

GLOSSARY

ACCELERATION LANE	An auxiliary lane to enable a vehicle entering a roadway to increase speed and merge with through traffic as applied at channelized intersections, or as a speed change lane at interchanges.
ACCESS CONTROL	The condition where the right of access to a road is controlled by a public authority.
ADVERSE CROWN	Negative superelevation on a curve, due to the normal cross-section of a non-superelevated road being used.
ARTERIAL	A general term denoting a highway primarily intended for through traffic, usually on a continuous route. Direct access to abutting lane may be restricted or eliminated.
AUXILIARY LANE	A lane placed in addition to and adjacent to a through lane, intended for a specific manoeuvre such as turning, merging, diverging, weaving, and for slow vehicles, but not parking.
AVERAGE ANNUAL DAILY TRAFFIC (AADT)	Total accumulated traffic passing an imaginary line across a road, over a period of a year, divided by the number of days in the year. The AADT may be expressed as traffic in one direction for divided roads or as the total bi-directional traffic on undivided roads.
AVERAGE SUMMER DAILY TRAFFIC (ASDT)	The average 24-hour, two-way traffic for the period May 1st to September 30th, including weekends.
AVERAGE TRAVEL SPEED	The average speed of a traffic stream computed as the length of a highway segment divided by the average travel time of vehicles traversing the segment, in kilometres per hour.
BACKSLOPE	Where the roadway is in cut, the slope between the ditch and the natural ground away from the road is referred to as a backslope.
BARRIER	A device to shield a hazard that is located on the roadside or in the median, which is either a longitudinal barrier or a crush cushion.
BIKEWAY	Any portion of a roadway, lane or path specifically designed for cycle traffic either exclusively or alongside other vehicles.
BOULEVARD	A reserve which separates the roadway from the sidewalk. It provides some protection to the pedestrian and can accommodate street accessories such as traffic signs and fire hydrants. It also provides an area for snow storage.
BRAKE REACTION TIME	See Perception/Reaction time.
BRAKING DISTANCE	The distance travelled from the instant that braking begins to the instant the vehicle comes to a stop.

BROKEN BACK CURVE	An arrangement of curves in which a short tangent separates two curves in the same direction.
CAPACITY	The maximum rate of flow at which persons or vehicles can be reasonably expected to traverse a point or uniform segment of a lane or roadway, during a specified time period under prevailing roadway, traffic, and control conditions. Capacity is usually expressed as vehicles per hour or persons per hour.
CAPACITY UTILIZATION (2-LANE HIGHWAY)	The ratio of the demand flow rate to the capacity of the facility.
CHANNELIZATION	The separation of traffic flow into positive paths, by means of traffic markings or islands.
CLASSIFICATION	See Design Designation.
CLEAR ZONE	Clear zone is defined as the border area starting at the edge of the travel lane, which should be clear of hazards and available for use by errant vehicles.
COLLECTOR	A highway facility that provides for traffic movements between arterials and local streets, with some direct access to adjacent property.
CONTROL OF ACCESS	See Access Control.
CRAWL SPEED	The maximum sustained speed that can be maintained by a specified type of vehicles on a constant upgrade of a given percentage, in kilometres per hour.
CREST VERTICAL CURVE	A vertical curve having a convex shape in profile.
CRITICAL DENSITY	The density at which capacity occurs for a given facility, usually expressed as vehicles per kilometre per lane.
CRITICAL GAP	The median time headway between vehicles in a major traffic stream which will permit side-street vehicles at a STOP — or YIELD — controlled approach to cross through or merge with the major traffic stream under prevailing traffic and roadway conditions, in seconds.
CRITICAL v/c RATIO	The proportion of available intersection capacity used by vehicles in critical lane groups.
CROSS FALL (CROSS-SLOPE)	The average grade between the edges of a cross-section element.
CROSS-SECTION	The transverse profile of a road.
CROSSING SIGHT DISTANCE	Sight distance required for a vehicle, entering a road, to make a safe crossing manoeuvre from a stop or a significantly reduced speed.
CROSSWALK	Any part of a roadway specifically intended for pedestrian crossing, and usually indicated by signs, lines or other markings.

CROWN	The highest break point of the surface of a roadway in cross section.
CUL-DE-SAC	A road open at one end only.
CURB	A member (usually concrete or asphalt), with a vertical or sloping face along the edge of a lane or shoulder, which strengthens or protects the edge and clearly defines the edge.
CURB AND GUTTER	Curb and gutter is placed adjacent to an outside lane or shoulder. They are intended to control and conduct storm-water and also provide delineation for traffic. In some instances, curb is introduced without a gutter.
CURVE TO SPIRAL (CS)	The point of alignment change from circular curve to spiral curve, in the direction of stationing.
CURVILINEAR ALIGNMENT	An alignment in which the majority of the length is composed of circular and spiral curves.
CUT	Any part of a roadway located below natural ground elevation is said to be in cut.
DECELERATION LANE	An auxiliary lane to enable a vehicle exiting from a roadway to reduce speed after it has left the through traffic lanes. Used at channelized intersections, or as a speed-change lane at interchanges.
DECISION SIGHT DISTANCE	The distance required for a driver to detect an information source or hazard which is difficult to perceive when the roadway environment is visually cluttered. The distance required allows the driver to recognize the hazard or its potential threat, select appropriate action, and complete the manoeuvre safely and efficiently.
DEFLECTION ANGLE	The angle between a roadway alignment line and the projection of the preceding line.
DESIGN CLASSIFICATION	See Design Designation.
DESIGN YEAR	Horizon year for which a highway is designed to operate at a predetermined level of service.
DELAY	Additional travel time experienced by a driver, passenger, or pedestrian beyond what would reasonably be desired for a given trip.
DEMAND VOLUME	The traffic volume expected to desire service past a point or segment of the highway system at some future time, or the traffic currently arriving or desiring service past such a point, usually expressed as vehicles per hour.
DENSITY	The number of vehicles occupying a given length of lane or roadway averaged over time. Usually expressed as vehicles per kilometre or vehicles per kilometre per lane.

