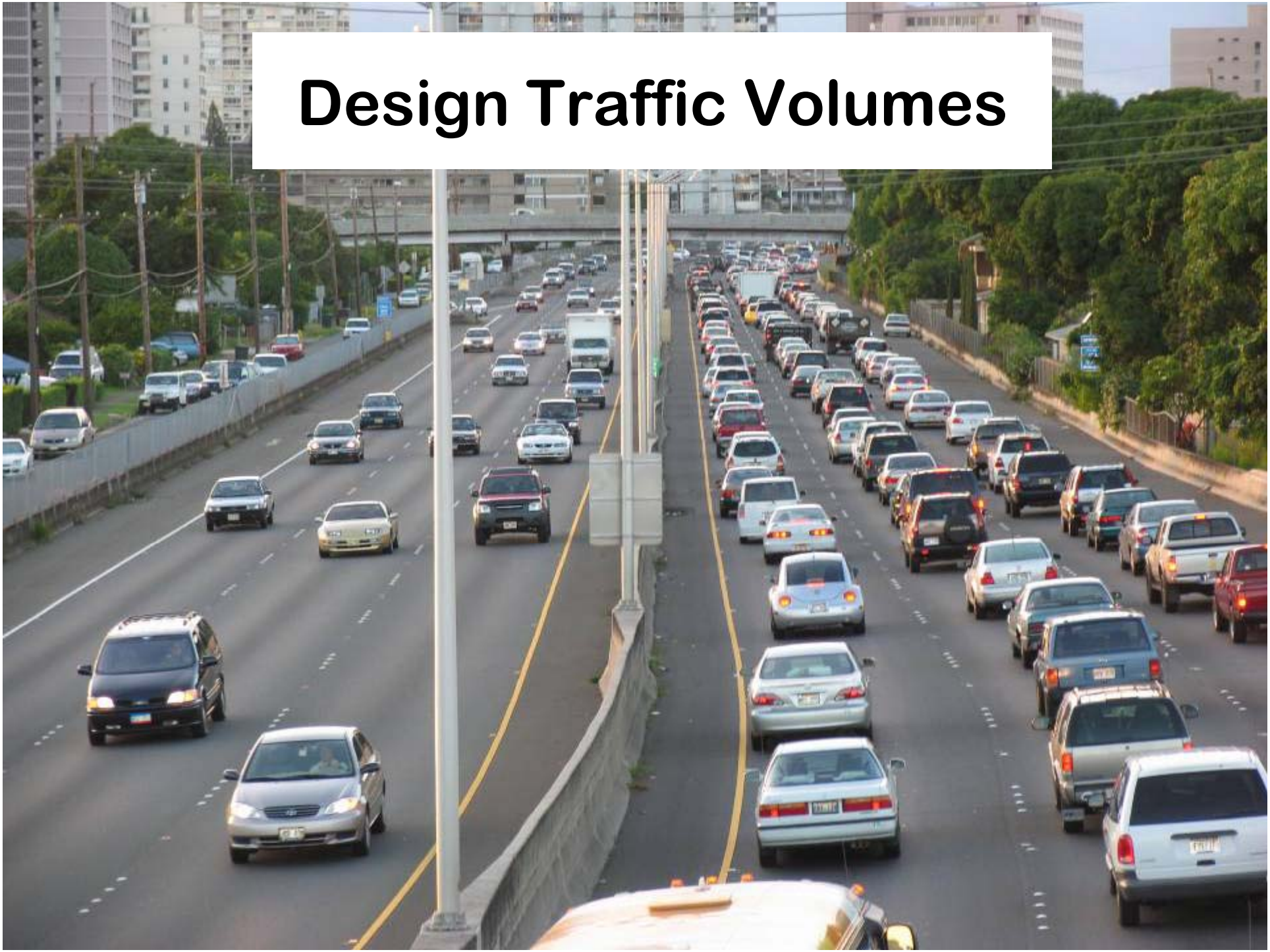
Design Traffic Volumes



Design Traffic Volumes

- **Need to figure out the appropriate hourly traffic volume to get a particular LOS**

