# 2020
## Quality/ Level of Service Handbook

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**State of Florida**
**Department of Transportation**

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# 1 Executive Summary

This Quality Level of Service (Q/LOS) Handbook is intended to be used by engineers, planners, and decision-makers in the development and review of roadway capacity and roadway users' Q/LOS at generalized planning levels. This Q/LOS Handbook provides tools to quantify multimodal transportation service inside the roadway environment (essentially inside the right of way).

This edition of the Q/LOS Handbook is updated and reorganized, still providing a foundation for high-quality, consistent capacity, and level of service (LOS) analyses and review in the State of Florida. It includes new analytical techniques from the Transportation Research Board's Highway Capacity Manual (HCM), Sixth Edition, and updated Generalized Service Volume Tables. With these professionally accepted techniques, analysts can easily evaluate roadways from a multimodal perspective, which results in better multimodal decisions for projects in generalized planning phases.

The focus of generalized planning is the extensive use of default values and is intended for broad applications such as regional analyses, initial problem identification, and future year analyses. Florida's Generalized Service Volume Tables at the end of this Q/LOS Handbook are the primary tools for conducting this type of planning analysis. At this time, only Freeways and Uninterrupted Flow Highways Generalized Service Volume Tables have been updated to be consistent with the HCM methodology. The State Signalized Arterials Generalized Service Volume Tables remained the same as the 2013 Q/LOS Handbook. There are future plans to update the State Signalized Arterials Generalized Service Volume Tables to be consistent with the HCM methodology.

Florida Department of Transportation (FDOT) welcomes questions and comments on the content and concepts of this Q/LOS Handbook. FDOT will provide technical assistance and training as needed for usage of the Q/LOS process. For additional resources, see the FDOT's Systems Implementation Office (SIO) website at https://www.fdot.gov/planning/systems/. **Initial contacts should be made with FDOT District and Florida's Turnpike Enterprise personnel**.

# 2 Q/LOS Handbook Purpose and Scope

This Q/LOS Handbook is a tool that can be utilized to analyze and review a roadway's capacity at a generalized planning level.

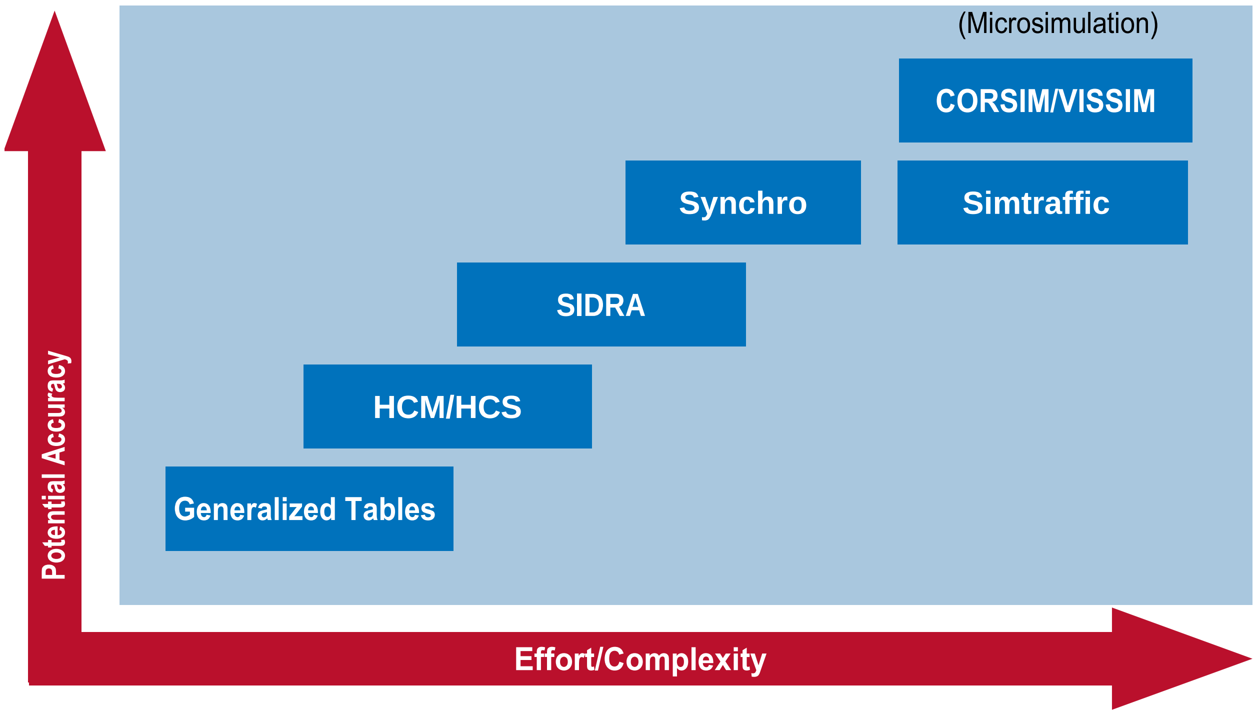
**The quality of service (QOS) is a traveler-based perception of how well a transportation service or facility operates. The LOS is a quantitative stratification of the QOS into six letter grades.** The LOS provides a measure that assesses multimodal service inside the roadway environment (essentially inside the right of way). **Capacity conceptually relates to the maximum number of vehicles that can pass a point on a roadway in a given amount of time under normal conditions.** The Q/LOS Handbook provides Generalized Service Volume Tables and background regarding statewide default values used in their development. The Generalized Service Volume Tables, found at the end of the Q/LOS Handbook, present maximum service volumes, or the highest numbers of vehicles for a given LOS.