DESIGN ANALYSIS	A usage of capacity analysis procedures to determine the size (number of lanes) required on a given segment of a facility in order provide a specified level of service.
DESIGN DESIGNATION	Design designation is an alphanumeric abbreviation which describes the principle design values used in a particular highway geometric design standard.
DESIGN HOUR FACTOR	Proportion of 24-hour volume occurring during the design hour for a given location or area.
DESIGN HOUR VOLUME	The number of vehicles that passes over a given section of a lane or a roadway during the 30th highest hourly volume of the design year.
DESIGN SPEED	Design speed is the maximum safe speed that can be maintained over a specified section of highway, when conditions are so favourable that the design features of the highway govern.
DESIRABLE STANDARD	See Standard.
DIAMOND INTERCHANGE	A four legged interchange with a single one-way ramp in each quadrant. All left turns are made directly on the cross-road.
DIRECTIONAL DISTRIBUTION	The proportion of traffic in each direction during the peak 15-minute flow period in the hour of interest.
ENTRANCE	The general area where turning roadway traffic enters the main roadway.
ENTRANCE TERMINAL	That part of an entrance composed of acceleration lanes or speed change lanes, including the entrance taper and the ramp proper up to the ramp controlling curve.
EXIT	The general area where turning roadway traffic departs from the main roadway.
EXIT TERMINAL	The part of an exit composed of deceleration lanes or speed change lanes, including the exit taper and the ramp proper up to the ramp controlling curve.
EXPRESSWAY	A multi-lane divided highway having a minimum of two lanes of traffic for each direction. Access is very limited, mostly through interchanges. Some at-grade intersections may remain. Generally, this is an interim stage for divided highways being upgraded to freeway.
FILL	Any part of a roadway located above the natural ground elevation is said to be in fill.
FILL SIDESLOPE	Where the roadway is in fill, the slope between the roadway and the natural ground is referred to as the fill sideslope, or sometimes the fill slope.

FREE-FLOW SPEED	1. The theoretical speed of traffic when density is zero; that is, there are no vehicles present; 2. the average speed of vehicles over an arterial segment not close to signalized intersections under conditions of low volume.
FREEWAY	A multi-lane divided highway having a minimum of two lanes for exclusive use of traffic in each direction and full control of access and egress.
FRICTION FACTOR	The coefficient of friction between tire and roadway, measured either longitudinally or laterally.
GEOMETRIC DESIGN	Geometric design is defined as the selection of the visible dimensions of the road.
GORE	Location where edge of highway and edge of ramp meet each other. The gore may include or exclude curb and gutter. The gore nose is the gore edge which faces the oncoming traffic.
GORE AREA	Area between the edge of the highway and the ramp edge from the painted nose up to and including the gore. The painted nose is the intersection of the ramp inside lane edge with the highway outside lane edge.
GRADE SEPARATION	Vertical separation of two roads or a road and a railway.
GRADIENT (GRADE)	The rate of rise or fall with respect to the horizontal distance; usually expressed as a percentage.
GRAVEL ROAD	A road that has a driving surface consisting of granular material.
GUARDRAIL	A longitudinal barrier of the general form of concrete or of posts and rail.
GUIDE	The word guide is used here to describe a document which provides guidance for highway geometric design. The guide provides general and specific information on the rationale used to select standards, the basis of standards and the application of desirable, minimum and below minimum standards to highway projects. The purpose of providing this information is to allow designers to exercise sound engineering judgement in applying standards consistent with AT&U philosophy.
GUTTER	A paved shallow waterway provided for carrying surface drainage.
HAZARD	Any obstacle or other feature such as an embankment, or body of water of depth greater than 1m, that without protection, is likely to cause significant injury to the occupants of a vehicle encountering it. It may be natural or manmade.
HEADWAY	The time between two successive vehicles in a traffic lane as they pass a point on the roadway, measured from front bumper to front bumper, in seconds.
HEAVY VEHICLE	Any vehicle with more than four wheels touching the pavement during normal operation.

