



Bridge Over Troubled Water

Instructions & Worksheet





Bridge Over Troubled Water Instructions and Worksheet

GENERAL INSTRUCTIONS

The State Highway Department has asked your company to design and construct a model of a new bridge to cross the Trinity River. Other teams are also designing bridges for this location. The Highway Department is going to have twenty bridges built around the state and will award a contract for all the remaining bridges to one of the teams. All competing teams are building models. Naturally, you want your team's model to win.

The Highway Department will make its decision based on two factors:

STRENGTH – If the model will support a weight of five pounds, for 20 seconds, it will meet the State's minimum standards.

LOW COST – This is an important consideration and will determine the winning team. The team with the lowest cost, who is able to hold the five-pound weight for 20 seconds, will be the winner.

There are two tasks facing your team.

1. Designing/drawing the bridge
2. Constructing the bridge

First, you will be given a design sheet and specific design instructions. Your task is to design a model.

Next, you will be asked to construct the bridge, following the construction rules.

DESIGN INSTRUCTIONS

Your bridge design must have a minimum length of 20 inches and a width of 3 inches, and must support a weight of five pounds at its center for 20 seconds.

You have been given:

1. *A blank design sheet to design your bridge*

First you must draw your design, including a top view and a side view on the design sheet.

2. *A sample of each type of building material that can be used.*

You must estimate the costs for material, time, and labor on the Budget sheet.

You will then purchase the materials from your Team Observer. You have a credit balance of \$61,000 that you must not exceed for design/construction time and material costs.

There are cost factors that you must consider:

- ▶ Design time costs \$600 per minute. You will be given 45 minutes and charged \$27,000 minimum design time. More time should be budgeted from the beginning. Discuss this issue with your team before you decide.
- ▶ Construction labor costs \$3,000 for every minute of estimated time. See Construction Rules to understand the challenges facing the construction team.
- ▶ Penalty charges cost \$6,000 per minute you go over or under your estimated time during the design/planning stage or actual construction.

Other Factors:

- ▶ Each construction worker may only use one hand during construction.
- ▶ During your 45 minutes you must buy your material from your Team Observer, construct the bridge for practice, decide who will construct bridge during competition, and buy construction time from your Team Observer.

CONSTRUCTION INSTRUCTIONS

- ▶ You may not begin assembling the model bridge until construction time begins.
- ▶ The model must be able to support a five-pound weight at the center for 20 seconds.
- ▶ You **MUST** follow the design that you created.
- ▶ You will be finished when the design and the model match and when your bridge holds a five-pound weight at the center for at least 20 seconds without any part of the bridge touching the water in the river.
- ▶ Construction time begins when you start building and ends after the 20 seconds of the weight test.
- ▶ Each construction worker may use only **ONE** hand during construction.

BUDGET AND COST SHEET

Materials	Cost/Each	Inventory Needed	Total Cost
1. Orange Rods – 10½"	\$500	_____	_____
2. Green Rods – 7"	\$400	_____	_____
3. Red Rods – 5½"	\$300	_____	_____
4. Blue Rods – 4¾"	\$200	_____	_____
5. Yellow Rods – 3"	\$200	_____	_____
6. Round Joints – 2" diam.	\$200	_____	_____
7. T-Extensions – 2"	\$300	_____	_____
TOTAL MATERIAL COST	_____		

Labor Costs

- 1. Design Time \$600/minute
- 2. Construction Time \$3,000/minute
- 3. Penalty Time \$6,000/minute

MAXIMUM FUNDS AVAILABLE: \$61,000

Factor	Team Estimate	Team Actual
1. Design Cost (\$600/minute)	_____	_____
2. Material Cost (See above)	_____	_____
3. Construction Cost (\$3,000/minute)	_____	_____
4. Penalty (\$6,000/minute)	_____	_____
5. Total Cost	_____	_____

DESIGN A BRIDGE THAT:

- ✔ Spans a 20" river without touching the water at any point.
- ✔ Holds a 5-lb weight at its center for 20 seconds.
- ✔ Costs less than \$61,000!!!!
- ✔ **Team that meets requirements with the lowest budget wins.**

DESIGN CONSIDERATIONS

- ✔ Minimum length of 20". Width should be 3".
- ✔ Must have top view and side view drawn on large sheet.
- ✔ You have 45 minutes for design, buying material, practice construction, etc. This will cost you \$27,000!!! Additional minutes are \$600/minute.
- ✔ You may buy more time but must decide to do so before design time begins.

CONSTRUCTION CONSIDERATIONS

- ✔ You must follow your design, no variations.
- ✔ **You can only use one hand!!!**
- ✔ Construction time begins when you start building and ends after the 20-second weight test.
- ✔ Construction time costs \$3,000/minute. You must estimate construction time during the 45-minute design time.

INSTRUCTIONS FOR TEAM OBSERVERS

Schedule

- 5:00-5:30 pm – Eat
- 5:30-5:35 pm – Distribute handouts to students, brief discussion
- 5:35-5:40 pm – Break into teams and go to different rooms
- 5:40-5:45 pm – Teams get situated and review rules

THE CHALLENGE WILL BEGIN PROMPTLY AT 5:45 PM – THIS IS WHEN THE 45-MINUTE TIME BEGINS

- 6:30 pm – Design time ends; students come downstairs with design (on large sticky sheet) and rationed Tinker Toys.
- 6:35 pm – Competition starts in kitchen area
- 7:00 pm – Competition over, give out prizes
- 7:10 pm – ACE Team Leader speaks to students

Because the schedule is tight, it is important the activity run smoothly and efficiently.

A few things to keep in mind during design time:

- ▶ Choose a Project Manager right away. Try to choose a student who is typically not outspoken.
- ▶ Keep students on task and mind the time.
- ▶ Make sure around 6:10 pm the students are starting to buy their materials from you and working on building their design.
- ▶ Remind students that they need to decide who is going to build the bridge during the competition.
- ▶ Fill out their budget sheets and put the Team # at the top.
- ▶ Try to guide and help the students as much as possible without designing the bridge for them.

When the teams reassemble for the competition, they will need:

- ▶ Budget sheets filled out completely with a final cost.
- ▶ Construction time decided.
- ▶ Materials bought. Design on large sticky sheet with top and side view.
Make sure Team # is on the design and other sheets.