Definitions

- **Annual average daily traffic (AADT)**
  - **Annual traffic averaged on a daily basis**
  - **Both directions**
- **Design hourly volume (DHV)**
  - **Traffic volume used for design calculations**
  - **Typically between the 10th and 50th highest volume hour of the year (30th highest is most common)**
- **K-factor**
  - **Ratio between DHV and AADT**

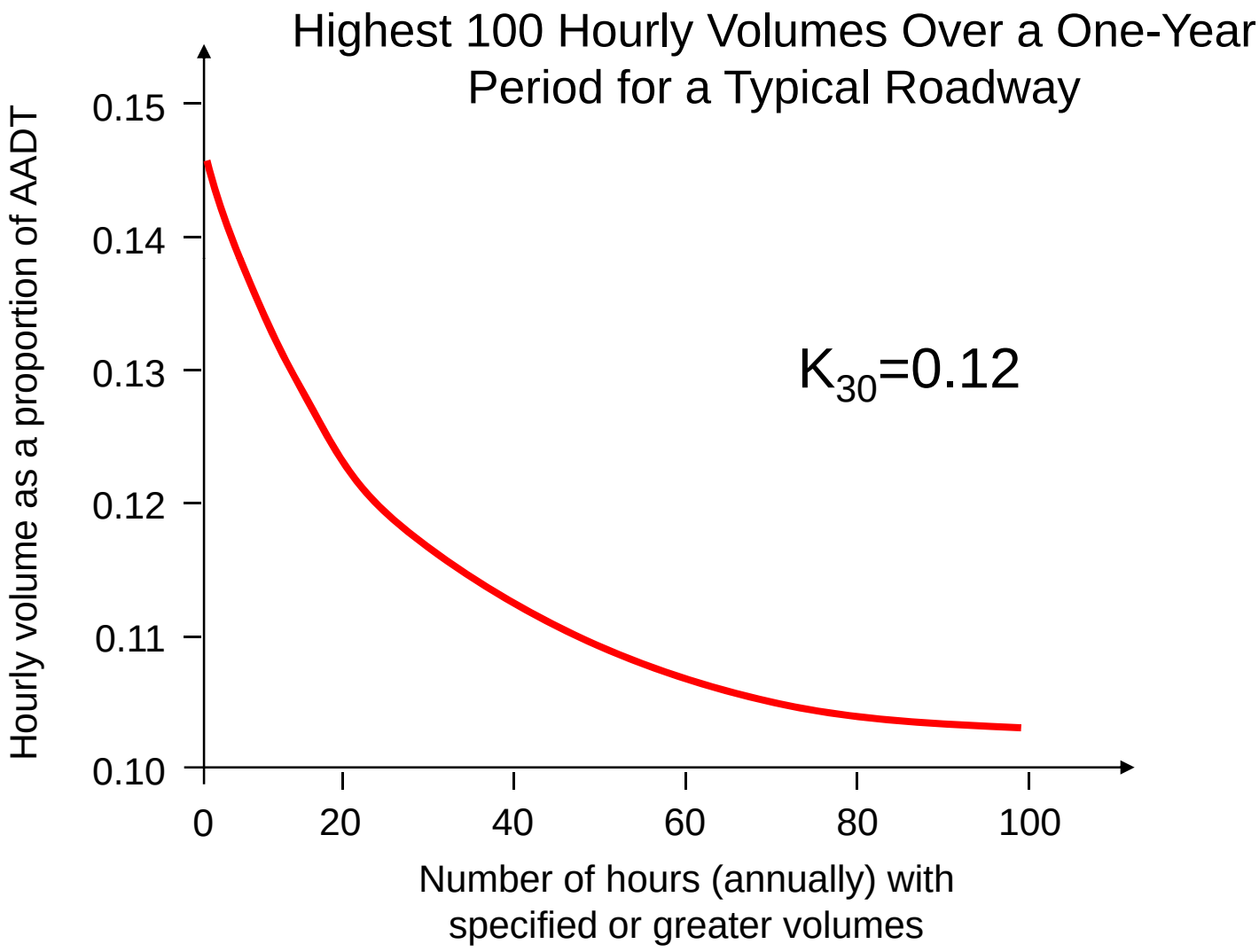
$$K = \frac{DHV}{AADT}$$

Definitions

- **Directional distribution factor (D)**
  - **Factor reflecting the proportion of peak-hour traffic traveling in the peak direction**
  - **Often there is much more traffic in one direction than the other**
- **Directional design-hour volume (DDHV)**

$$DDHV = K \times D \times AADT$$

Typical Graph



Is 2 lanes sufficient to ensure LOS C?

$$DDHV = K \times D \times AADT$$

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

Is 2 lanes sufficient to ensure LOS C?