Directions found within the Q/LOS Handbook provide assistance in selecting the most appropriate tools for Q/LOS analysis. This handbook offers specific instructions on how to use the Generalized Service Volume Tables.

## 2.1. Levels of Analysis

There are many methods for computing capacity and the LOS, which form a hierarchy ranging from Generalized Service Volume Tables (the simplest to use but potentially least accurate) to complex operational analysis tools (very precise, but time-intensive and costly). **Figure 2-1** provides a list of some traffic analysis tools measured by accuracy and complexity. In selecting the appropriate tools, tradeoffs among study purposes (e.g., generalized planning application, signal timing application), accuracy and precision of results (e.g., variability in data for current year analyses, variability in future year analyses), and data preparation effort (e.g., use of existing statewide traffic data, use of direct field measurements) should be considered. Please refer to the FDOT Traffic Analysis Handbook for additional tools and guidance in selecting the appropriate analysis tool.

**Figure 2-1: Traffic Analysis Tools**




### 2.1.1. Generalized Planning

Generalized planning covered in this handbook makes extensive use of default values and is intended for broad applications, such as initial problem identification (e.g., deficiency and needs analyses, geographic influence areas), statewide analyses (e.g., statewide calculation of delay), and future year analyses (e.g., 10-year planning horizon).

Florida's Generalized Service Volume Tables provided at the end of this handbook are the primary tools for conducting Generalized planning analysis. The updated tables have been developed using guidance provided in the HCM.

## 2.2 Travel Modes

The HCM defines four major travel modes: automobile, pedestrian, bicycle, and transit. Each mode includes a unique set of characteristics that define a traveler's experience during a trip, and it is important to consider each perspective when analyzing a multimodal facility.

### 2.2.1 Automobile

The three major elements that affect the operation of a vehicle are: roadway characteristics, traffic characteristics, and control characteristics.

Vehicles include passenger cars, trucks, vans, buses, recreational vehicles, and motorcycles. Each vehicle type has a unique set of operational characteristics, and the percentage makeup of each vehicle type within a traffic stream affects the capacity of a facility because of these differences. For example, trucks, buses, and recreational vehicles have lower acceleration and deceleration rates than standard passenger cars. Factors, such as pavement type and condition, time of day, and weather, affect the operational characteristics of vehicles as well as driver behavior. Other factors, such as fatigue, health, and driving under the influence of drugs and alcohol, also affect driver behavior. **This handbook assumes base conditions that include typical drivers on dry pavement during daylight hours**.

### 2.2.2 Pedestrian

Many trips include at least one part where the traveler is a pedestrian. This is particularly important for transit trips, where the pedestrian section of the trip may have an impact on future mode choice.