HIGHWAY	Synonymous with road except it is applied generally only to rural areas.
HORIZONTAL ALIGNMENT	The configuration of a road or roadway as seen in plan, consisting of tangents, lengths of circular curve, and lengths of spiral or transition curves.
HORIZONTAL CURVE	A curve in plan to provide for change of direction. Usually includes spirals.
IDEAL CONDITIONS	Characteristics for a given type of facility which are assumed to be the best possible from the point of view of capacity; that is, characteristics which if further improved would not result in increased capacity.
IDEAL CONDITIONS FOR FREEWAY	<ol style="list-style-type: none"> 1. Twelve-foot minimum lane widths. 2. Six-foot minimum lateral clearance between the edge of the travel lanes and the nearest obstacle or object on the roadside or in the median. (Note that certain types of median barriers do not represent an obstacle, even when closer than 1.8m to the pavement edge.) 3. All passenger cars in the traffic stream. 4. Driver characteristics typical of weekday commuter traffic streams in urban areas, or regular users in other areas. 5. Design speed of 110 km/h.
IDEAL CONDITIONS FOR TWO-LANE UNDIVIDED HIGHWAYS	<p>Ideal conditions for two-lane highways are defined as no restrictive geometric, traffic, or environmental conditions. Specifically, they include:</p> <ol style="list-style-type: none"> 1. Design speed greater than or equal to 100 km/h. 2. Lane widths greater than or equal to 3.7m. 3. Clear shoulders wider than or equal to 1.8m. 4. No no-passing zones on the highway. 5. All passenger cars in the traffic stream. 6. A 50/50 directional split of traffic. 7. No impediments to through traffic due to traffic control or turning vehicles. 8. Level terrain.
IDEAL CONDITIONS FOR MULTI-LANE HIGHWAYS	<ol style="list-style-type: none"> 1. Level terrain. 2. Lane widths of 3.7m. 3. A minimum of 1.8m lateral clearance between the edge of travel lanes and obstructions at the roadside or in the median. 4. Passenger cars only in the traffic stream. 5. A divided highway cross section in a rural environment. 6. Design speed of 110 km/h.
INDEPENDENT ALIGNMENT	A divided highway in which each roadway is designed independently both in horizontal and vertical alignments, to take advantage of topographical features.
INTERCHANGE	A grade-separated intersection with one or more turning roadways (or ramps) for travel between the through roads.
INTERSECTION (AT-GRADE)	The general areas where two or more roads join or cross, within which are included the roadway and roadside facilities for traffic movements.

INTERSECTION SIGHT DISTANCE	Intersection sight distance is defined as the distance available along the major highway from a point where vehicles are required to stop on the minor road before entering the intersection. The intersection sight distance is adequate when it allows the design vehicles to safely make all the manoeuvres that are permitted by the layout. Examples include left turn onto the highway or crossing the highway, based on certain design assumptions.
ISLAND	A defined area between traffic lanes for control of vehicle movements or for pedestrian refuge and location of traffic control devices.
LAND SERVICE INTERCHANGE	An interchange between a freeway/expressway and a highway, providing local or area-wide service.
LANE (TRAFFIC LANE)	A part of the travelled way intended for the movement of a single line of vehicles.
LEVEL OF SERVICE (GENERAL DEFINITIONS)	A qualitative measure describing operational conditions within a traffic stream; generally described in terms of such factors as speed and travel time, freedom to manoeuvre, traffic interruptions, comfort and convenience and safety.
<i>Level of Service A - (General)</i>	Represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent.
<i>Level of Service B - (General)</i>	Is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desired speeds is relatively unaffected, but there is a slight decline in the freedom to manoeuvre within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than a LOS A, because the presence of others in the traffic stream begins to affect individual behavior.
<i>Level of Service C - (General)</i>	Is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and manoeuvring within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level.
<i>Level of Service D - (General)</i>	Represents high-density but stable flow. Speed and freedom to manoeuvre are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level.

Level of Service E - (General)

Represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to manoeuvre within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to give way to accommodate such manoeuvres. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is extremely high. Operations at this level are usually unstable, because small increases in flow or minor perturbations within the traffic stream will cause breakdowns.

Level of Service F - (General)

Is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse the point. Queues form behind such locations. Operations within the queue are characterized by stop-and-go waves, and they are extremely unstable. Vehicles may progress at reasonable speeds for several hundred metres or more, then be required to stop in a cyclic fashion. Level of service F is used to describe the operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases operating conditions of vehicles or pedestrians discharged from the queue may be quite good. Nevertheless, it is the point at which arrival flow exceeds discharge flow which causes the queue to form, and level-of-service F is an appropriate designation for such points.

**LEVEL OF SERVICE:
FREEWAYS**

Level of service (LOS) criteria for freeways are defined in terms of density. Density is a measure which quantifies the proximity to other vehicles in the traffic stream. It expresses the degree of manoeuvrability within the traffic stream. Boundary values of density are given, as follows, for the various levels of service.

Level of Service		Maximum Density (pc/km/ln)
A	less than or equal to	7
B	less than or equal to	12
C	less than or equal to	19
D	less than or equal to	26
E	less than or equal to	42
F	greater than	42

These values are boundary conditions representing the maximum allowable densities for the associated level of service. The LOS-E boundary of 42 pc/km/ln has been generally found to be the *critical density* at which capacity most often occurs. This corresponds to an average travel speed of 50 km/h and a capacity of 2,000 pcphpl for 100 km/h and 110 km/h design speeds. The exact speed and density, however, at which capacity occurs may vary somewhat from location to location.

