PAPER

Structures

HOUSE OF CARDS: *Optimizing a structure's Design*

Brentwood Middle School Technology Education –S.Grad

Introduction to Technology
Module T-3 Problem Solving

NAME: _____

Period: _____

Date:

THE PROBLEM: To design and build a support structure capable of holding a minimum of 250 pounds, using only paper and white glue.

Background Information:
There was once a time when people did not have houses to live in. They may have lived in caves, under a bush or out in the open. The need for structures came from the need to protect themselves from the elements and/or danger. As people began to move away from familiar land, there need for shelter became even greater but they lacked technology to make any type of sophisticated dwelling so the first type of shelter was very simple. It was just enough to protect them from the weather (rain, sleet, snow, wind etc..) Native Americans did this by stretching animal skins over a wood frame to form what they called Teepees.

As people started to settle in particular areas, the structures became more permanent and villages formed. A village was an area where two or more structures are grouped together. Natural materials like wood, stone, and mud were used and later mud and straw were formed into bricks so sturdier structures could be built.

The Romans, Greeks, and Egyptians were very good at building these permanent structures. One of the greatest Roman contributions to construction technology was the **arch** to support structures. What other shapes do you see around you that have been used to support weight and are used in building structures? Have you seen circles, squares, rectangles and/or triangles? They are all present in modern day construction

Construction refers to building a structure right where it will be used. This location is called a construction site. A construction system processes the seven resources of technology (People Information, Materials, Tools and Machines,

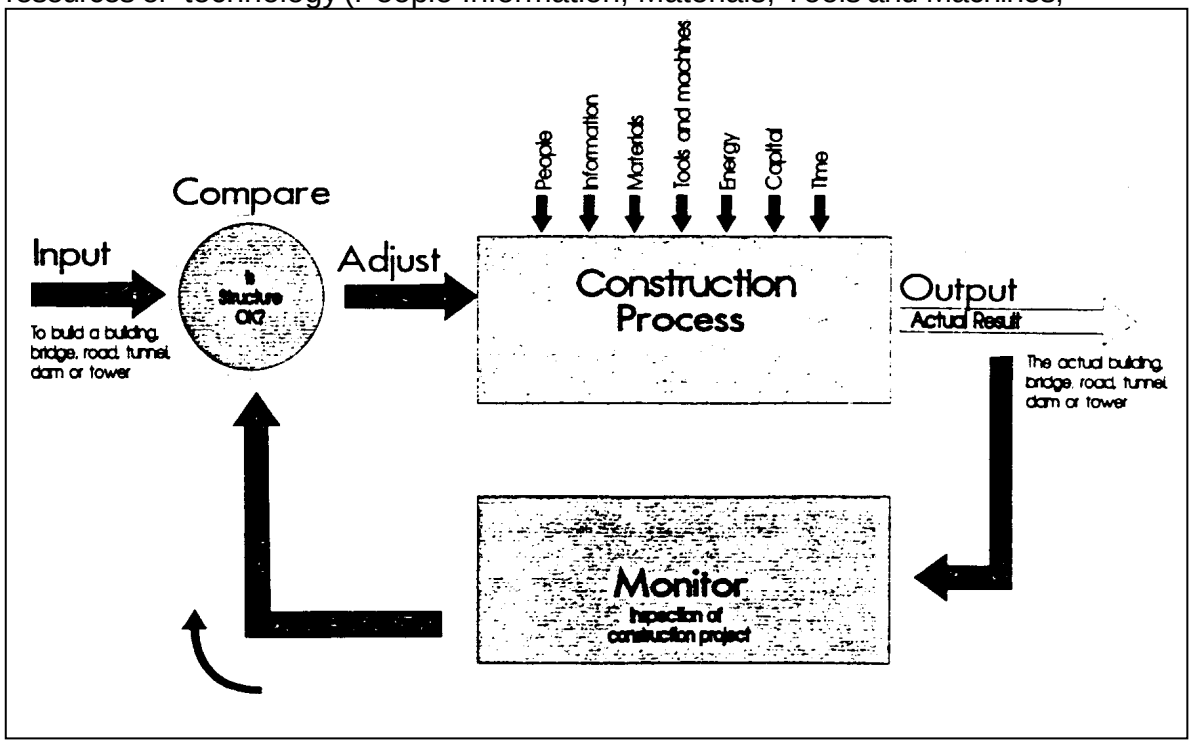


fig. 1

If the resources are combined correctly, the result is a usable structure such as a dam, building, bridge, road, or tunnel. The failure of anyone of these resources to do its job correctly could result in poor work, dangerous conditions, and total failure.

In this exercise, each group must adhere to the following criteria:

Limitations and Constraints:

1. Each group will be given
   a. 24 Cards, 3" x 4"
   b. 1 piece of cardboard, 6" x 6" c. White glue

2. The cards may be folded, cut, shaped, layered, combined, or glued in any way that will solve the problem with the following exceptions:
   a. No more than three pieces of paper may touch in any place.
   b. The structure must be 3" tall.
   c. The top and bottom of the structure must be flat and have an overall dimension of 6" x 6".

3. The following tools may be used:

   b. Ruler
   c. Triangles
   d. Paper Clips (May be used to hold paper together only while glue dries.)

4. Requirements:
   a. Before beginning construction, each group must submit the following:
      i. Test pieces of shapes they will use in their design
      ii. A top view of their completed design
   b. The completed structure as designed and ready for testing.

5. Structure Strength Test
   Each group must test their structure in the testing device and they must collect the following data:
   a. Total weight of the structure before testing

   =_____grams

b. Total weight held by the structure in pounds

Lbs.

