

## 2004 Transportation Education Academy Activity:

**Title:** Transportation Problem-Constant Route Vehicle

**Education Level:** This transportation activity is designed for students in middle school grades 5 - 8 but could be used in high school by adding additional math and science concepts.

**Time to Complete:** The estimated completion time for students is 6 to 7 hours.

**Standards Being Met:** When completing this activity, students will meet the following Standards for Technological Literacy:

1. Number 11, Apply the design process
2. Number 8, the attributes of design

**Brief Description:** This activity is designed to help students problem solve a transportation problem of how to best transport a given commodity over a fixed, repeatable route in the least amount of time and at the least possible cost of transport.

**Objectives:** At the end of this activity the student will be able to accomplish the following:

1. Identify and use creative problem solving in a group setting relating to a transportation problem.
2. To design, construct, purchase the parts and test a fixed route transportation vehicle to transport a Given product given a choice of material and the transport route.
3. To understand and apply the concepts of “cost of transportation” of the goods and how it effects the Retail price of the product.

**Group Size:** This activity is best accomplished in groups of 2 to 3 students.

**Background Information:** Where do ideas come from? They come from thinking. Some people may call this “daydreaming.” That’s a good term for it, dreaming in the day time: being fully awake so that you can control your fantasies, yet in a dream world so that reality doesn’t have to matter.

Good ideas often come from the unusual... Never be afraid to dream the unusual. Reality will impose itself soon enough. Enjoy the poetic license of fantasy whenever you can. However, it is daring to dream of the unusual, which leads to new inventions, theories, philosophies, arts, and so on.

New creations come from an ability to risk making a mistake. If your criteria for doing something is that it must work exactly as planned, then you are not likely to test the waters of originality. If you are not a risk taker, then you’ll only do what has been proven successful. Your ideas will consist of investigation what others have done and copying their model.

In this transportation activity we are going to explore your creative problem solving abilities and challenge your mind.

As you recall, one the of types of ground transportation is a fixed route. Basically this means that the vehicle must travel on a route that has been prepared for it with little or no deviation. For example, an escalator that carries people has a “fixed” route. Some other examples are of course cars, trains, subways, trains, etc.

In this activity we are going to become “creative thinkers” and solve a problem related to a fixed route transportation system.

When designing you vehicle and mode of transportation remember that you must take into consideration the unit cost and the speed of transporting the goods to the destination. You will be graded on theses two things plus the creativeness of your vehicle in solving the problem.

Using the materials located on the Materials List you are to design and construct a fixed route transportation system, which will transport goods (in our case a clothespin) between two points. See diagram below.

# TRANSPORTATION GUIDEWAY

POINT A

POINT B

I-----I

1. You may use only materials listed on Materials List to construct your vehicle. Remember, total cost of finished vehicle will be considered in the evaluation. You must use your checks for payment with no refunds or returns.
2. If you require special tools, such as scissors, stapler, razor knife, drill, etc. consult your instructor.
3. Human hands can only touch the system before the vehicle departure and after arrival, or if the system fails between these two points.
4. The power source should be part of the system. Any power source may be used as long as it can be made from the materials at the lab store. You may not use human power, pushing, throwing or blowing.
5. Speed of transport is part of the evaluation: however, the vehicle must be in control and present no safety hazards such as flying parts or disintegration upon arrival.
6. The faster you solve the problem the more points you will receive. The vehicle should be able to make at least three consecutive runs without damage or major malfunction.
7. You may disconnect the guideway (undo the swivel) if you need to remove the vehicle.

**Supplies, Tool, Materials Needed** To complete this activity you will need to have the following materials available for each team to buy. **NO REFUNDS.**

DESCRIPTION	COST
Balloons	\$350.00
Rubber Bands	\$250.00
Paper Clips	\$75.00
Pipe Cleaners	\$75.00
Straws	\$25.00/inch
Napkins	\$25.00 each
Aluminum Foil	\$10.00/sq. inch
Popsicle Stick	\$25.00 each
Masking Tape	\$10.00/inch
Paper 8 1/2 " x 11"	\$250.00
Paint	\$25.00/coat
Wheels	\$25.00 each
Steel Axle	\$50.00 each
Wood Axle	\$25.00 each
Compressed Air	\$100.00/ use

**Safety Precautions:** Please follow each precaution listed below plus all general safety rules in place at your school when completing this transportation activity.

**Procedure:**

1. The instructor will divide you into “research teams.”
2. Review the PROBLEM SHEET and notice the parameters.
3. Review the MATERIALS LIST sheet.
4. Review the VEHICLE EVALUATION SHEET. Have your instructor check you off.
5. Brainstorm as many ideas as possible. Write all ideas down.
6. Choose your best idea and illustrate or model what the system might look like given the materials you may use from the materials list.
7. Obtain the materials from the “store.” Remember that the less money you spend solving the problem The more points you will receive. Use the checks to pay the store on the “CHECK PAGE.”
8. Build a prototype of your best idea and test it. Keep your plans and prototype TOP SECRET!!
9. After testing, modify your design if necessary and retest.
10. Complete your production model and call the instructor for a final demonstration run. Keep in mind The evaluation criteria!!!
11. Complete the Worksheet and hand in for grading.

**WORKSHEET**

1. Fill out the Bill of Materials chart for your vehicle. Write down all materials even if you did not use them in your final vehicle. You still have to pay for them!

QUANTITY	DESCRIPTION	COST/UNIT	COST

TOTAL COST \_\_\_\_\_

2. Determine the cost of transport of the goods in total cost of the vehicle compared to the distance covered. The formula is:  $\frac{\text{cost in dollars}}{\text{distance in feet}} = \text{cost /ft.}$

### Evaluation and Assessment:

1. A series of 5 short answer questions.

- List 4 other types of fixed route transportation systems used today.
- List the 6 parts of transportation technology and how your group used each one.
- Why is it important for industry to keep their research projects secret?
- What part of your vehicle added the most cost to the product you transported?
- Explain why and how your group came up with your design.

2. Vehicle Evaluation Criteria

- a. Problem Solving Speed  
(Record place below)

5 - 1st to solve problem  
4 - 2nd to solve problem  
3 - 3rd to solve problem  
2 - 4th to solve problem  
1 - 5th to solve problem  
0 - Didn't solve

SCORE

- b. Material Cost  
(From worksheet  
Bill of Materials  
Record cost below)

5 - Less than \$500  
4 - \$501 to \$600  
3 - \$601 to \$700  
2 - \$701 to \$800  
1 - \$801 to \$900  
0 - Over \$901

SCORE

- c. Speed of Transport  
(Record trial times below)

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

5 - Fastest time  
4 - 2nd fastest time  
3 - 3rd fastest time  
2 - 4th fastest time  
1 - 5th and above  
0 - Didn't finish

SCORE

- d. Durability  
(Record below)

1. \_\_\_\_\_  
2. \_\_\_\_\_  
3. \_\_\_\_\_

4 - No malfunctions/damage  
3 - 1 malfunction/damage  
2 - 2 malfunctions/damage  
1 - 3 malfunctions/damage  
0 - Didn't make it

SCORE

3. Grading Sheet

- |                          |           |       |
|--------------------------|-----------|-------|
| a. Activity check points | (6 pts.)  | _____ |
| b. Quiz                  | (20 pts.) | _____ |
| c. Worksheet             | (10 pts.) | _____ |
| d. Vehicle Evaluation    | (20 pts.) | _____ |
| Total                    | 56 pts.   |       |

4. Grade Breakdown

- A 51-56  
B 47 - 50  
C 43 - 46  
D 40 -42