- Level of Service A (Freeway)*** Describes primarily free flow operations. Average travel speeds near 100 km/h generally prevail on 110 km/h freeway elements. Vehicles are almost completely unimpeded in their ability to manoeuvre within the traffic stream. The average spacing between vehicles is about 143m, or 23 car lengths, with a maximum density of 7 pc/km/ln. This affords the driver a high level of physical and psychological comfort. The effects of minor incidents or breakdowns are easily absorbed at this level. Although they may cause a deterioration in LOS in the vicinity of the incidents, standing queues will not form, and traffic quickly returns to LOS A on passing the disruption.
- Level of Service B (Freeway)*** Also represents reasonably free-flow conditions, and speeds of over 92 km/h are maintained on 110 km/h freeway elements. The average spacing between vehicles is about 79m, or 13 car-lengths, with a maximum density of 12 pc/km/ln. The ability to manoeuvre 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 breakdowns are still easily absorbed, though local deterioration in service would be more severe than for LOS A.
- Level of Service C (Freeway)*** Provides for stable operations, but flows approach the range in which small increases in flow will cause substantial deterioration in service. Average travel speeds are still over 87 km/h. Freedom to manoeuvre within the traffic stream is noticeably restricted at LOS C, and lane changes require additional care and vigilance by the driver. Average spacings are in the range of 53m, or nine car-lengths, with a maximum density of 19 pc/km/ln. 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. The driver now experiences a noticeable increase in tension due to the additional vigilance required for safe operation.
- Level of Service D (Freeway)*** Borders on unstable flow. In this range, small increases in flow cause substantial deterioration in service. Average travel speeds of 74 km/h or more can still be maintained on 110 km/h freeway elements. Freedom to manoeuvre within the traffic stream is severely limited, and the driver experiences drastically reduced physical and psychological comfort levels. Even minor incidents can be expected to create substantial queuing, because the traffic stream has little space to absorb disruptions. Average spacings are about 38m, or six car-lengths, with a maximum density of 26 pc/km/ln.

Level of Service E (Freeway)

The boundary between LOS D and LOS E describes operation at capacity. Operations in this level are extremely unstable, because there are virtually no usable gaps in the traffic stream. Vehicles are spaced at approximately 24m, or four car-lengths, at relatively uniform headways. This, however, represents the minimum spacing at which stable flow can be accommodated. Any disruption to the traffic stream, such as a vehicle entering from a ramp, or a vehicle changing lanes, causes following vehicles to give way to admit the vehicle. This condition establishes a disruption wave which propagates through the upstream traffic flow. At capacity, the traffic stream has no ability to dissipate even the most minor disruptions. Any incident can be expected to produce a serious breakdown with extensive queuing. The range of flows encompassed by LOS E is relatively small compared to other levels, but reflects a substantial deterioration in service. Manoeuvrability within the traffic stream is extremely limited, and the level of physical and psychological comfort afforded to the driver is extremely poor. Average travel speeds at capacity are approximately 50 km/h.

Level of Service F (Freeway)

Describes forced or breakdown flow. Such conditions generally exist within queues forming behind breakdown points. Such breakdowns occur for a number of reasons:

1. Traffic incidents cause a temporary reduction in the capacity of a short segment, such that the number of vehicles arriving at the point is greater than the number of vehicles that can traverse it.
2. Recurring points of congestion exist, such as merge or weaving areas and lane drops, where the number of vehicles traversing the point is restricted.
3. In forecasting situations, any location presents a problem when the projected peak hour or other flow rate exceeds the estimated capacity of the location.

It is noted that in all cases, breakdown occurs when the ratio of actual arrival flow rate to actual capacity or the forecasted flow rate to estimated capacity exceeds 1.00. Operations at such a point will generally be at or near capacity, and downstream operations may be better as vehicles pass the bottleneck (assuming that there are no additional downstream problems). The LOS F operations observed within a queue are the result of a breakdown or bottleneck at a downstream point. The designation LOS F is used, therefore, to identify the point of the breakdown or bottleneck, as well as the operations within the queue which forms behind it.

**LEVEL OF SERVICE:
MULTI-LANE HIGHWAYS**

Level of service (LOS) criteria for multi-lane highways are defined in terms of density. Density is a measure which quantifies the proximity to other vehicles in the traffic stream. It expresses the degree of manoeuvrability within the traffic stream. Boundary values of density are given, as follows, for the various levels of service. They are the same as the values used for freeways.

Level of Service		Maximum Density (pc/km/ln)
A	less than or equal to	7
B	less than or equal to	12
C	less than or equal to	19
D	less than or equal to	26
E	less than or equal to	42
F	greater than	42

Level of service criteria depend on the design speed of the highway element being studied. A highway element can be an isolated geometric element, such as a curve or grade having a reduced design speed, or a series of such geometric elements that dominate the operation of a longer segment of highway. Straight and level highway segments are assumed to have a design speed of 110 km/h.

**Level of service A
(Multi-lane)**

Describes completely free-flow conditions. The operation of vehicles is virtually unaffected by the presence of other vehicles, and operations are constrained only by the geometric features of the highway and driver preferences. Vehicles are spaced at an average of 143m, or 23 car-lengths., at a maximum density of 7 pc/km/ln. The ability to manoeuvre within the traffic stream is high. Minor disruptions to flow are easily absorbed at this level without causing significant delays or queuing.

**Level of Service B
(Multi-lane)**

Is also indicative of free flow, although the presence of other vehicles begins to be noticeable. Average travel speeds are somewhat diminished for LOS A, but are still generally over 85 km/h on sections with 110 km/h design speed. Vehicles are spaced at an average of approximately 80, or 13 car-lengths, at a maximum density of 12 pc/km/ln. Minor disruptions are still easily absorbed at this level, although local deterioration in LOS will be more obvious.