Analyzing the pedestrian experience can be summarized by two primary types of analysis: individual delay and facility attributes. Delay at intersections can be easily quantified and analyzed. The factors that describe a facility and, therefore, contribute to the overall walking experience are less easily quantified, including safety, security, lighting, grades, surface conditions, and even street activity levels. Automobile and heavy vehicle traffic volume, and the extent to which pedestrians are separated from vehicular traffic, also influence pedestrians' perception of QOS while using a sidewalk. **This handbook accounts for the user's perception and facility attributes when determining Pedestrian LOS (PLOS).**

### 2.2.3 Bicycle

Bicycles are used to make a variety of trips, including trips for recreation, commuting, and errands. Bicycles can help extend the market area of transit service as bicycle travel is typically five times faster than travel on foot.

Similar to the pedestrian experience, Bicycle LOS (BLOS) can be summarized by delays encountered at intersections as well as the attributes of the facility itself. As with the pedestrian analysis, the Q/LOS Handbook focuses on facility attributes when determining BLOS. These attributes include the volume and speed of adjacent vehicles, heavy vehicle presence, the presence of on-street parking and pavement conditions. Because of the severe deterioration of perceived QOS at flow levels well below the theoretical capacity of a bike path, the concept of capacity has little utility in the design and analysis of bicycle paths.

### 2.2.4 Transit

Transit riders can be grouped into two primary categories: choice and captive riders. Choice transit riders typically have other means of transportation readily available, but choose transit to avoid congestion, save money on fuel and parking, use their travel time productively for other activities, and/or reduce their impact on the environment. Captive riders, however, are unable to drive because of age, physical, mental, or financial reasons, and depend on transit or other modes for their daily transportation needs.

**Unlike other modes, transit is primarily focused on service levels rather than facility characteristics.** Infrastructure for driving, biking, or walking is available at all times, once constructed; transit service is only available during certain times along designated routes. Additionally, transit passengers are not in direct control of their travel time, service frequency and reliability, therefore, these are important factors that affect the quality and utility of transit service.

When bus service frequencies reach a high enough level of demand (headway of approximately 10 minutes or less), bus passengers do not feel the need to consult bus schedules. This allows transit users the freedom to treat the system as they would treat other modes. Service frequencies that require passengers to plan their trips around a limited transit schedule offer much less utility, and deter choice riders.

**Because transit passengers typically must walk to and from transit stops on either end of their trip, the quality of the walking experience at the beginning or end of a trip may be just as important to the transit passenger as the actual transit experience.**

## 2.3 What's New in This Version of the Q/LOS Handbook?

This edition of the Q/LOS Handbook primarily reflects an update to the 2013 edition and incorporates updates included in the sixth edition of the HCM. The Q/LOS Handbook has been revised to focus on generalized planning for freeways and highways. No changes have been made in this version of the handbook to the arterial methodology and arterial Generalized Service Volume Tables from the 2013 Q/LOS Handbook.

The Generalized Service Volume Tables are the primary tools supported by FDOT for generalized planning. The freeway and highway automobile mode portions of the tables have been updated using the Highway Capacity Software 7 (HCS7), which incorporates the latest procedures provided in the HCM, Sixth Edition. The updated tables also include revised inputs and parameters that coincide with the current methodology in the HCM and default values. The updated tables can be found at the end of this handbook. A summary of the methodology changes is provided below:

- The Generalized Service Volume Tables
    - The 2020 freeway and highway Generalized Service Volume Tables were developed using HCS7, which is based on the HCM, Sixth Edition.
    - There are **no changes** for arterial service volumes between the 2012 and 2020 Generalized Service Volume Tables.
- The freeway service volumes are now based on freeway facilities procedures, incorporating basic segments and interchanges rather than just basic segments.
- The inputs are generally consistent between the 2012 and 2020 versions of the tables, but there have been some updates to maintain internal consistency in the 2020 set of tables.
- New inputs such as Speed Adjustment Factor (SAF) and Capacity Adjustment Factor (CAF) have been introduced into the development of the tables because the input requirements for HCS7 are more extensive than those for Level of Service Planning (LOSPLAN).
- FDOT **no longer** supports the LOSPLAN program and it has not been included in this version of the handbook.

