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Professor
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EXERCISE 4: METRO TRANSIT EVALUATION
(10/30/08-11/6/08)

In 1985, a leading metropolitan area (Washington, D.C.) had no public transportation system. On each of 250 annual work days, 1.2 million commuters made 2 (one way) trips - each trip averaging 15 miles. The operating costs of these trips was 20 cents per mile on average, and the average value of time was then about \$10 per hour. The time per mile (hours) that it took each driver to traverse the full 15 miles obeyed the following time/volume relationship:

$$\text{time} = .05 (\text{volume}/1,200,000)^2$$

where: volume is the total number of (1-way) commuter trips.

a). What was the total value of time and money cost then spent on travel in the metro area assuming that every driver was "average"?

A public rapid transit system was then proposed which would provide an alternative way of satisfying the commuting pattern of the area. It would have a capital cost of 5 billion dollars, and variable operating costs of \$1.25 per trip (for the average 15 mile). It was proposed that the fares of the system would be set at these operating costs. The system would provide its riders with a speed of 20 mph over the same 15-mile average commute.

b). How many riders would use the system if drivers chose that mode with the cheapest combined time and money costs?

c). What would the total value of time and money costs spent traveling on both modes be now?

d). At what discount rate would it pay to build the system, assuming that it lasts forever without any depreciation or maintenance {use the inverse perpetuity rule}.

e). Write out the full expression for total travel costs as a function of how many travelers use the transit system. Either mathematically or by using trial and error numerical simulation, determine what is the level of ridership that minimizes total travel costs for the Washington D.C. area.

f). If this number could be forced to use the system at what discount rate would it pay to build the system?

g). As a planner - how could you get the "right" number of people to use the system. Be specific as to any policies.