Convert weight held in pounds to grams Pounds X 450 grams =

_____grams.

b. Strength Factor = ___ (weight held in grams) ___ ✗1000
(weight of the structure in gram)

To calculate the strength factor, divide the weight held in grams by the weight of the structure in grams. Kilograms held per gram.

6. Grading Rubric

a. Drawing (20 points) = _____

b. Strength factor (50 points) = _____

c. Attention to detail (30 points) _ _____

d. Total (Out of 100 points) =_____

ENGINEERING PRINCIPLES
FOR
DESIGNING STRUCTURES OR BRIDGES

1) DEAD LOAD: The weight of all the materials that compose a structure.

2) LIVE LOAD:, Impermanent objects that a structure must support such as people, furniture, equipment, stored goods etc..

3) STATIC LOADS: The sum of the live and dead load for particular structure.

4) DYNAMIC LOADS: Loads that change value rapidly and even abruptly, such as the pressure of a wing gust, or the action of an dropping an object on the floor.

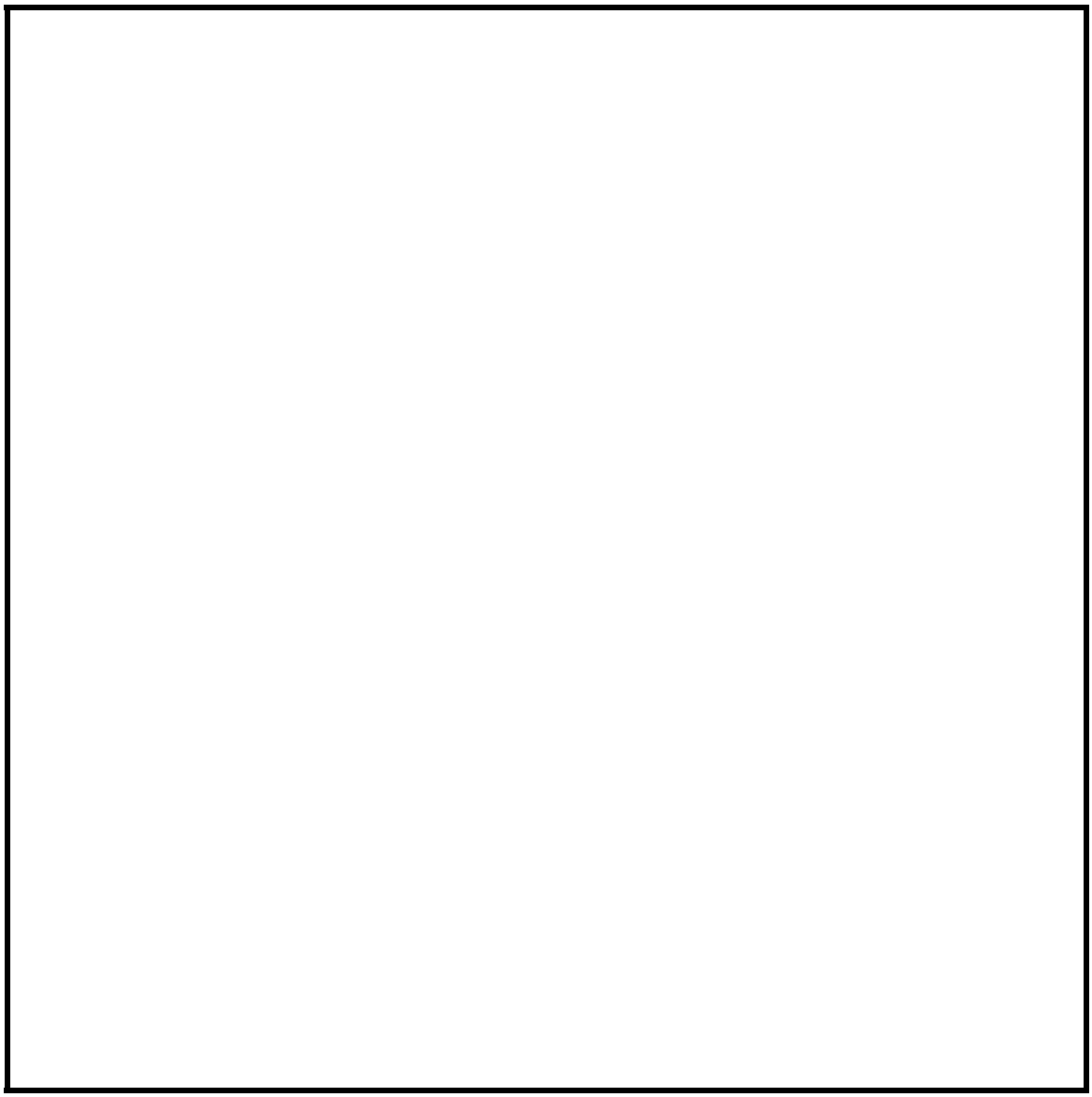
5) OSCILLATION: The circular movement of the upper most part of a superstructure ,also,known-.as a "sway factor".

6) PERIOD:, The time it takes a building to swing through a complete oscillation. For a example, the period of the World Trade Center in New York City, which is 1,350 feet high, is 10 seconds. While the period of a ten story brick building may be as short as a half a second.

7) RESONANCE: When a force is rhythmically applied to a structure with the same period as that of the structure. This is the most dangerous force a structure may be subjected to.

8) WIND FORCES: The speed of wind, which grows with height. Wind pressure increases as the square of the wind speed. Thus, the wind effects on a building are compounded as its height increases. The total wind force is the sum of the windward pressure and the leeward suction.

9) THERMAL LOADS: All building materials expand and contract due to changes in the temperature. Structures **must be made less rigid** to allow this to happen.



Team_____

Names_____

Class_____