- Use 30th highest annual hourly volume
- Freeway, 2 lanes each direction
- Passenger car only facility
- AADT = 35,000 veh/day
- FFS = 70 mph
- Commuters
- D = 65% (PH traffic in peak dir.)
- PHF=0.85

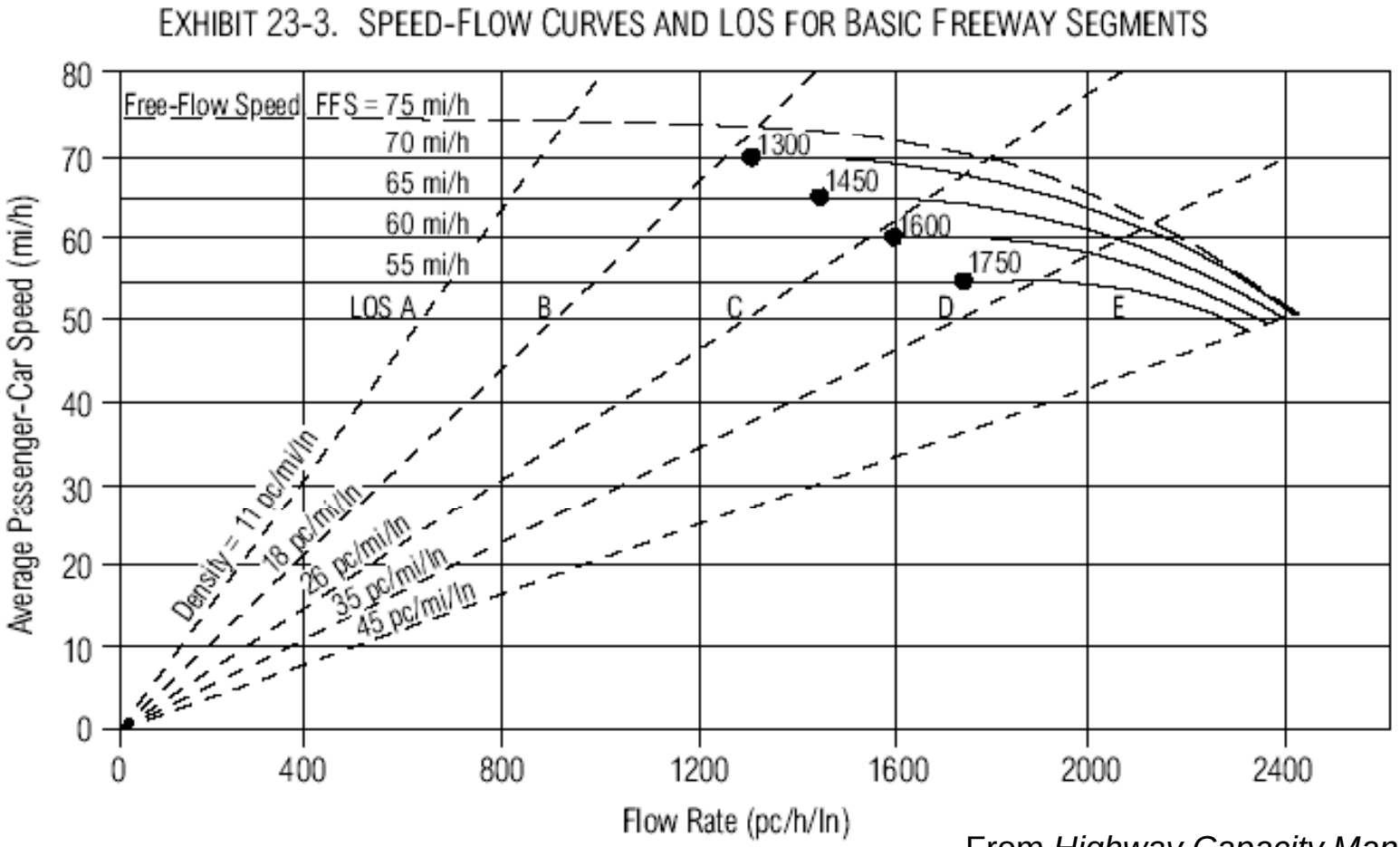
$$DDHV = K \times D \times AADT$$

Example

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

Define Speed-Flow Curve

Select a Speed-Flow curve based on FFS



From *Highway Capacity Manual*, 2000

Example

Determine the typical LOS for SR 520 eastbound near Microsoft (MP 10.25 – shown in the picture below) at 7 a.m. and 10 p.m.