**Level of service C
(Multi-lane)**

Represents a range in which the influence of traffic density on operations becomes marked. The ability to manoeuvre within the traffic stream, and to select an operating speed, is now clearly affected by the presence of other vehicles. Average travel speeds are reduced to about 80 km/h on 110 km/h design speed sections, and the average spacing of vehicles is reduced to approximately 53m, or nine car-lengths, at a maximum density of 19 pc/km/ln. Minor disruptions may be expected to cause local deterioration in service, and queues may form behind any significant traffic disruption. Severe or long-term disruptions may cause the facility to operate at LOS F.

**Level of service D
(Multi-lane)**

Borders on unstable flow. Speeds and ability to manoeuvre are severely restricted because of traffic congestion. Average travel speeds are approximately 64 km/h on 110 km/h design speed sections, while the average spacing of vehicles is 38m, or six car lengths, at a maximum density of 26 pc/km/ln. Only the most minor of disruptions can be absorbed without the formation of extensive queues and the deterioration of service to LOS F.

**Level of Service E
(Multi-lane)**

Represents operations at or near capacity, and is quite unstable. At capacity, vehicles are spaced at only 24m, or four car-lengths, at a maximum density of 42 pc/km/ln. This is the minimum spacing at which uniform flow can be maintained, and effectively defines a traffic stream with no usable gaps. Thus, disruptions cannot be damped or dissipated, and any disruption, no matter how minor, will cause queues to form and service to deteriorate to LOS F. Average travel speeds at capacity are approximately 50 km/h.

**Level of service F
(Multi-lane)**

Represents forced or breakdown flow. It occurs at a point where vehicles arrive either at a rate greater than that at which they are discharged or at a point on a planned facility where forecasted demand exceeds the computed capacity. While operations at such points (and on immediately downstream sections) will appear to be at capacity or better, queues will form behind these breakdowns. Operations within queues are highly unstable, with vehicles experiencing short spurts of movement followed by stoppages. Average travel speeds within queues are generally under 50 km/h, with densities higher than 42 pc/km/ln. Note that the term LOS F may be used to characterize both the point of the breakdown and the operating conditions within the queue. It must be remembered, however, that it is the point of breakdown that causes the queue to form, and that operations within the queue are generally not related to defects along the highway segment over which the queue extends.

**LEVEL OF SERVICE:
TWO-LANE
UNDIVIDED HIGHWAYS**

Level of service criteria for two-lane highways address both mobility and accessibility concerns. The primary measure of service quality is percent time delay, with speed and capacity utilization used as secondary measures. Level of service criteria are defined for 15-minute flow periods, and are intended for application to segments of significant length. Ideal capacity is 2800 pcph total, in both directions.

Boundary values of percent time delay for the various levels of service are given below.

Level of service For General Two-Lane Highway Segments

LOS	Percent Time Delay
A	less than or equal to 30
B	less than or equal to 45
C	less than or equal to 60
D	less than or equal to 75
E	greater than 75
F	100

Level of service A (2-lane)

The highest quality of traffic service occurs when motorists are able to drive at their desired speed. Without strict enforcement, this highest quality representative of *Level of service A* would result in average speeds approaching 100 km/h on two-lane highways. The passing frequency required to maintain these speeds has not reached a demanding level. Passing demand is well below passing capacity, and almost no platoons of three or more vehicles are observed. Drivers would be delayed no more than 30 percent of the time by slow moving vehicles. A maximum flow rate of 420 pcph, total in both directions, may be achieved under ideal conditions.

Level of service B (2-lane)

Characterizes the region of traffic flow wherein speeds of 90 km/h or slightly higher are expected on level terrain. Passing demand needed to maintain desired speeds becomes significant and approximately equals the passing capacity at the lower boundary of level-of-service B. Drivers are delayed up to 45 percent of the time on the average. Service flow rates of 750 pcph total, in both directions, can be achieved under ideal conditions. Above this flow rate, the number of platoons forming in the traffic stream begins to increase dramatically.

Level of service C (2-lane)

Further increases in flow characterize *Level of service C*, resulting in noticeable increases in platoon formation, platoon size, and frequency of passing impediment. Average speed still exceeds 85 km/h on level terrain, even though unrestricted passing demand exceeds passing capacity. At higher volume levels, chaining of platoons and significant reductions in passing capacity begin to occur. While traffic flow is stable, it is becoming susceptible to congestion due to turning traffic and slow moving vehicles. Percent time delays are up to 60 percent. A service flow rate of up to 1,200 pcph total, in both directions, can be accommodated under ideal conditions.

Level of service D (2-lane)

Unstable traffic flow is approached as traffic flows enter *Level of service D*. The two opposing traffic streams essentially begin to operate separately at higher volume levels, as passing becomes extremely difficult. Passing demand is very high, while passing capacity approaches zero. Mean platoon sizes of five to 10 vehicles are common, although speeds of 80 km/h can still be maintained under ideal conditions. The fraction of no passing zones along the roadway section usually has little influence on passing. Turning vehicles and/or roadside distractions cause major shock waves in the traffic stream. The percentage of time motorists are delayed approaches 75 percent. Maximum service flow rates of 1,800 pcph total, in both directions, can be maintained under ideal conditions. This is the highest flow rate that can be maintained for any length of time over an extended section of level terrain, without a high probability of breakdown.

