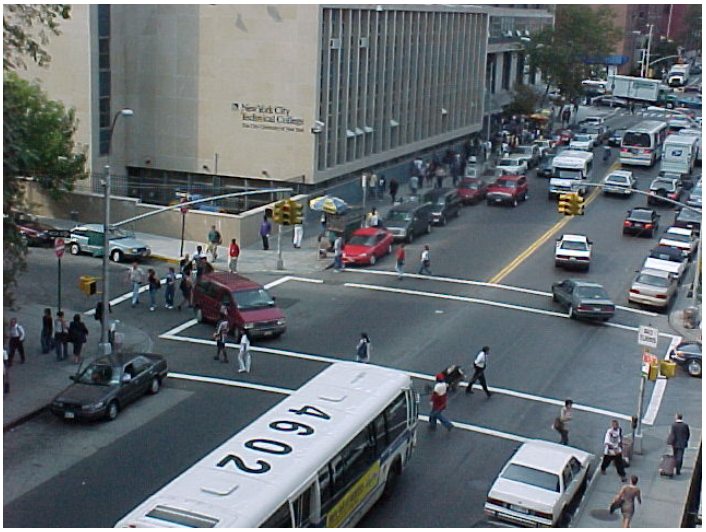
Traffic Engineering 5th edition Roess Solutions Manual

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TRAFFIC ENGINEERING

5TH Edition



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SOLUTIONS MANUAL

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Solutions to Problems in Chapter 2

Transportation Modes and Characteristics

Problem 2-1
The capacity of a street or highway is affected by a) the physical design of the roadway – such features as the number of lanes, free-flow speed, and geometric design, b) the traffic composition – particularly the presence of trucks and local buses, and c) the control environment – such features as lane use controls, signalization, curb lane controls, etc.

Problem 2-2
The capacity of a rapid transit line is affected by: the number of tracks, the person-capacity of each rail car, the length of trains, and the minimum headways at which trains can operate. The latter is limited by either the control system or station dwell times.

Problem 2-3
The key element here is that trains may operate 1.8 minutes apart. In this case, the dwell time controls this limit, not the train control system, which would allow closer operation. Thus, one track can accommodate 60/1.8 = 33.3 (say 33) trains/h.

Each train has 10 cars, each of which accommodates a total of 50+80 = 130 passengers. The capacity of a single track is, therefore:

33*10*130 = 42,900 people/h

Problem 2-4
From Table 2-5 of the text, a freeway with a free-flow speed of 55 mi/h has a vehicle-capacity of 2,250 passenger cars/h.

Traffic contains 10% trucks and 2% express buses, each of which displaces 2.0 passenger cars from the traffic stream. At capacity, there are:

2,250*0.10 = 225 trucks
2,250*0.02 = 45 express buses

Each of these displaces 2.0 passenger cars from the traffic stream. Thus, the 225+45 = 270 heavy vehicles displace 2*270 = 540 passenger cars from the traffic stream. Thus, the number of passenger cars at capacity is:

2,250 – 540 = 1,710 passenger cars

Using the vehicle occupancies given in the problem statement, the person-capacity of one lane is:

(1710*1.5)+(225*1.0)+(45*50) = 5,040 persons/h

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As there are 3 lanes in each direction, the capacity of each direction is 3*5040 = 15,120 people/h.

Problem 2-5

A travel demand of 30,000 persons per hour is virtually impossible to serve entirely with highway facilities. Even in the best case of a freeway with a 70-mi/h free-flow speed, and an assumed occupancy of 1.5 persons/car, a lane can carry only 3,600 people/h (Table 2-5). That dictates a need for 30,000/3,600 = 8.33 fully-dedicated freeway lanes to serve this demand. While this might be technically feasible if the area were basically vacant land with a new high-density trip generator being built, it would be intractable in most existing development settings.

That leaves various public transit options (Table 2-6). Given the observed capacities, it is doubtful that such a demand could be handled by bus transit (either on the street or on a private right-of-way) or light rail. A rapid transit line with one track in each direction would be able to handle the demand.

A lot depends on what type of development is spurring the demand. If it is a stadium or entertainment complex that generates high-intensity demand for short periods of time, the solution may be different from a case of a regional shopping mall, where trips are more distributed over time.

It is likely that some mix of modes would be needed. Rail transit is expensive, and any new service would have to be linked into a larger rapid transit network to be useful. Auto access is generally preferred by users (except for the traffic it generates), but involves the need to provide huge numbers of parking places within walking distance of the desired destination. A stadium could rely fairly heavily on transit, with heavy rail, light rail, and bus options viable. Some highway access and parking would also be needed. A regional shopping center would have to cater more to autos, as most people would prefer not to haul their purchases on transit.

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Solutions to Problems in Chapter 3
Speed, Travel Time, and Delay Studies

Problem 3-1

The reaction distance is given by Equation 3-1:

$$d_r = 1.47 S t$$

For a speed of 70 mi/h, the result is:

$$d_r = 1.47 * 70 * 3.5 = 360.2 \ ft$$

Other values for the range of speeds specified are shown in Table 1. Figure 1 plots these values.

Table 1: Reaction Distance vs. Speed

Speed	Distance
30	154.4
35	180.1
40	205.8
45	231.5
50	257.3
55	283.0
60	308.7
65	334.4
70	360.2

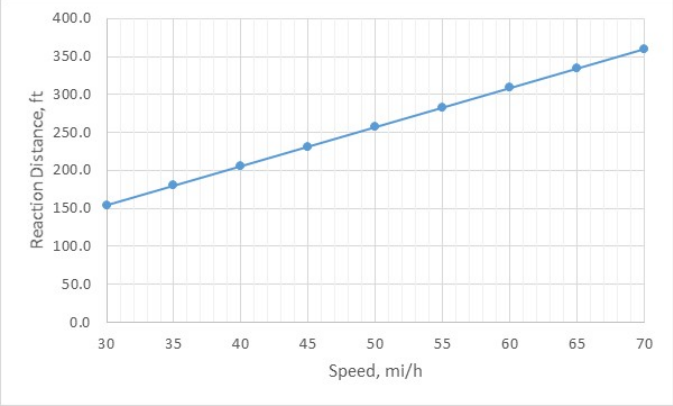


Figure 1: Reaction Distance vs. Speed

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