Geometry

- **11 ft. lane width**
- **Left lateral clearance = 5 ft.**
- **Right lateral clearance = 4 ft.**

Other

- **7 am PHF = 0.95**
- **10 pm PHF = 0.99**
- **2% trucks**
- **3% buses**

from WSDOT's SRWeb
http://srview.wsdot.wa.gov/

Determine FFS

EXHIBIT 23-4. ADJUSTMENTS FOR LANE WIDTH

Lane Width (ft)	Reduction in Free-Flow Speed, f_{LW} (mi/h)
12	0.0
11	1.9
10	6.6

Determine FFS

EXHIBIT 23-5. ADJUSTMENTS FOR RIGHT-SHOULDER LATERAL CLEARANCE

Right-Shoulder Lateral Clearance (ft)	Reduction in Free-Flow Speed, f_{LC} (mi/h)			
	Lanes in One Direction			
	2	3	4	≥ 5
≥ 6	0.0	0.0	0.0	0.0
5	0.6	0.4	0.2	0.1
4	1.2	0.8	0.4	0.2
3	1.8	1.2	0.6	0.3
2	2.4	1.6	0.8	0.4
1	3.0	2.0	1.0	0.5
0	3.6	2.4	1.2	0.6

EXHIBIT 23-6. ADJUSTMENTS FOR NUMBER OF LANES

Number of Lanes (One Direction)	Reduction in Free-Flow Speed, f_N (mi/h)
≥ 5	0.0
4	1.5
3	3.0
2	4.5

Note: For all rural freeway segments, f_N is 0.0.