Level of service E (2-lane)

Is defined as traffic flow conditions on two-lane highways having a percent time delay of greater than 75 percent. Under ideal conditions, speeds will drop below 80 km/h. Average travel speeds on highways with less than ideal conditions will be slower, as low as 40 km/h on sustained upgrades. Passing is virtually impossible under level-of-service E conditions, and platooning becomes intense when slower vehicles or other interruptions are encountered.

The highest volume attainable under level of service E defines the capacity of the highway. Under ideal conditions, capacity is 2,800 pcph total, in both directions. For other conditions, capacity is lower.

Operating conditions at capacity are unstable and difficult to predict. Traffic operations are seldom observed near capacity on rural highways, primarily because of a lack of demand.

Capacity of two-lane highways is affected by the directional split of traffic. As directional split moves away from the 50/50 ideal condition, total two-way capacity is reduced, as follows:

Directional Split	Total Capacity (pcph)	Ratio to Capacity
50/50	2,800	1.00
60/40	2,650	0.94
70/30	2,500	0.89
80/20	2,300	0.83
90/10	2,100	0.75
100/0	2,000	0.71

For short lengths of two-lane road, such as tunnels or bridges, opposing traffic interactions may have only a minor effect on capacity. The capacity in each direction may approximate that of a fully loaded single lane, given appropriate adjustments for the lane width and shoulder width (5).

Level of service F (2-lane)

As with other highway types, *Level of service F (2-lane)* represents heavily congested flow with traffic demand exceeding capacity. Volumes are lower than capacity, and speeds are below capacity speed. Level of service E is seldom attained over extended sections on level terrain as more than a transient condition. Most often, perturbations in traffic flow as level E is approached cause a rapid transition to level-of-service F.

LEVEL TERRAIN

Any combination of grades and horizontal and vertical alignment permitting heavy vehicles to maintain approximately the same speed as passenger cars. This generally includes short grades or no more than 1 to 2 percent.

LOCAL

A street or road primarily for access to residences, businesses or other abutting property.

LONGITUDINAL BARRIER

A barrier placed adjacent to a roadway, intended to contain a vehicle leaving the normal travel path, by re-directing it. See Barrier.

LOW VOLUME ROAD

A road with AADT or 200 or less, and whose service functions are oriented toward rural road systems. A low volume road may be to or within an isolated community, a recreation road or a resource development road.

MAJOR RURAL INTERSECTION

An intersection where an expressway, an arterial or a collector (more than 200 AADT) intersects an arterial or a collector (more than 200 AADT).

MAXIMUM SERVICE FLOW RATE

The highest 15-minute rate of flow that can be accommodated on a highway facility under ideal conditions, while maintaining the operating characteristics for a stated level of service, expressed as passenger cars per hour per lane.

MEDIAN

The median is the area between driving lanes of traffic travelling in opposite directions on a divided highway. The median width is defined as the perpendicular distance from edge of driving lane to edge of driving lane (opposite direction).

MEDIAN BARRIER

A longitudinal barrier placed in the median to prevent a vehicle from crossing the median and colliding with oncoming traffic or to protect a vehicle from a fixed object in the median.

MINIMUM STANDARD	See Standard.
MINIMUM STOPPING SIGHT DISTANCE	The least stopping sight distance required by a driver to come to a stop under prevailing vehicle, pavement and climatic conditions.
MINOR RURAL INTERSECTION	An intersection where a collector (less than 200 AADT) intersects a collector or a local road with AADT equal to or less than 200.
MOUNTAINOUS TERRAIN	Any combination of horizontal and vertical alignment causing heavy vehicles to operate at crawl speeds for significant distances or at frequent intervals.
MULTI-LANE HIGHWAY	A highway with at least two lanes for the exclusive use of traffic in each direction, with no or partial control of access, that may have periodic interruptions to flow at signalized intersections.
NET PASSING OPPORTUNITY (NPO)	Net Passing Opportunity (NPO) is a function of both passing opportunities provided by highway geometry and the number of gaps in the opposing traffic stream. NPO is the product of percentage of highway that is clear of barrier lines (pavement markings) and the probability of heavy time gaps (30 seconds) available for passing on the oncoming traffic stream.
NO PASSING ZONE	A segment of a two-lane, two-way highway along which passing is prohibited in one or both directions.
NON-RECOVERABLE SLOPE	A slope which is traversable but on which the errant vehicle will continue on to the bottom. Embankment slopes of between 4:1 and 3:1 are only considerate traversable but non-recoverable if they are smooth and have no fixed object hazards.
OBSTACLE	Any fixed object that is likely to cause significant injury to occupants of a vehicle encountering it.
OPERATING SPEED	Operating speed is the highest overall speed at which a driver can travel on a given highway. This is under favourable weather conditions and under prevailing traffic conditions where the driver never exceeds the safe speed as determined by the design speed on a section-by-section basis.
OPERATIONAL ANALYSIS	A use of capacity analysis to determine the prevailing level of service on an existing or projected facility, with known or projected traffic, roadway, and control conditions.
OVERPASS	A grade separation where the road passes over an intersecting road or railway.
PARCLO	An abbreviation for partial cloverleaf interchange, i.e., a grade separation with ramp in less than all four quadrants.
PASSENGER CAR EQUIVALENT	The number of passenger cars that are displaced by a single heavy vehicle of a particular type under prevailing roadway, traffic, and control conditions.

