TRAFFIC ENGINEERING

Civil Engineering Department

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Parking Studies

- Any vehicle traveling on a highway will at one time or another be parked for either relatively shorter time or much longer time, depending on the reason of parking. The provision of parking facilities is therefore an essential element of the highway transportation.

- The need for parking spaces is usually in areas where land uses include :
  - Residential.
  - Commertial.
  - shopping centers.
  - etc.

Types of Parking Facilities

Parking facilities can be divided → On-street parking (curb parking).
→ off-street parking

1. On-street parking :
Which is also known as curb parking and provided along side the curb on one or both sides of the street.

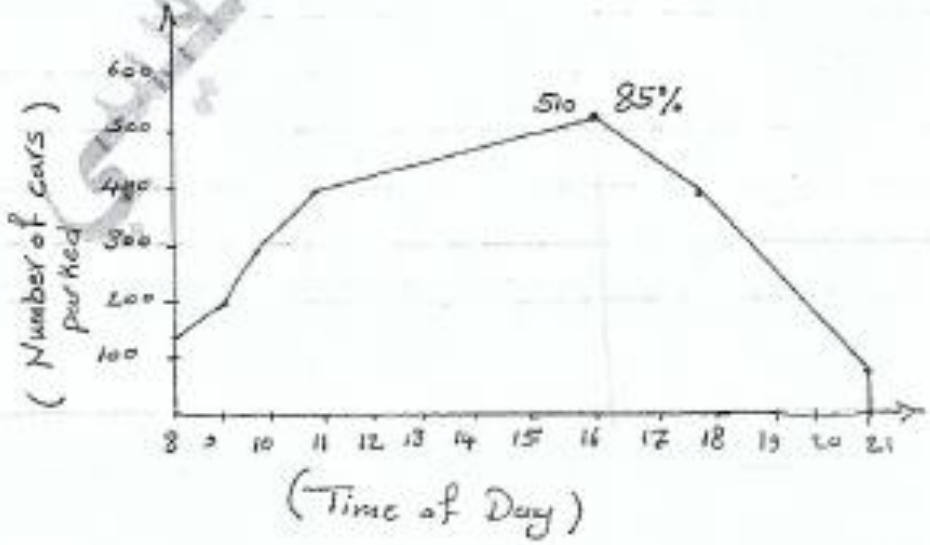
2. Off-street parking:
This facilities may be privately or publicly owned.

- Surface parking
- multistory garage.
- under ground garage.

Definitions of Parking Term

1. A space-hour : defins the use of a single parking space for period of 1 hr.
2. Parking volume: total number of vehicles that park in a study area during specific length of time, usually a day.
3. Parking accumulation : is the number of parked vehicles in a study area at any specified time.

These data can be plotted as a curve of parking accumulation against time, which shows the variation of the parking accumulation during the day.



4. The parking load: The area under the accumulation curve between two specific times. It is usually given as the number of space-hours used during the specified period of time.

5. Parking duration: the length of time a vehicle is parked at a parking bay. (minutes or hour)

6. Parking Turnover: is the rate of use of a parking space and is obtained by dividing the parking volume for a specified period by the number of parking spaces.

$$TR = \frac{N}{ST_s}$$

TR: parking turnover rate (veh./space/hr).
N: total number of vehicle parked.
S: total number of parking spaces.
T_s: duration of the study periods (hr).

7. Occupancy: proportion spaces utilized at any movement

$$\text{Occupancy} = \frac{\text{accumulation}}{\text{total spaces}}$$

- The space-hours of demand for parking are obtained from the expression:

$$D = \sum_{i=1}^{N} (n_i t_i)$$

Where:

D: space vehicle-hours demand for a specified period of time.

N: number of classes of parking duration ranges.

t_i: midparking duration of ith class.

n_i: number of vehicles parked for the ith duration range.

- The space-hours of supply are obtained from the expression:

$$S = f \sum_{i=1}^{N} (t_i)$$

Where:

S: practical number of space-hours of supply for a specified period of time.

N: number of parking spaces available.

t_i: total length of time in hours when the ith space can be legally parked during the specified period.

f: effeciency factor, it is determined on the basis of the best performance a parking facility is expectected to produce.

Example

The owner of a parking garage located in CBD has observed that 20 percent of those wishing to park are turned back every day during the open hours of 8 a.m. to 6 p.m. because of lack of parking spaces. An analysis of data collected at the garage indicates that 60 percent of those whom park are commuters, with an average parking duration of 9 hr, and the remaining are shoppers, whose average parking duration is 2 hr. If 20 percent of those who cannot park are commuters and the rest are shoppers, and a total of 200 vehicles currently park daily in the garage, determine the number of additional spaces required to meet the excess demand.
Assume parking efficiency is 0.8

Solution:

Calculate the space-hours of demand using

$$D = \sum_{i=1}^{N} (n_i t_i)$$

Commuters now being served = $0.6 \times 200 \times 9 = 1080$ space-hr
shoppers now being served = $0.4 \times 200 \times 2 = 160$ space-hr
Total number of vehicles turned away = $\frac{200}{0.8} - 200 = 50$

Commuters not being served = $0.2 \times 50 \times 9 = 90$ space-hr
Shoppers not being served = $0.8 \times 50 \times 2 = 80$ space-hr

Total space-hrs of demand = (1080 + 160 + 90 + 80) = 1410

Total space-hrs served = 1080 + 160 = 1240

Number of space-hours required = 1410 − 1240 = 170

The number of parking spaces required

$$S = f \sum_{i=1}^{N} t_i = 170 \text{ space-hr}$$

length time that each space can legally parked 8 a.m. through 6 p.m. = 10 hr.

$$0.8 \times 10 \times N = 170$$

$$N = 21.25 \cong 22$$

At least 22 additional spaces will be required, since a fraction of a space cannot be used.

Example: Determine the accumulation for the following off-street parking counts.

Time period	vehicle entering (VE)	leaving vehicle (VL)	Accumulation (A)
			25
8:00 - 8:15	150	20	150 - 20 + 25 = 155
8:15 - 8:30	220	40	220 - 40 + 155 = 335
8:30 - 8:45	250	42	250 - 42 + 335 = 543
8:45 - 9:00	175	52	175 - 52 + 543 = 666
9:00 - 9:15	180	80	180 - 80 + 666 = 766