# 3 Q/LOS Principles

Providing safety and mobility for people and goods remains transportation's most essential function and part of FDOT's mission. There are four dimensions of mobility:

- Quality of travel: traveler satisfaction with a facility or service.
- Quantity of travel: magnitude of use of a facility or service.
- Accessibility: ease in which travelers can engage in desired activities.
- Capacity utilization: quantity of operations relative to capacity.

This Q/LOS Handbook focuses primarily on quality, followed by capacity utilization. The quantity of travel and accessibility dimensions are not addressed in this Q/LOS Handbook.

The QOS is based on a user's perception of how well a transportation service or facility operates. In other words, it's how travelers perceive the overall QOS.

The LOS is a quantitative stratification of the QOS.The HCM divides highways QOS into six letter grades, A through F, with A being the best and F being the worst. With this scheme, traffic engineers more easily explained operating and proposed design concepts to the general public and elected officials.

**Despite its widespread use as an independent measurement, it is important to note that the LOS is simply a quantitative breakdown from transportation users' perspectives of transportation QOS. The LOS reflects the QOS, as measured by a scale of user satisfaction, and is applicable to each of the following modes that use roadways: automobiles, trucks, bicycles, pedestrians, and buses.**

Because this handbook deals with the overall quality of user satisfaction and its quantitative breakdown, it is labeled as the Q/LOS Handbook. The measurement techniques, however, are simply referred to as LOS analysis. This Q/LOS Handbook deals with the QOS and the LOS that roadways provide to users (i.e., motorists, bicyclists, pedestrians, and transit passengers) and provides planning tools to assist transportation planners and engineers. The overall quality of the entire trip experience, which depends on a variety of factors, including aesthetics, safety, and other social measures are not covered in this handbook.

## 3.1 Common Q/LOS Misconceptions

Common misconceptions about Q/LOS that often arise:

- The QOS is directly related to all other dimensions of mobility.

This misconception is related to the relationship between quality and other dimensions of mobility. *The QOS is frequently related to the other dimensions of mobility, but not in all cases.* Q/LOS for automobile drivers is usually closely linked to how many other vehicles are on the road. However, the relationship is not always perfect.

For example, arterial speeds are more closely tied to signalization conditions than the number of other vehicles on the roadway. A higher Q/LOS grade may exist on a four-lane arterial with twice the volume of another arterial due to efficient signal progression. For transit users, pedestrians, and bicyclists, there is often an even weaker relationship between total demand and Q/LOS. **In most situations in Florida, the total number of bicyclists and pedestrians on a facility has very little, if any, impact on Q/LOS.Similarly, in most of Florida, bus**

**frequency is typically much more important to transit users than how many people are actually on a bus.**

In some cases, particularly for the non-automobile modes, an analysis of total potential demand is a more important component of the decision-making process than the QOS. This handbook only addresses Q/LOS, not the methods of determining overall demand or mode splits. Other tools, such as logit models, are more appropriate for these types of analyses.

- The LOS is applicable only to automobile analysis, while the QOS is related to the non-automobile modes.

This misconception is that LOS applies only to automobiles, and QOS applies to the non-automobile modes. It is often assumed that while automobile analyses are highly quantitative, the bicycle, pedestrian, and transit analyses are more qualitative. *However, the bicycle, pedestrian, and transit techniques are as quantitative and rigorously developed and tested as those for automobiles.* An example of LOS by mode for arterials is illustrated in **Figure 3-1**.

**Figure 3-1: Examples of LOS by Mode for Arterials**


- The LOS A–F grades are comparable to American school letter grades.

The most common misconception about LOS A–F grades is that they are comparable to school letter grades. Although they share some basic similarities, there are some important distinctions to make at a planning level. *Unlike school grades, LOS A is not necessarily a desirable goal, and the meaning of A–F is not entirely consistent across modes.* **Although it is true that LOS A is best and LOS F is worst, this is strictly from a traveler experience and perspective. LOS A is not necessarily a desirable goal to achieve from an overall transportation or societal perspective.** LOS A in a peak travel hour could be an indicator of an inefficient use of limited funding. It is simply not cost-effective to design the state's roadways to operate at LOS A during the peak hour. FDOT's LOS targets in **Chapter 10** should be considered a desirable condition during the peak hour, with significant variance from those targets in either direction an undesirable condition. The LOS targets are an FDOT Policy (000-525-006) and discussed in **Chapter 10**.