PASSING SIGHT DISTANCE	The visibility distance required to allow drivers to execute safe passing manoeuvres in the opposing traffic lane of a two-lane, two-way highway.
PEAK-HOUR FACTOR	The hourly volume during the maximum volume hour of the day divided by the peak 15-minute rate of flow within the peak hour; a measure of traffic demand fluctuation within the peak hour.
PERCENTAGE NO PASSING ZONE	Percentage of segment of a two-lane, two-way highway along which passing is prohibited in one or both directions.
PERCENT TIME DELAY (2-LANE HIGHWAY)	The average percentage of time that all vehicles are delayed while travelling in platoons due to the inability to pass.
PERCEPTION/REACTION TIME	The time that elapses from the instant an object comes into view, making the driver decide to stop, until the instant the driver takes remedial action (contacts the brake pedal).
PLATOON	A group of vehicles or pedestrians travelling together as a group, either voluntarily or involuntarily due to signal control, geometrics, or other factors.
PLATOON FLOW RATE	The rate of flow of vehicles or pedestrians within a platoon.
RAMP	A turning roadway to permit the movement of traffic from one through road to another.
RATE OF FLOW	The equivalent hourly rate at which vehicles or persons pass a point on a lane, roadway, or other traffic way for a period of time less than one hour. It is computed as the number of persons or vehicles passing the point divided by the time interval in which they passed (in hours), and is expressed as vehicles or persons per hour.
RECOVERABLE SLOPE	A slope on which a motorist may retain or regain directional control of a vehicle. Slopes of 4:1 or flatter are generally considered recoverable. A non-recoverable slope is a traversable slope on which the errant vehicle will continue down to the bottom with a low probability of serious vehicle damage or significant injury to occupants. Smooth embankment slopes steeper than 4:1, up to and including 3:1, are non-recoverable and traversable if they are free of obstacles. (See definition of Clear Zone.)
RECREATIONAL VEHICLE	A heavy vehicle, generally operated by a private motorist, engaged in the transportation of recreational equipment or facilities. Examples include campers, boat trailers and motorcycle trailers.
REVERSE CURVE	Two curves that curve in opposite directions either from a common point or with a minimal transition between.
RESERVE CAPACITY	The capacity of a lane at an unsignalized intersection minus the demand for that lane, where all terms are stated in passenger cars per hour.
RIGHT LANE	On any roadway, the travel lane on the extreme right, in the direction of traffic flow, available for moving traffic.

RIGHT OF WAY	The area of land acquired for or devoted to the provision of a road or highway.
RIGID BARRIER	A form of longitudinal barrier intended to redirect an errant vehicle with minimum deflection in the barrier system that usually consists of a continuous concrete mass.
ROAD	The entire right-of-way comprising a common or public thoroughfare, including a highway, street, lane, alley, bridge and any other structure incidental thereto.
ROADSIDE	The area between the outside shoulder edge and the right-of-way limits.
ROADSIDE BARRIER	A longitudinal barrier placed adjacent to the right or left roadway edge to prevent a departing vehicle from encountering a hazard in or on the roadside.
ROADWAY	The part of the road that is improved, designed or ordinarily used for the passage of vehicular traffic, inclusive of the shoulder.
ROADWAY CONDITIONS	Geometric characteristics of a street or highway, including the type of facility, number and width of lanes (by direction), shoulder widths and lateral clearances, design speed, and horizontal and vertical alignments.
ROLLING TERRAIN	Any combination of horizontal and vertical alignments causing heavy vehicles to reduce their speed substantially below that of passenger cars, but not causing heavy vehicles to operate at crawl speeds for any significant amount of time.
ROUNDING	The introduction of slope transition between two transverse slopes to minimize the abrupt slope change and to maximize vehicle stability and manoeuvrability.
SAG VERTICAL CURVE	A vertical curve having a concave shape in profile.
SERVICE FLOW RATE	The maximum hourly rate at which persons or vehicles can be reasonable expected to traverse a point of uniform section of a lane or roadway during a given time period (usually 15 minutes) under prevailing roadway, traffic, and control conditions while maintaining a designated level of service, expressed as vehicles per hour or vehicles per hour per lane.
SERVICE ROAD	Same as frontage road but not necessarily contiguous with the through road.
SHOULDER	Areas of pavement, or gravel, placed adjacent to through or auxiliary lanes. They are generally intended for emergency stopping and travel by emergency vehicles only, but can usually be used by cyclists. They also provide structural support for the pavement.
SIDESLOPE	The slope between the roadway and ditch is referred to as the sideslope.

