

Appendix F

Levels of Service (LOS) Descriptions

TRAFFIC LEVELS OF SERVICE

Analysis of traffic volumes is useful to understand the general nature of traffic in an area, but, by itself, does not indicate the ability of the street network to carry additional traffic or the quality of service afforded by specific facilities. To this end, the concept of level of service (LOS) was developed to subjectively describe street and/or intersection performance. Bottlenecks are most often found at intersections, and the ability of the street network to carry traffic efficiently is generally diminished in their vicinities. As a result, LOS is most often evaluated at intersections, but key corridors can be evaluated as well.

LOS categories are similar to report card ratings. Levels of Service A, B, and C indicate conditions where traffic moves without significant delays over periods of peak travel demand. Levels of service D, E, and F represent progressively worse peak hour operating conditions. Most urban communities set level of service D as the minimum acceptable level of service for peak hour operation and plan for level of service C or better for all other times of the day. The Highway Capacity Manual provides LOS calculation methodologies for both intersections and arterials.¹

¹ *Highway Capacity Manual 2000*, Transportation Research Board, Washington D.C., 2000, Chapters 16 and 17.

UNSIGNALIZED INTERSECTIONS

All-Way Stop Controlled

Level of service for all-way stop controlled intersection operations are reported for each intersection leg. This method calculates a delay value for each approach to the intersection.

The following table describes the amount of delay associated with each level of service for all-way stop controlled intersections.

Level of Service	Delay (seconds/vehicle)
A	0-10
B	>10-15
C	>15-25
D	>25-35
E	>35-50
F	>50

Source: Highway Capacity Manual 2000, Exhibit 17-22

Two-Way Stop Controlled

For two-way stop controlled intersections, level of service is reported for both major and minor streets. The LOS evaluation assesses available and critical gaps in the traffic stream, which are necessary for minor street traffic to be able to enter the major street traffic flow. It is not unusual for an intersection to experience level of service E or F conditions for the minor street left turn movement. However, poor level of service experienced by a few vehicles does not necessarily mean that the intersection as a whole is not operating within acceptable parameters.

The following table describes the amount of delay associated with each level of service for two-way stop controlled intersections.

Level of Service	Delay (seconds/vehicle)	Description
A	0-10	Little or no delay
B	>10-15	Short traffic delays
C	>15-25	Average traffic delays
D	>25-35	Long traffic delays
E	>35-50	Very long traffic delays
F	>50	Extreme delays potentially affecting other traffic movements in the intersection

Source: Highway Capacity Manual 2000, Exhibit 17-2

SIGNALIZED INTERSECTIONS

For signalized intersections, level of service is evaluated based upon average vehicle delay experienced by vehicles entering the intersection. Per the Highway Capacity Manual 2000, control delay (or signal delay) includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. As delay increases, the level of service decreases. Calculations for signalized and unsignalized intersections are different due to variations in traffic flow that are caused by different traffic control devices.

Level of Service	Delay (seconds/vehicle)	Description
A	0-10	Free Flow/Insignificant Delays: No approach phase is fully utilized by traffic and no vehicle waits longer than one red indication. Most vehicles do not stop at all. Progression is extremely favorable and most vehicles arrive during the green phase.
B	>10-20	Stable Operation/Minimal Delays: An occasional approach phase is fully utilized. Many drivers begin to feel somewhat restricted within platoons of vehicles. This level generally occurs with good progression, short cycle lengths, or both.
C	>20-35	Stable Operation/Acceptable Delays: Major approach phases fully utilized. Most drivers feel somewhat restricted. Higher delays may result from fair progression, longer cycle lengths, or both. Individual cycle failures may begin to appear at this level, and the number of vehicles stopping is significant.
D	>35-55	Approaching Unstable/Tolerable Delays: The influence of congestion becomes more noticeable. Drivers may have to wait through more than one red signal indication. Longer delays may result from some combination of unfavorable progression, long cycle lengths, or high v/c ratios. The proportion of vehicles not stopping declines, and individual cycle failures are noticeable.
E	>55-80	Unstable Operation/Significant Delays: Volumes at or near capacity. Vehicles may wait through several signal cycles. Long queues form upstream from intersection. These high delay values generally indicate poor progression, long cycle lengths, and high v/c ratios. Individual cycle failures are a frequent occurrence.
F	>80	Forced Flow/Excessive Delays: Represents jammed conditions. Queues may block upstream intersections. This level occurs when arrival flow rates exceed intersection capacity, and is considered to be unacceptable to most drivers. Poor progression, long cycle lengths, and v/c ratios approaching 1.0 may contribute to these high delay levels.

Source: Highway Capacity Manual 2000, Exhibit 16-2