Although LOS F represents a failing condition, there are more factors to consider when the LOS reaches F. Essentially, LOS F either means travel demand exceeds capacity and the roadway is operating in oversaturated conditions, or another undesirable condition exists.

Although each of the methodologies for automobiles, bicycles, pedestrians, and buses make use of the LOS A–F scales, **the meaning of A–F is not entirely consistent across the modes.**

Transportation professionals widely consider LOS D for the automobile mode an acceptable condition, and this threshold is often used as a design condition in urbanized areas. The bus and automobile LOS scales were developed by transportation professionals, with the objective of classifying various levels of congestion in undersaturated conditions. Members of the general public, however, determined the derivation of the bicycle and PLOS thresholds, thus incorporating a general perception of LOS D as a largely undesirable condition. Because of this, LOS D likely represents a worse condition from the user perspective for the bicycle and pedestrian modes than the automobile and bus modes. FDOT and its research team evaluated and considered various methods to make the LOS thresholds more consistent across modes, but found no scientific basis to adjust the scales. Users should therefore simply be cautious about comparing the same LOS letter grade across modes.

## 3.2. Highway Capacity Manual

For capacity and automobile, pedestrian, and bicycle Q/LOS analysis, the HCM is the foremost recognized and accepted analysis tool. HCM defines capacity as the maximum sustainable flow rate, which persons or vehicles can reasonably be expected to traverse a point or a uniform segment of a lane or a roadway during a given time period under prevailing roadway, environmental, traffic, and control conditions.

### 3.2.1 Traffic Flow and Capacity Concepts

The HCM defines two primary facility types: uninterrupted and interrupted flow facilities. The terms refer to the type of facility and, therefore, the analysis type, not the quality of traffic flow at any given time.

**Uninterrupted flow facilities have no fixed causes of delay or interruption external to the traffic stream, such as signals or stop signs.** Non-tolled freeways represent the purest form of uninterrupted flow, because there are no fixed interruptions to traffic flow, and access to the facilities are limited to ramp locations. Multilane and two-lane highways operate under uninterrupted flow in long segments between points of fixed interruption (e.g., traffic signals), but it is often necessary to examine the points of fixed interruption using interrupted flow methodologies.

**Interrupted flow facilities have fixed causes of periodic delay or interruption to the traffic stream, such as traffic signals or stop signs, with average spacing less than or equal to 2 miles.** Traffic flow patterns on interrupted flow facilities are the result not only of vehicle interactions and the facility's geometric characteristics, but also of the traffic control used at intersections and the frequency of access points to the facility. Traffic signals, for example, allow designated movements to occur only during portions of the signal cycle, and therefore affect flow and capacity, because the facility is not available for continuous use. Traffic signals also create platoons of vehicles that travel along the facility as a group. By contrast, intersections controlled by all-way stops and roundabouts discharge vehicles more randomly, creating periodic but sometimes small gaps in traffic at downstream locations.

Capacity on uninterrupted and interrupted flow facilities can be defined in terms of, passenger cars per hour (pcph), or vehicles per hour (vph), depending on the type of analysis or system element.

Reasonable expectancy is the basis for defining capacity. Capacity is, therefore, not the absolute maximum flow rate observed at a facility, but rather a flow rate that can be achieved repeatedly for peak periods of sufficient demand.

**Prevailing roadway, traffic, and control conditions define capacity.** These conditions should be relatively uniform for any segment of a facility that is analyzed. Base conditions, by comparison, assume optimum conditions, including good weather, dry pavement conditions, users who are familiar with the system, and no impediments to traffic flow. In most cases, prevailing conditions differ from base conditions (e.g., there are trucks in the traffic stream, rolling terrain). As a result, the computations of capacity, service flow rate, and LOS include an adjustment to capacity under base conditions.

