Classical Conversations – Wallowa County
Cycle 2 Science Tutor Prep
Week 20-21 – Straw Bridge Construction

Prep Notes	For the end-of-year "contest", consider **designating** the bridge span distance, and just measuring its strength. If one class wanted to make a really long or really short bridge, it would be fun to see it perform, but it could not be expected to perform on even par with bridges of different lengths. Also for the end-of-year contest, design your weighting mechanism to evenly distribute the weight about the bridge, rather than pulling from only one point (which might be a weak point) on a bridge. One of the easiest ways to do this is by simply stacking the weight on top of the bridge, but with such a high center-of-gravity, this might result in tipping prior to a real bridge failure. To avoid this, coach your students to make the bridge relatively wide. Another idea would be to use a platform (wood board) suspended by multiple strings below the bridge, on which you'd place your weights. But this can be a lot trickier and take more time to set up during the end-of-year contest; you want the contest to run quickly and smoothly, so beware of intricate measurement schemes.
Materials	Straws (about 50 per class or per "team" if a class is to divide into multiple teams) Rubber bands (about 200 per class or team) Play-Doh (about 1 container per class or team) Play-doh can be a real mess to use for any "bonding" purposes – prefer rubber bands for that. Play-doh is great for the bridge "feet", to give definitive, sticky ground contact points at either end of the span
Teacher Background	See the "common truss bridge shapes" page, below, for some shape ideas. In general, the triangle is the pivotal shape in a truss bridge, usually with 1 or 2 members in compression and 1 or 2 members in tension.
Opener Ideas	Ask about the shapes people usually see in bridges. Consider printing some pictures of (famous) bridges and asking students to observe the common shapes used.
Grammar	(Don't spend too much time on this – get to building quickly!) • **Tension**: "pulling force" along a string or strut (straw) – if too great, the strut will "rip" • **Compression**: "pushing force" along a strut (straw) – if too great, the strut will "buckle"

Scientific Method

The scientific method is not uniquely applicable here, and the first order of business is to build a bridge and have fun doing it. But the scientific method **could** be employed to answer questions like:

- Will duplicating a design, making it doubly tall or thick, make it stronger, or just heavier, and thus more prone to fail?
- Will doubling the (span) length of a design make it only half as strong? Or less or more?

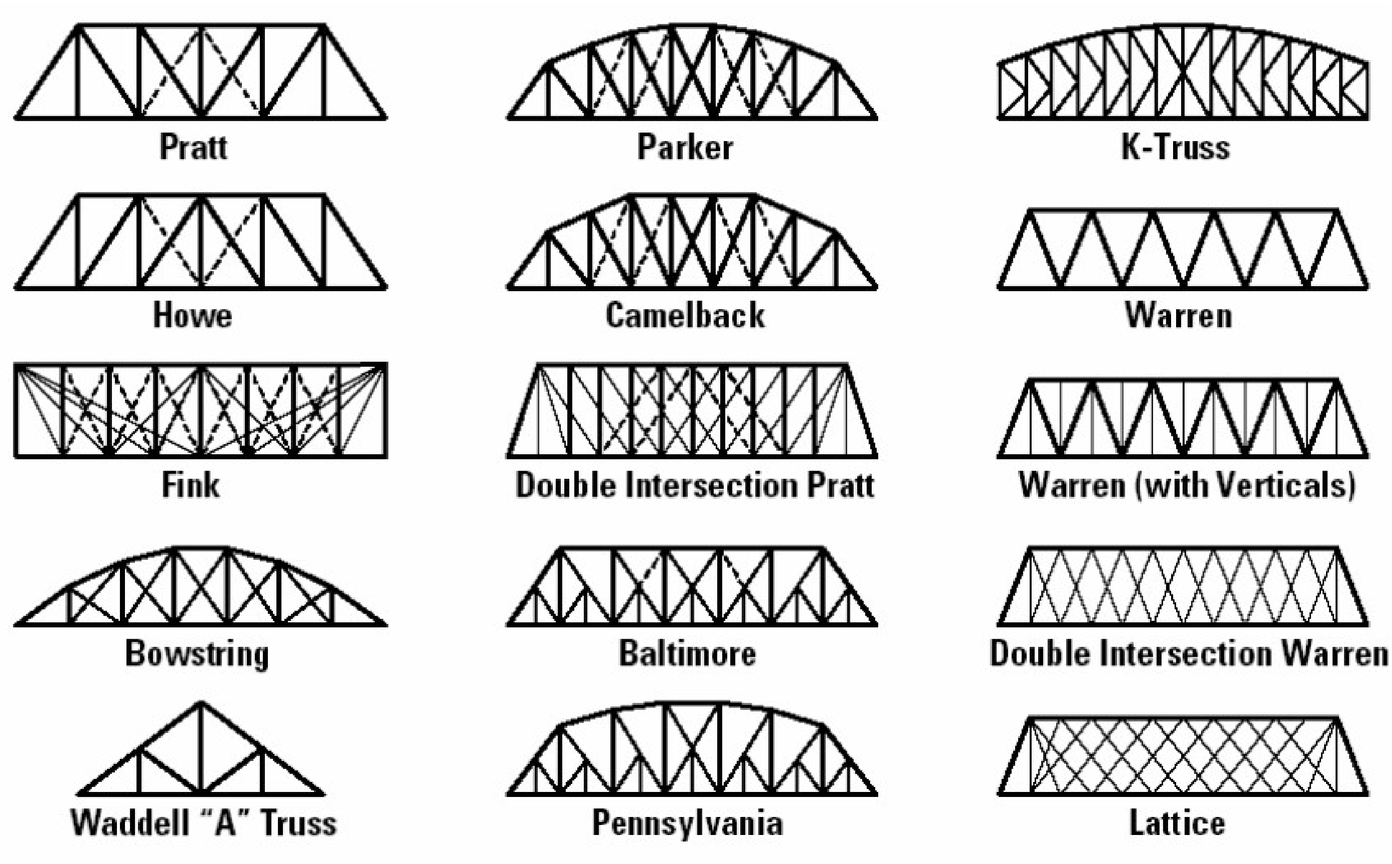
Each could inspire some experimental design ideas which attempt to define the constants (all of the variables you try to keep the same; e.g., the weighting mechanism, bridge height and design), modify the independent variable (e.g., the (span) length of the bridge), and measure the dependent variable (e.g., the weight it will bear). Remember that the best way to draw conclusions from such an experiment is to run multiple trials and take the average of the measurements you make.

More

Some "tricks of the trade" that might be helpful:

- You can "insert" one straw into another if you slit one a half-inch up so that it can fit inside the other.
- Over-bending and unbending a straw can really weaken it. Consider "experimenting" with a few straws, then, once a student decides on a scheme, deploying it with fresh, perfectly-bent straws.
- Trying to rubber-band straws together at different angles can be frustrating and unpredictable. Instead, coach students to band straws together in parallel, and then bend them apart down the line to achieve the desired shapes.

Common (truss) bridge shapes:



(taken from https://sites.google.com/a/wyckoffschools.org/stem-grade-8/2-types-of-bridges)

NOTE: Other bridge shapes, like arches, beams, and suspensions, do not lend themselves as well to straw-based building.