

HW Problem 15:

2005

solution

1. Estimate the number of drop-off recycling centers needed in Dusseau's Folly if the average number of cars per hour is to be less than or equal to 20 during the typical daily peak hour.

Note: The same drop-off centers are used in both Scenario A and B.

Given: 95000 people. 3.3 people / house.

Centers are open 7 days per week, 24 hours a day; however, we'll assume they are only used from 7 AM to 7 PM, seven days per week.

30 % of the homes participating, drop-off once per week

50 % drop-off once in two weeks

20 % drop-off once in four weeks

Assume the typical daily peak hour rate is 4.75 times the average hourly rate.

The centers accept newspaper, cardboard, glass, steel cans, HDPE, PET, and aluminum.

Assume that newspaper is 20 % of the the paper fraction (as generated)

Assume that HDPE and PET are 80 % of the plastics fraction

a) What is the participation rate? Assume that participating homes recycle 80 % of material available (e.g., if a home generates 10 lbs/week of material accepted at the drop-off center, 8 lbs actually makes it to the center. The rest ends up at the landfill.)

Note: you will need to use data from previous problems. Use the same method as in the recyclables collection problem)

The total amount of material delivered to drop-off centers is 4770 tons

How many people does it take to make that much material?

The materials recycled at the drop off center include:

	lbs available out of 100 lbs generated
Paper (newspaper)	7.0
Cardboard	6.5
Glass	8.9
Steel cans	5.6
Plastic (HDPE & PET)	5.5
Aluminum cans	0.7
Total	34.2

Data is from as generated composition. Paper and Plastic values are adjusted to be just newspaper, HDPE, and PET

therefore, 34.2 lb out of every 100 lb generated could be sent to the drop-off center, or 0.342 as a fraction.

Total available amount = population x 365 x MSW generated/person/d x fraction recyclable material is of total MSW
= 69056875 lb/year

PR = Amount sent to drop-off center / Amount available / % available material delivered to drop off center
= 0.17 or 17.27 %

b) How many homes use drop off centers per week?

= PR x population / people/home = 0.17 x 95000 / 3.3
= 4971.199

Cars per week, assuming one car per home per trip =
number of once per week + once per two week + once per four week cars

= 4971.20 x (0.3 + 0.5 x 0.5 + 0.2 x 0.25)
= 2982.719 cars per week

c) What is the average number of cars using drop-offs per hour? Assume one car per home per drop-off.

Number of operating hours per week = 7 days x 12 hours per day = 84 hours

Average cars per hour = 2982.719 / 84 = 35.5

d) What is the typical daily peak hour rate?

$$4.75 \quad \times \quad 35.5 \quad = \quad 169$$

e) How many drop-off centers does Dusseau's Folly need?
(i.e., to have < 20 cars during peak hour.)

$$= \quad 169 \quad / \quad 20 \quad = \quad 8.4$$

Four or five should be acceptable.