### 3.2.2. Bicycle LOS (BLOS)

**BLOS is based on bicyclists' perceptions of the roadway environment.** BLOS is based on five variables, with relative importance ordered in the following list:

- Average effective width of the outside through lane
- Vehicle volumes
- Vehicle speeds
- Heavy vehicle (truck) volumes
- Pavement condition

Average effective width is largely determined by the width of the outside travel lane and striping for bicyclists but includes other factors, such as the effects of street parking and drainage grates. Each of the variables is weighted by coefficients derived by stepwise regression modeling importance. A numerical LOS score, generally ranging from 0.5 to 6.5, is determined and stratified to an LOS letter grade. Thus, unlike the determination of automobile LOS, in which there is typically only one service measure (e.g., average travel speed), BLOS is determined by multiple factors.

### 3.2.3. Pedestrian LOS (PLOS)

Like BLOS, **PLOS is based on the pedestrians' perceptions of the roadway or nearby roadside environment.** PLOS is based on four variables with relative importance ordered in the following list:

- Existence of a sidewalk
- Lateral separation of pedestrians from vehicles
- Vehicle volumes
- Vehicle speeds

The PLOS model applies to the roadway facilities within the right of way. Therefore, estimating PLOS for facilities outside the right of way at significantly greater distance, may exceed the validated range of the model and is not recommended.

## 3.3. Transit Capacity and QOS

The Transportation Research Board (TRB) [Transit Capacity and Quality of Service Manual (TCQSM)] is the nation's leading document for transit and Q/LOS analysis. As used in this Q/LOS Handbook, transit or bus is limited to scheduled, fixed-route bus transit.

One significant exhibit in the TCQSM is a table for urban scheduled transit service based on service frequency. **Table 3-1** replicates this TCQSM table, but includes Florida-specific modifications to the adjusted service frequency.

**Table 3-1: Service Frequency LOS Thresholds**

| Level of Service | Adjusted Service Frequency (Vehicles/hour) | Headway (minutes) | Comments |
|---|---|---|---|
| A | >6 | <10 | Passengers don't need schedules |
| B | >4 | <15 | Frequent service, passengers consult schedules |
| C | ≥3 | ≤20 | Maximum desirable time to wait if transit vehicle missed |
| D | ≥2 | ≤30 | Service unattractive to choice riders |
| E | ≥1 | ≤60 | Service available during hour |
| F | <1 | >60 | Service unattractive to all riders |

## 3.4. Simplifying Assumptions

Planning-level analyses make extensive use of default values and simplifying assumptions to the operational models on which they are based. As such, there are multiple simplifying assumptions used in this Q/LOS Handbook.

### 3.4.1. Averages

This Q/LOS Handbook makes extensive use of averages. **For generalized planning (Generalized Service Volume Tables), most of the default input variables represent statewide averages. Similarly, for generalized planning, simple averages are recommended.** For example, if an arterial facility has daily volumes of 20,000, 25,000, and 24,000, it would be reasonable to use the average (23,000) of the three. However, users should be cautious of outlying values and use some judgment when applying simple averages. In the above example, if the first value were 10,000, the user may want to disregard that value or use the median value (i.e., 24,000).

### 3.4.2. Turning Movements

One of the most significant planning assumptions is that the mainline turning movements are adequately accommodated. Within this Q/LOS Handbook, the through movement is defined as the traffic stream with the greatest number of vehicles passing directly through a point. While this movement is typically the Straight Ahead movement, occasionally the right or left turn could qualify as the through movement. When the turning movement has the greatest number of vehicles (more than the Straight Ahead), it is recommended to consider the turning movement as the controlling movement. See **Section 5.9** for additional details.

Most analyses of through movements in the HCM are relatively straightforward. Complications arise with the treatment of turning or merging movements, especially for signalized intersections and arterials. By handling turning arterial movements (i.e., turns from the arterial, side-street movements) in a general way, Q/LOS and capacity analyses are greatly simplified. This is also true for some two-lane uninterrupted flow highways in which mid-block turning movements may affect capacity. Off- and on-ramp movements along freeways are also handled in a general way and are assumed to be adequately accommodated. Most importantly, it is assumed that movements at off-ramps do not back up into the through lanes of the freeway.

When turning movements are not adequately accommodated in the available storage, the techniques to determine the LOS for an arterial found in this handbook are not appropriate. Although, the arterial analysis in this handbook includes all vehicles on the arterial, the focus is on the vehicles making through movements rather than turning movements. For example, only the green time for the through movement is included, and penalties are assigned if there are no left-turn lanes at signalized intersections and no medians exist mid-block.