Determine FFS

In a 6-mile stretch from I-405 to Redmond there are 5 interchanges

from Microsoft MapPoint

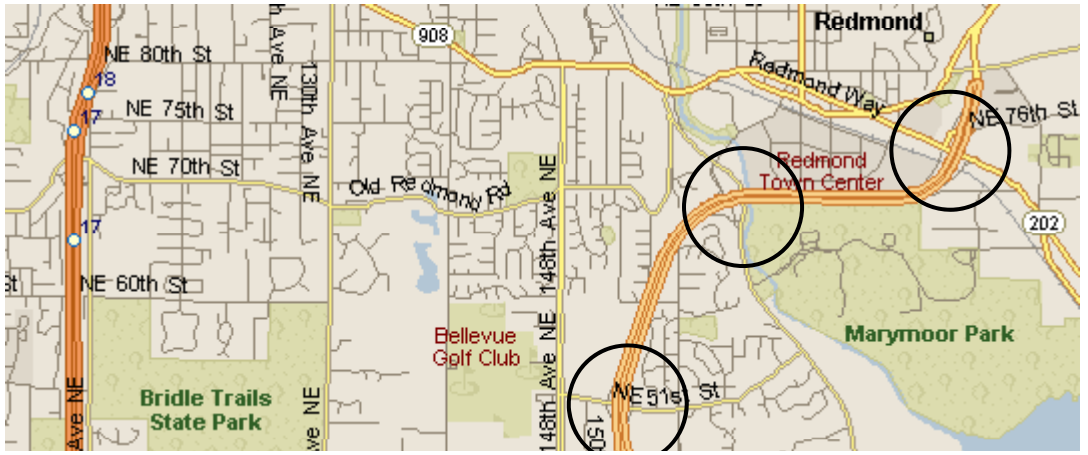
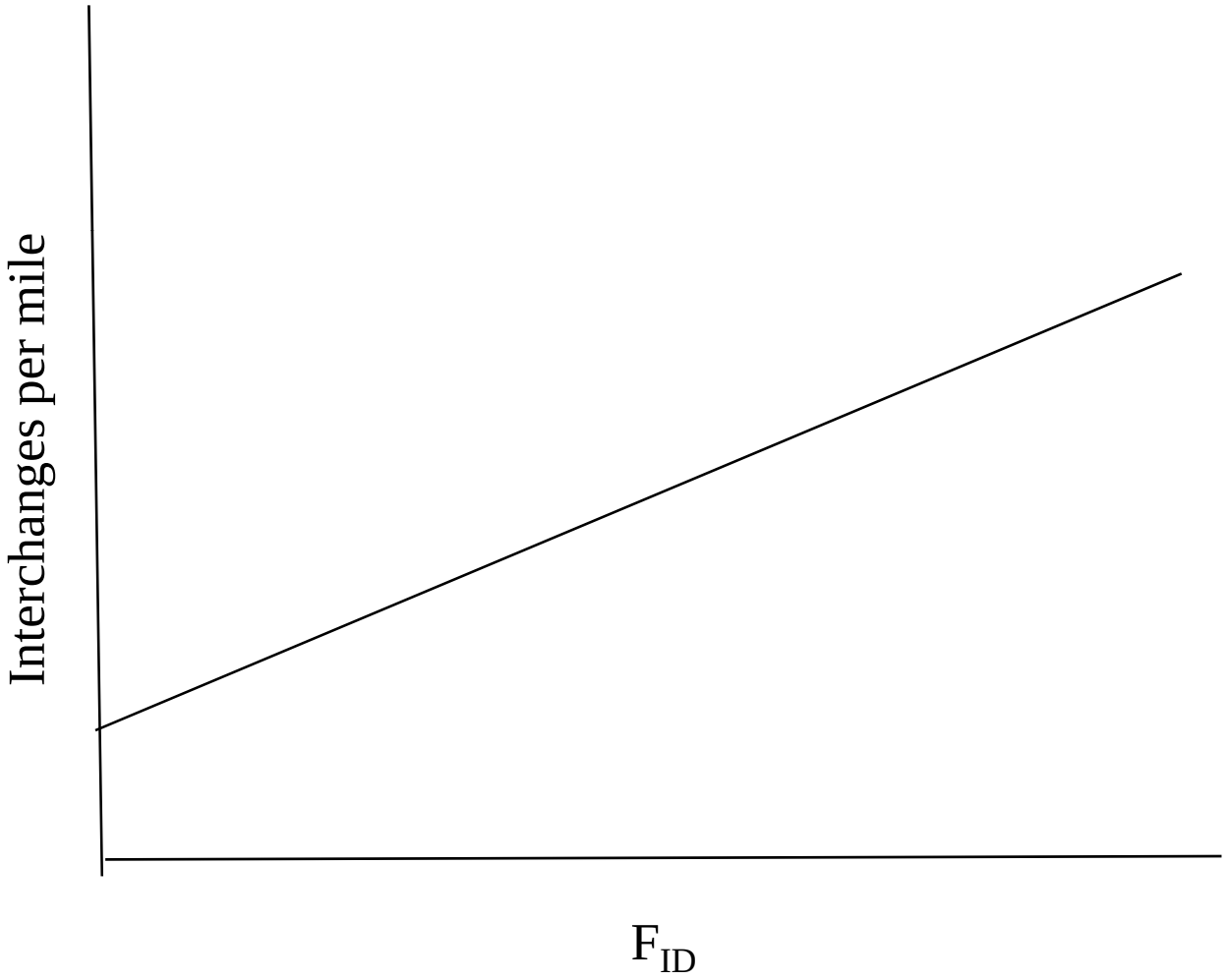


