

Solutions to Fleet Size Problems:

- 1) How many vehicles are needed to maintain a 20 minute headway on a route 10 miles long with an average speed of 12 mph?

$$NV = \frac{120 * L}{S * H} = \frac{120 * 10}{12 * 20} = \frac{100}{20} = 5 \text{ vehicles}$$

- 2) How long should the route be if only four vehicles are available for the route?

$$NV = \frac{120 * L}{S * H}, 4 = \frac{120 * L}{12 * 20}, 4 = \frac{L}{2}, L = 8 \text{ miles}$$

- 3) What would the average speed have to be to maintain a 10 mile route with 4 vehicles at 20 minute headway?

$$NV = \frac{120 * L}{S * H}, 4 = \frac{120 * 10}{S * 20}, 4 = \frac{60}{S}, S = 15 \text{ mph}$$

- 4) For No. 3, what level of demand peak can be accommodated with 50 passenger buses at a 1.0 load factor?

$$H = \frac{\text{Seats} * LF * 60}{PP}, 20 = \frac{50 * 1 * 60}{PP}, PP = \frac{300}{20} = 150 \text{ passengers/hour}$$

- 5) How many buses would be needed to accommodate a peak flow of 250 persons (50 passenger buses, 1.0 load factor, speed = 15 mph, 10 mile route)?

$$NV = \frac{2 * L * PP}{S * \text{Seats} * LF} = \frac{2 * 10 * 250}{15 * 50 * 1} = \frac{100}{15} = 6.6, \text{ use 7 buses}$$

- 6) For No. 5, what is the resulting average headway?

$$NV = \frac{120L}{S * H}, 7 = \frac{120 * 10}{15 * H}, H = \frac{80}{7} = 11.4 \text{ minutes}$$

- 7) For No. 5, what load factor would allow the cutting of one bus?

$$NV = \frac{2 * L * PP}{S * SE * LF}, 6 = \frac{2 * 10 * 250}{15 * 50 * LF} = \frac{100}{15 * LF}, LF = \frac{100}{90}, LF = 1.11$$

Interpretation of the Examples:

With the basic data, it takes 5 vehicles to operate a route that is 10 miles long on a 20 minute headway and with an average speed of 12 mph (Problem 1). This can be reduced to four vehicles by either making the route shorter at 8 miles (Problem 2) or by operating at a higher average speed at 15 mph (Problem 3). With four vehicles the route has a capacity of 150 passengers per hour (Problem 4).

If the demand was 250 passengers per hour, the route will require 6.6 buses, this is rounded up to seven (Problem 5). Then the average headway is 11.4 minutes (Problem 6). Finally, if you wanted to operate six vehicles and accommodate the demand, the load factor at the peak load point would be 111% (Problem 7).