### 3.4.3. Queue Spillback

Another major assumption is that turning movements do not back up into adjacent through lanes. Essentially, adequate storage is assumed to be available for turning vehicles on arterials and for vehicles exiting freeways. Therefore, where mainline turning movements are not adequately accommodated, the planning techniques found in the Q/LOS Handbook are not appropriate. If this is the case, higher level analysis is recommended.

### 3.4.4. Capacity

For the HCM analyses of uninterrupted flow facilities, capacity is set in terms of passenger cars per hour per lane (pcphpl). **Free-flow speed is estimated based on other variables, such as percent heavy vehicles, CAFs and SAFs, median type, and lateral clearance.**

For the HCM analyses of interrupted flow facilities, capacity represents the maximum number of vehicles that can pass a point during a specified time period under prevailing roadway, traffic, and control conditions.

The Q/LOS Handbook primarily relies on and reports capacity values based on the interrupted flow concept of capacity, with free-flow speed considered a roadway variable input. **For planning purposes, the assumed free-flow speed is 5 mph over the posted speed limit.**

### 3.4.5. Bus Frequency

For transit analysis purposes, the most significant assumption is that bus frequency is the single most important factor in determining the Q/LOS to transit users along a transit route segment or roadway facility. FDOT, in cooperation with the TCQSM authors and others, has incorporated that concept. Certainly, the LOS varies for individual transit users along a facility, but **in the determination of bus LOS along a transit route segment or roadway facility, the availability of buses is usually the more relevant performance measure.**

## 3.5. Arterial Analyses

#### ADJUSTED SATURATION FLOW RATE

Variables such as  area type, speed limit, number of lanes, percent right turn lanes, percent heavy vehicles, median type, left turn lanes and population size have effects on adjusted saturation flow rates. Furthermore, as traffic queues get longer, traffic pressure affects capacity.These effects are included in FDOT’s Generalized Service Volume Tables.

### ADD-ON/DROP-OFF LANES

The add-on/drop-off lane (or expanded intersection) will contribute to intersection capacity, but not likely to the extent of a full through lane. The add-on/drop-off lane contains up to half the capacity of a full through lane. For any capacity benefit to be considered, two conditions should be met:

- the add lane and drop lane each must be at least 800 feet in length
- the add-on/drop-off pair combined must be at least 1,760 feet in length

For additional discussion, see **Section 4.3.1**.

### ONE-WAY STREETS

The Generalized Service Volume Tables include a factor that has been approved for the evaluation of one-way streets. Essentially, one-way pairs are assumed to have a 20 percent higher service volumes than corresponding two-way roadways with the same number of lanes.

### LOS CRITERIA

The maximum control delay at a signalized intersection for LOS D is 55 seconds. While that value may be reasonable based on user perception in an urbanized area, in a small town or at an isolated intersection on a rural highway, that delay would be considered LOS F. To overcome this difference in user perception, FDOT has adopted different control delay criteria in rural undeveloped and rural developed areas. The criteria are one-half, rounded up, of the urbanized area criteria. For arterials in rural developed areas, arterial Class I LOS thresholds apply. These LOS criteria are embedded in FDOT's rural undeveloped and rural developed Generalized Service Volume Tables. The LOS criteria appear on the back of each table.

## 3.5.1 Pedestrian and Bus Analyses

### PEDESTRIAN LOS

PLOS is determined by the methodology contained in this handbook. **The methodology is consistent and unchanged from the 2013 Q/LOS Handbook.** The pedestrian LOS adjustment factors as they relate to bus LOS are shown in **Table 3-2**.

