HW Problem 10: **SOLUTION** **2005**

Dusseau's Folly's curent landfill is near capacity. It is currently not known where the new landfill will be located. The Mayor and Council are considering a transfer station.

Use the following data.

Use the information from the MSW collection problem for Truck volume, for an 8 hr day.

The cost of operating a collection vehicle to transport MSW is
$/hr/cu-yd = (2.8) - (0.023) x vehicle capacity in cu-yd
The cost to transport waste in a 105 cu-yd tractor-semi trailor is 43 $/hr.

Transfer operating costs are 3.5 $/cu-yd
The specific weight of the MSW is the same in each vehicle.
Each vehicle travels at about the same speed.
The transfer station is located such that it does not result in additional travel time.

a. For Scenarios A, B, and C, determine the landfill travel time at which a transfer station is economic for MSW transport.

Scenario A: Truck volume is 29 cu-yd

Convert transportation costs to $/cu-yd/minute

Collection vehicle: $/hr = ($/hr/cu-yd from linear equation given above) x volume of vehicle
$/hr = [(2.8) - (0.023 x 29)] x (29)
= 62.2
$/cu-yd/minute = 62.2 x 1/60 / 29
= 0.0355

Tractor-semi: $/hr = 43
$/cu-yd/minute = $/hr / 60 / volume of vehicle
$/cu-yd/minute = 43.0 x 1/60 / 105
= 0.0068

Collection vehicle costs: 0.0355 x travel time in minutes

tractor-semi costs: 0.0068 x travel time in minutes + 3.5

setting the two equations equal and solving for travel time:

Break-even travel time = 122 minutes

Scenario B

Truck volume is 26 cu-yd

Convert transportation costs to $/cu-yd/minute

Collection vehicle: $/hr = [(2.8) - (0.023 x 26)] x (26)
= 57.5

$/cu-yd/minute = 57.5 x 1/60 / 26
= 0.0366

Tractor-semi: $/cu-yd/minute = 0.0068 from Scen A

Collection vehicle costs: 0.0366 x travel time in minutes

tractor-semi costs: 0.0068 x travel time in minutes + 3.5

setting the two equations equal and solving for travel time:

Break-even travel time = 117 minutes

Scenario C

Truck volume is 24 cu-yd

Convert transportation costs to $/cu-yd/minute

Collection vehicle: $/hr = [(2.8) - (0.023 x 24)] x (24)
= 54.5

$/cu-yd/minute = 54.5 x 1/60 / 24
= 0.0373

Tractor-semi: $/cu-yd/minute = 0.0068 from Scen A

Collection vehicle costs: 0.0373 x travel time in minutes

tractor-semi costs: 0.0068 x travel time in minutes + 3.5

setting the two equations equal and solving for travel time:

Break-even travel time = 115 minutes

b. Assuming each vehicle maintains a speed of 50 miles/hr between the transfer station and landfill, determine the distance to the landfill at which a transfer station becomes economic.

Scenario	break even time minutes	speed mi/hr	break evn distance mi
	1	2	3
A	122	50	102
B	117	50	98
C	115	50	96

Calculations

Column	Description
1	from part a
2	given
3	column 1 x column 2 / 60