SIDEWALK	A travelled way, intended for pedestrian use, following an alignment generally parallel to that of the adjacent roadway.
SIGHT DISTANCE	The visible distance ahead available to a driver to the roadway for travel in his direction.
SPEED	A rate of motion expressed as distance per unit of time.
SPEED CHANGE LANE	A deceleration or acceleration lane.
SPIRAL TO CURVE (SC)	The point of change from spiral curve to circular curve in the direction of stationing.
SPIRAL TO TANGENT (ST)	The point of change from spiral curve to tangent in the direction of stationing.
STANDARD (MINIMUM -, DESIRABLE -)	A <u>standard</u> is a value for a specific feature, which practice or theory has shown to be appropriate, where the prevailing circumstances are normal and general, and where no unusual constraints influence the design. The lowest value that would normally be applied in these circumstances is the <u>minimum standard</u> . Where constraints are severe and the requirement to meet the minimum standard would impose significant property or environmental damage, or would incur excessive cost, values below minimum standard may be acceptable. The degree of deviation below the minimum value that is acceptable is a matter of judgement, and depends on the nature of the standard and the severity of the constraints. In situations where conditions allow standards to be exceeded without significant cost, property or environmental damage, the minimum values are normally avoided in favour of higher values. In such cases the <u>desirable standards</u> , where shown, represent a target for which to aim.
STOP BAR	Transverse pavement marking to indicate where vehicles are required to stop for a traffic control device.
STOPPING SIGHT DISTANCE	The total distance travelled by the vehicle between the time that the driver sees an object, for which he decides to stop, until the vehicle comes to a full stop.
SUBURBAN	Pertains to areas of mixed urban and rural land use. Typically, suburban land development is a ribbon of high trip generators and attractors along otherwise rural collectors and arterials.
SUPERELEVATION	The gradient measured at right angles to the centreline across the roadway from the inside to the outside edge.
SWALE	A shallow drainage channel.
SYSTEM INTERCHANGE	A freeway-to-freeway (or freeway-to-expressway) interchange, maintaining traffic on a controlled-access system.
TANGENT TO SPIRAL (TS)	The point of alignment change from tangent to spiral curve in the direction of stationing.

TANGENT RUNOUT	The length of road needed to accomplish the change in cross-slope from a normal cross section to a section with the adverse crown removed.
THREE-LANE HIGHWAY	A highway having a three-lane cross section. The third lane (centre) may be used in a variety of ways, including as a passing lane, a two-way left-turn lane or a climbing lane.
3R/4R	3R is defined as resurfacing, restoration and/or rehabilitation of existing paved roads. 4R is defined as reconstruction of existing paved roads. 3R/4R standards have been developed by various highway authorities to address the special considerations that exist when applying geometric design standards to existing paved roads. The purpose of 3R/4R standards is to extend the service life of existing paved highways generally, and thus enhance highway safety on a network basis.
THROUGH LANE	A lane intended for through traffic movement.
TRAFFIC BARRIER/BARRIER	Traffic barriers are placed adjacent to a roadway to protect traffic from hazardous objects either fixed or moving (other traffic). Barriers placed in a median are referred to as median barriers and may be placed in flush, raised or depressed medians.
TRANSITION (SPIRAL) CURVE	A curve whose radius continuously changes according to mathematical formulae. Generally, the entry spiral, which is known as the clothoid, is used.
TRAVELLED WAY	The part of a roadway intended for vehicular use excluding shoulders. It may have a variety of surfaces but is most commonly hard surfaced with asphalt, concrete or gravel surfaced.
TRUCK	A heavy vehicle engaged primarily in the transport of goods and materials, or in the delivery of services other than public transportation.
TURNING ROADWAY	A separate roadway or ramp to accommodate turning traffic at the intersection or interchange of two roads.
TURNOUT	A short section of a lane added to a two-lane, two-way highway for the purpose of allowing slow-moving vehicles to leave the main roadway and stop to allow faster vehicles to pass.
TWO-LANE HIGHWAY	A roadway having a two-lane cross section with one lane for each direction of flow, on which passing maneuvers must be made in the opposing lane.
TWO-LANE ROAD	A road that provides for one lane of through traffic in each direction.
UNDERPASS	A grade separation in which the subject road passes under a highway or railway.
UNINTERRUPTED FLOW	A category of facilities having no fixed causes of delay or interruption external to the traffic stream. Examples of such facilities include freeways and unsignalized sections of multi-lane and two-lane rural highways.

URBAN LAND USE	Pertains to areas of medium to high density land use. Land in urban areas is subdivided into serviced lots requiring a medium to high level of both access and mobility. Traffic generated per unit area on urban land is significantly higher than on suburban or rural land.
URBAN ROADS	Roadways that include curb and gutter are generally considered urban. Urban roadways frequently include lighting and sometimes sidewalks (depending on adjacent land use).
USABLE SHOULDER WIDTH	Clear shoulder width without any obstruction. A roadway with 1.8m or more clear shoulder is considered to have an ideal shoulder width from a capacity point of view. Increasing the shoulder width will not increase the theoretical capacity.
v/c RATIO	The ratio of demand flow rate to capacity for a traffic facility.
VERTICAL ALIGNMENT	The configuration of a road or roadway, as seen in longitudinal section, consisting of tangents and parabolic curves.
VERTICAL CURVATURE (K) FACTOR	The horizontal distance along a parabolic curve required to effect a one percent change in gradient.
VERTICAL CURVE	A parabolic curve on the longitudinal profile or in a vertical plane or a road to provide for change of gradient.
VOLUME	The number of persons or vehicles passing a point on a lane, roadway, or other traffic way during some time interval, often taken to be one hour, expressed in vehicles.
WARRANT	A criterion or set of criteria that identifies a potential need or the justification for an addition to the highway such as traffic signals, traffic barrier, truck climbing lanes, passing lanes, left turn lanes, etc.
WEAVING SECTION	A section of roadway between an entrance and an exit, where the frequency of lane changing exceeds that for open highway condition.