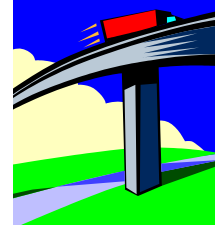


Pier (Column) Design Worksheet



You are engineers working for a structural design company in Colorado. The state of Colorado needs a new transportation bridge to serve as an overpass connecting a highway to a small mining town business district.

1. **Brainstorm a list of questions to be answered before designing the bridge.**

2. **Make a list of the possible loads that the bridge must withstand.**

3. **Using the given values for loads, calculate the different possible loads for the bridge.**
 - a) Dead Load + Live Load + Snow Load
 - b) Dead Load + Live Load + Wind Load (or Earthquake Load)
 - c) Dead Load + Live Load + Wind Load + (Snow Load \div 2)
 - d) Dead Load + Live Load + Snow Load + (Wind Load \div 2)
 - e) Dead Load + Live Load + Snow Load + Earthquake Load

Load values for a scaled model of this bridge in Colorado:

Maximum dead load = 2 lbs

Maximum live load = 2 lbs

Maximum wind load = 1 lbs

Maximum snow load = 2 lbs

Maximum earthquake load = 1 lbs

Which is the maximum load (force) that the bridge must be able to hold? _____

4. Choose one of the available materials for your model and calculate the cross-section area required for a pier (column) to support the maximum load. Use the following information and equation, and show your work.

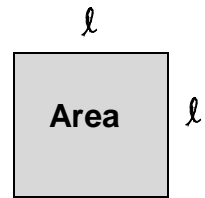
The compressive strength (F_y) of clay is 7 lb/in².

The compressive strength (F_y) of large marshmallows = 5 lb/in²

The compressive strength (F_y) of foam = 3 lb/in²

Force = maximum load, as calculated in #3.

Solve for the area using the following equation: **Area = Force \div F_y .**



5. Using a calculator, find the length (ℓ) of each side of your cross-section area of the pier (column) from #4. Show your calculations.

Hint: For a rectangular pier, take the square root of your area to find the length of the sides.

Hint: For a cylindrical pier, divide the area by 3.14, and then take the square root of your answer to find the radius of the end of the column.

6. Double-check that your length dimensions are correct. Show your work. Does it match your area answer from #4?

Hint: For a rectangular pier, multiply the length of one side by the length of the other side to find the area.

Hint: For a cylindrical pier, multiply the radius by itself, and then multiply by 3.14 to find the area.

7. Build your model pier (column) using the materials you chose. Draw a sketch of your pier below, using the length of sides you just calculated and a height of 3 inches. Write the measurements on your drawing and indicate forces using arrows.



8. Test your pier model by adding the weight of books to equal the force you calculated in #3. Record each book weight as you add it. Total the book weights to find the total load at each stage. Record your observations on how the column is withstanding the applied load. Your pier (column) material: _____

Book #	Book Weight	Total Load	Pier/Column Observations & Measurements
0	None	None	Column begins 3 inches high.
1			
2			
3			
4			
5			
6			
7			
8			
9			

9. Describe what happened to your column during testing.

10. Was the material you chose for your model effective? Why or why not?

11. What could you do to improve the design of your column?