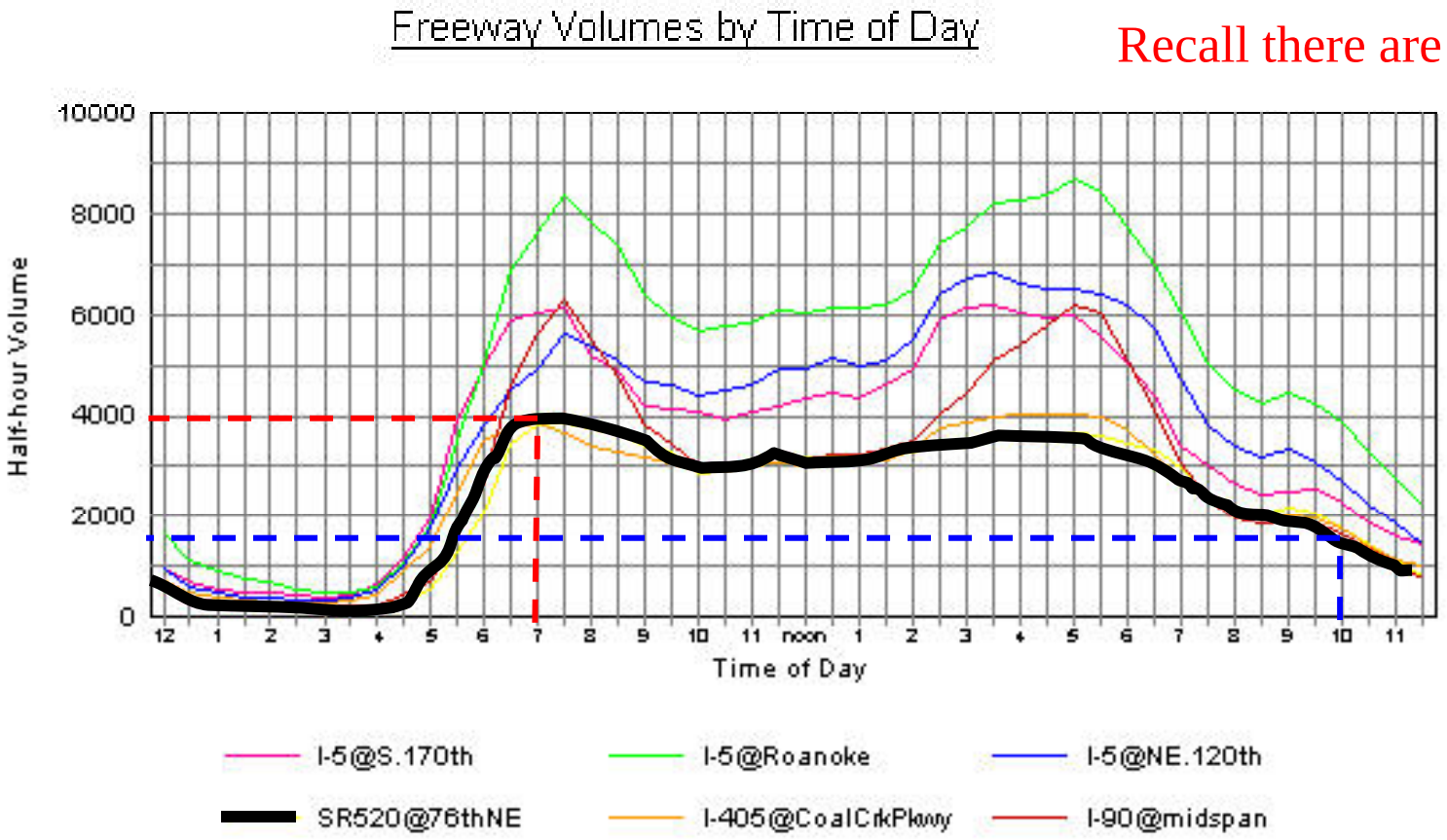
EXHIBIT 23-7. ADJUSTMENTS FOR INTERCHANGE DENSITY

Interchanges per Mile	Reduction in Free-Flow Speed, f_{ID} (mi/h)
0.50	0.0
0.75	1.3
1.00	2.5
1.25	3.7
1.50	5.0
1.75	6.3
2.00	7.5

Determine F_{ID}



Determine Flow Rate (v_p)



Recall there are 2 lanes

At 7am the ½ hour volume is about 4000 veh/hr
At 10 pm the ½ hour volume is about 1700 veh/hr

Graph from the Puget Sound Regional Council's *Puget Sound Trends*, No. T6, July 1997

Determine Flow Rate (v_p)

