

## #5 Level of Service

A level of service is defined by the Highway Capacity Manual as “ a qualitative measure describing operational conditions within traffic stream, or their perception by motorists and/or passengers...” with these conditions generally described by “... such measures as speed and travel time, freedom to maneuver, traffic interruptions, comfort and convenience, and safety.”

Level of service (LOS) is calculated based on a number of design and operating criteria, such as lane width, roadside obstacles, trucks & busses, curvature, grades, etc. Levels of service are assigned letters, much the same as grades are reported in school (except for the E category). Levels of service for **freeways** are briefly defined below and are illustrated pictorially in the attached illustrations pulled from the 1985 Highway Capacity Manual.

- LOS A describes free-flow operations. Free-flow speeds prevail. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream. The effects of incidents or point breakdowns are easily absorbed at this level.
- LOS B represents reasonably free flow, and free-flow speeds are maintained. The ability to maneuver within the traffic stream is only slightly restricted, and the general level of physical and psychological comfort provided to drivers is still high. The effects of minor incidents and point breakdowns are still easily absorbed.
- LOS C provides for flow with speeds at or near the free-flow speed of the freeway. Freedom to maneuver within the traffic stream is noticeably restricted, and lane changes require more care and vigilance on the part of the driver. Minor incidents may still be absorbed, but the local deterioration in service will be substantial. Queues may be expected to form behind any significant blockage.
- LOS D is the level at which speeds begin to decline slightly with increasing flows and density begins to increase somewhat more quickly. Freedom to maneuver within the traffic stream is more noticeably limited, and the driver experiences reduced physical and psychological comfort levels. Even minor incidents can be expected to create queuing, because the traffic stream has little space to absorb disruptions.
- LOS E describes operation at capacity. Operations at this level are volatile, because there are virtually no usable gaps in the traffic stream. Vehicles are closely spaced, leaving little room to maneuver within the traffic stream at speeds that still exceed 49 mi/hr. Any disruption of the traffic stream, such as vehicles entering from a ramp or a vehicle changing lanes, can establish a disruption wave that propagates throughout the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruption, and any incident can be expected to produce serious breakdown with extensive queuing. Maneuverability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded the driver is poor.

- LOS F operations within a queue are the result of a breakdown or bottleneck at a downstream point. LOS F is also used to describe conditions at the point of the breakdown or bottleneck and the queue discharge flow that occurs at speeds lower than the lowest speed for LOS E, as well as the operations within the queue that forms upstream. Whenever LOS F conditions exist, they have the potential to extend upstream for significant distances.

Two-lane highways operate substantially different than multi-lane highways because of the interaction of vehicles flowing in close proximity in opposite directions. As passing must be done in the opposing lane, traffic in one direction limits and affects flow in the other. A graphic representation of level of service on two-lane highways is also attached (Figure 5- Level of Service Ratings for Two-Lane Highways).


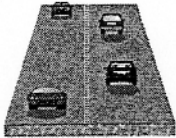
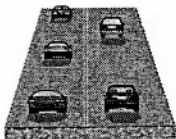


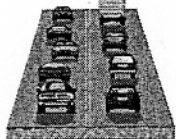
As stated in the 1985 Highway Capacity Manual, “Few two-lane highways are ever observed operating at or near capacity. That is because most two-lane highways will experience severe operating problems at flow levels well below capacity. These often require improvements creating three or four-lane alignments.” The manual further states “Thus, two-lane highways operating at small fractions of their capacity experience severe operating problems.”

Level of service is used to determine the function of existing transportation systems as well as to design for the proper sizing of new improvements. The American Association of State Highway and Transportation Officials (AASHTO) states “As may be fitting to the conditions, the highway agency should strive to provide the highest level of service feasible. In heavily developed sections of metropolitan areas, conditions may necessitate the use of level-of-service D for freeways and arterials, but such use should be rare and at least level-of-service C should be strived for. For some urban and suburban highways, conditions may necessitate the use of level-of-service D.”

Sources: Highway Capacity Manual - Special Report 209 (Transportation Research Board) 1985  
Highway Capacity Manual (Transportation Research Board) 2000



Figure 5. Level of Service Ratings for *Two-Lane* Highways

<b>LEVELS OF SERVICE</b> for Two-Lane Highways			
Level of Service	Flow Conditions	Operating Speed (mph)	Technical Descriptions
<b>A</b>		55+	Highest quality of service. Free traffic flow with few restrictions on maneuverability or speed. <b>No delays</b>
<b>B</b>		50	Stable traffic flow. Speed becoming slightly restricted. Low restriction on maneuverability. <b>No delays</b>
<b>C</b>		45	Stable traffic flow, but less freedom to select speed, change lanes or pass. <b>Minimal delays</b>
<b>D</b>		40	Traffic flow becoming unstable. Speeds subject to sudden change. Passing is difficult. <b>Minimal delays</b>
<b>E</b>		35	Unstable traffic flow. Speeds change quickly and maneuverability is low. <b>Significant delays</b>
<b>F</b>			Heavily congested traffic. Demand exceeds capacity and speeds vary greatly. <b>Considerable delays</b>

Source: 2000 HCM, Exhibit 20-2, LOS Criteria for Two-Lane Highways in Class 1