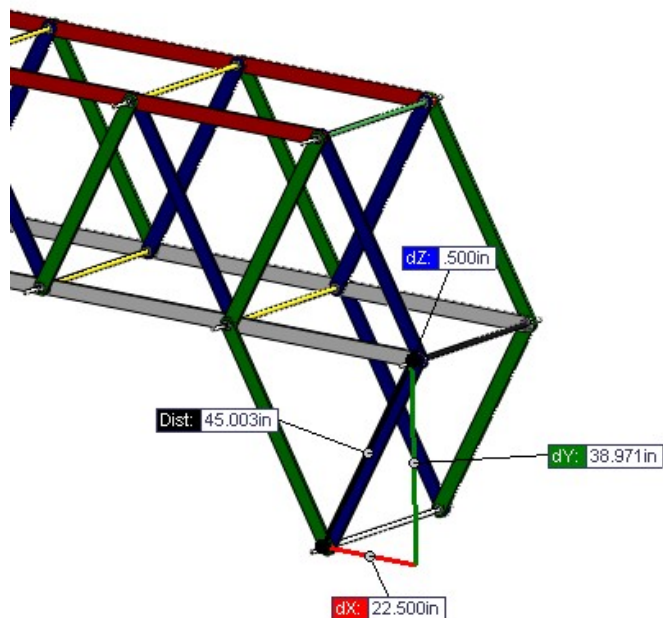
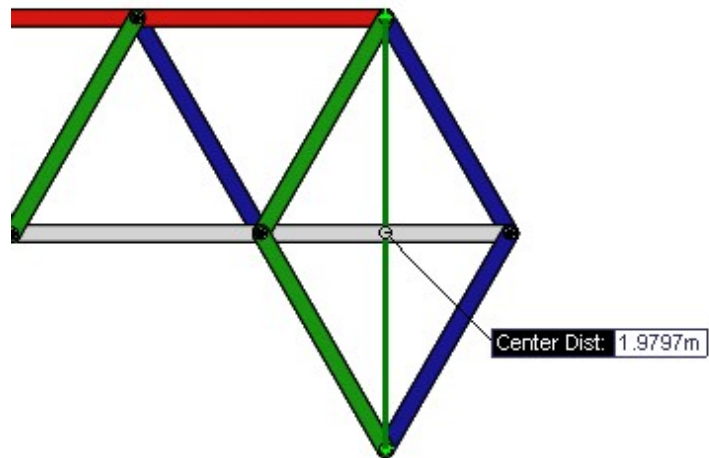
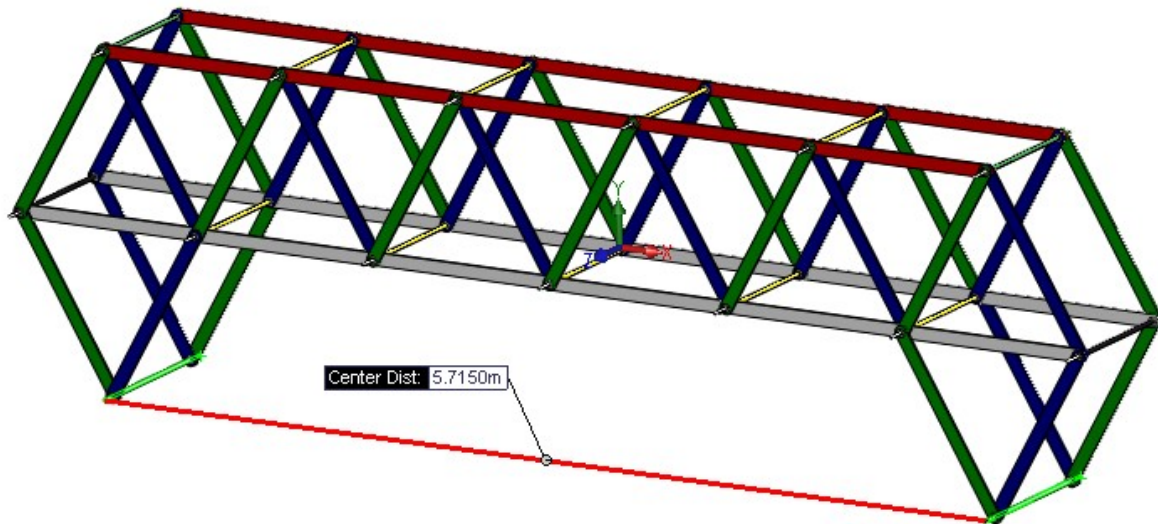
The Warren Truss Design is based on Equilateral Triangles. I made the sides of the triangles 4 foot long, 3 inches wide and a half inch thick. I drilled $\frac{3}{4}$ inch concentric holes with the rounded corners ends in order to accept the axle pins as shown here as the basic concept.



In this next picture I am trying to show you the lattice work of bracing I used to stop the desert winds from toppling this bridge over. Most of the time I had to lay it down on its side so it would not be adversely affected by things. It is higher than the wall which is slightly over 6 feet high. Yes, my neighbors think I am crazy.



From the two areas that this bridge is suppose to touch the ground is a distance of 5.715 meters or 18.75 feet.





I used EMT compression pipe couplings cut in half to use as my axle locks. Only a pair of channel locks pliers and a crescent wrench are needed to tighten them.



Seemingly with the braces added the wind is no longer a threat to collapse it. I have no proof to offer you, but it does feel much sturdier.



$\frac{3}{4}$ inch PVC was cut and sleeved over the $\frac{1}{2}$ inch axles to prevent the bridge from collapsing in on itself. Some assembly required here.



Very flexible wood struts but they were painted in order to make assembly easier. Red to red, Blue to blue, Green to green, etc...



Only some minor adjustments are left to do along with some marking and numbering on the braces. Maybe electrical marking tapes will work to identify like members to make the selections from the pile of materials more sensible. The young girls are surprisingly talented, cooperative and when given something like this to tackle, they meet the challenge and have never disappointed me yet. Some last pictures of the bridge challenge are down below.



Upside down so I could work on things.



Remember the Wright Brothers with their invention? Well gee whiz why not. That is 160 lbs (72.6 Kilograms) at mid-span. See any sagging?



My son took the picture at a distance. Ye of so little faith!



**This is Corporal Willy saying believe in your ideas and projects when you work.
Bye for now.**