EXERCISE 1: METRO TRANSIT EVALUATION

A leading metropolitan area (Washington, D.C.) has no public transportation system. On each of 250 annual work days, 1.2 million commuters make 2 (one way) trips of 15 miles each way. The operating costs of these trips are 20 cents per mile on average, and the average value of time is presently $10 per hour. The time per mile (hours) that it takes drivers to traverse the 15 miles obeys the following time/volume relationship:

\[ \text{time} = 0.04 \left( \frac{\text{volume}}{1,200,000} \right)^2 \]

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

a). What is the total value of time and money cost currently spent on travel in the metro area?

A public rapid transit system is currently being proposed which would provide an alternative way of satisfying the present commuting pattern of the area. It would have a capital cost of 5 billion dollars, and operational costs of $1 per (15 mile) trip. It is 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.

Some officials argue that drivers impose social costs on one another. If an efficient congestion toll were charged (and the revenue returned to consumers in a lump sum manner), how would the situation change? In particular:

e). How many drivers would use the transit system, and what would be the total value of time and money costs be on both systems now? Should you count the toll receipts?

f). At what discount rate would it pay now to build the system?