

Purdue University
School of Civil Engineering
CE 361 Introduction to Transportation Engineering

Homework 10

FREIGHT TRANSPORTATION

Posted: Fri. 5 December 2003

Due: Fri. 12 December 2003

Dear Consultant(s):

The competition between cities to attract employers with good jobs is getting intense. The local planners need expertise that allows them to duplicate the kinds of analyses that corporations conduct when making location decisions. Submitting applications for federal grants to upgrade the regional transportation infrastructure also depends on certain analyses. Demonstrate your ability to conduct such analyses by completing the problems below and submitting clear, professional solutions.

Note: You must submit this HW as a member of a group of at least two and no more than four CE361 students. As usual, the top sheet of the material submitted must be signed by each group member.

1. **Determining plant location.** (20 points) Mythaca Mining and Manufacturing (M^3) wishes to locate its newest factory at a site that minimizes transport costs from its suppliers and to its major distribution centers. The locations of its 5 principal suppliers and its two DCs are given in the table below. The table also includes volumes and transport rates. Use the format of CNotes Table 12.6 to find the least-cost location.

	x	y	tons/yr	\$/mi/cwt
Supplier A	62.0	73.5	4901	4.38
Supplier B	43.5	76.6	4268	4.19
Supplier C	85.5	93.2	3847	5.20
Supplier D	58.2	90.9	9755	3.08
Supplier E	79.8	83.3	9929	0.81
DC1	37.0	25.4	2340	2.45
DC2	37.6	27.8	9575	5.74

2. **Use Distribution Centers?** Check Figure 12.5 by finding the following:
- A. (5 points) How many miles from the Manufacturing Plant in the direction of City A is the point at which the total plant-to-customer costs are equal? What is that cost?
 - B. (5 points) How many miles from the Manufacturing Plant in the direction of City B is the point at which the total plant-to-customer costs are equal? What is that cost?
 - C. (5 points) How many miles from City A in the direction of City B is the point at which the total plant-to-customer costs are equal? What is that cost?
 - D. (5 points) Is the figure drawn accurately? If not, what corrections need to be made?
3. **Mixed Freight Train.** A mixed freight train has 120 cars. Each car has an average tare weight of 70,000 pounds and a load of 60,000 pounds. The train's route has a ruling grade of 0.25 percent. The desired speed for the train is 60 mph.

- A. (5 points) If the train's aerodynamic coefficient is 0.09, what drawbar pull will be required?
 - B. (5 points) If the company has 5500-HP engines derated to 91 percent, how many will be needed? Use an engine resistance of 1500 lbs per engine.
 - C. (5 points) If the ruling grade is 1 percent, how many 5500-HP engines will be needed to maintain a speed of 60 mph?
 - D. (5 points) How fast can the train, with the number of engines determined in Part B, pull the train up the 1-percent incline?
4. **Horsepower for 2x3 tow.** (20 points) A 2 x 3 tow (each scow is 35 by 195 feet) is carrying coal and has a draft of 8.5 feet. The desired speed in still water is 5 knots. If the water is at the depth of 13 feet, estimate the horsepower to be delivered to the tow.
5. **Heavy Oil Pipeline.** (20 points) Heavy oil is to be transported in a smooth pipe at a temperature so that its viscosity is 0.006 pound-seconds per foot squared and its specific gravity is 0.88. The anticipated flow rate is 50,000 barrels per day. What is the minimum size pipe so that the oil will move at laminar flow?