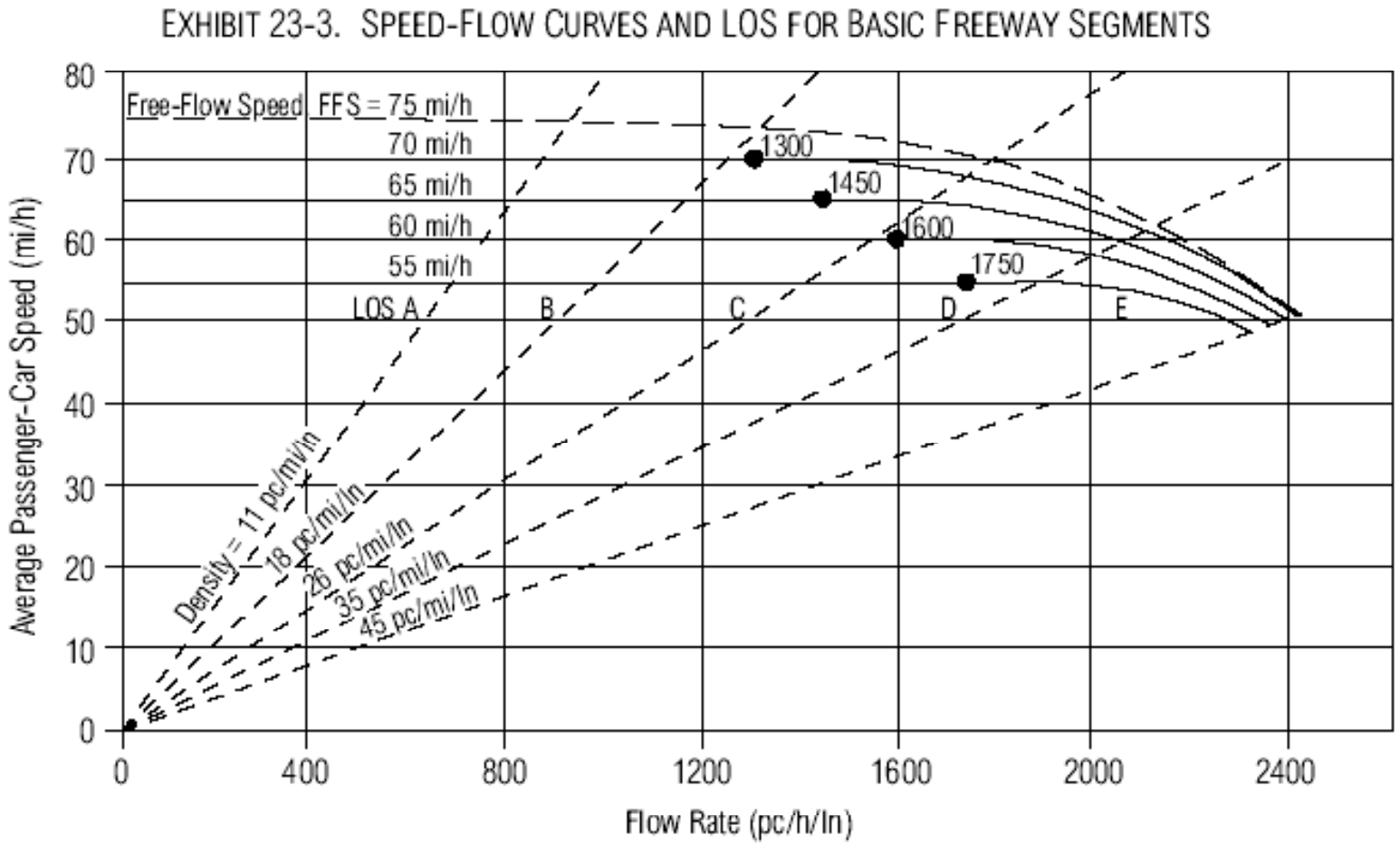
EXHIBIT 23-8. PASSENGER-CAR EQUIVALENTS ON EXTENDED FREEWAY SEGMENTS

Factor	Type of Terrain		
	Level	Rolling	Mountainous
E_T (trucks and buses)	1.5	2.5	4.5
E_R (RVs)	1.2	2.0	4.0

$$f_{HV} = \frac{1}{1 + P_T(E_T - 1) + P_R(E_R - 1)}$$

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$

Determine LOS, speed



What is LOS at 10:00 pm?

$$v_p = \frac{V}{PHF \times N \times f_{HV} \times f_p}$$