**Table 3-2: PLOS Adjustment Factors on Bus LOS**

| Pedestrian Level of Service | Adjustment Factor |
|---|---|
| Pedestrian LOS A | 1.15 |
| Pedestrian LOS B | 1.10 |
| Pedestrian LOS C | 1.05 |
| Pedestrian LOS D | 1.00 |
| Pedestrian LOS E | 0.80 |
| Pedestrian LOS F | 0.55 |

## ROADWAY CROSSING DIFFICULTY

When catching a bus, transit users frequently have to cross a road. **Crossing difficulty is typically influenced by three broad factors: traffic signal density, crossing length, and vehicle volume.** It is more difficult to cross roadways with low signal densities than roadways with closely spaced, signalized intersections. Mid-block crossing difficulty increases with road width and lack of pedestrian refuges (i.e. restrictive or raised medians). Mid-block crossing difficulty also increases as the number of vehicles increase, which results in fewer gaps. These three broad factors and other major factors, such as vehicle speed, are interrelated. To account for crossing difficulty in a general way, FDOT's approach includes a set of roadway crossing adjustment factors which capture the crossing difficulty. **Roadway crossing adjustment factors are used to determine the adjusted bus frequency by applying a factor that captures crossing difficulty.**

## PASSENGER LOAD FACTOR

Bus crowding plays a role in the user's perception of QOS, particularly on overcrowded buses when no seating is available. FDOT's approach includes a set of passenger load factors, which are applied to help determine the adjusted bus frequency value. **Passenger load factors are used to determine the adjusted bus frequency value by applying a factor commensurate to the level of passenger crowding.** These factors can be found in **Chapter 7** of this Q/LOS Handbook.

## BUS STOP AMENITIES

Passenger comfort and safety within the passenger waiting areas play a role in user perception of the QOS and desirability of a transit system. FDOT's approach includes a set of bus stop amenity factors, which are used to help determine the adjusted bus frequency value. The factors can also be found in **Chapter 7** of this Q/LOS Handbook.

## BUS STOP TYPE

Delay time at bus stops plays a role in travel times along routes, and thus impacts overall average travel speed. **FDOT includes a bus stop type adjustment factor, which is used to add 15 to 35 seconds of delay per route for typical and major bus stops, respectively.**

## BUS FACILITY ANALYSIS

The TCQSM structure for Q/LOS analysis consists of points (e.g., bus stops), route segments, and systems. It does not include a facility analysis. Nevertheless, to maintain consistency, a method of aggregating segment-level bus frequency to facility-level was needed. At the generalized level, a simple average is acceptable. For example, if on a 3-mile facility, four buses serve the first 2 miles and two buses serve the last mile, then using a value of three buses [(4 + 2)/2] is acceptable for a generalized level analysis.

# 4 Roadway Variables

Florida's Generalized Service Volume Tables are based on the HCM, TCQSM, and Florida roadway, traffic, control (signalization), and multimodal data. **The resulting tables are valid in Florida, and FDOT encourages the use of the generalized planning level approach.** Recognizing varying characteristics with the state and differing roadway, traffic, control, and multimodal characteristics, the Generalized Service Volume Tables are not adequate for all analysis needs. **Chapters 4 through 7** provide a description of input variables used in the development of the Generalized Service Volume Tables. Roadway variables describe the geometric and functional characteristics of a facility.

## 4.1. Roadway Type

Compatible with the terminology of the HCM, this Q/LOS Handbook is based on three major roadway types:

- Freeways
- Uninterrupted flow highways
- Interrupted flow roadways

Note: when using the Generalized Service Volume Tables, the number of lanes for arterials and other interrupted flow facilities should be determined at major intersections, rather than mid-block.

### 4.1.1. Freeways

**Freeways are multilane, divided highways with at least two lanes for exclusive use of traffic in each direction and full control of ingress and egress.**

### 4.1.2. Highways

**Uninterrupted flow highways are roadways with a combination of roadway segments, which have average signalized intersection spacing greater than 2 miles and are not freeways**. Because of the significantly different operating characteristics, these types of roadways are frequently also distinguished as two-lane highways and multilane highways.

### 4.1.3. Arterials

**Interrupted flow roadways or arterials are characterized by signals with average signalized intersection spacing less than or equal to 2 miles.** In this Q/LOS Handbook, signalized arterials are the predominant type of interrupted flow roadway. They primarily are operated by the state and serve through traffic. Also included in this category are signalized Non-State roadways, but not local streets. As used here, signalized intersections refer to all fixed causes of interruption to the traffic stream and may occasionally include stop signs or other control types.

Arterials are further classified based on posted speed. There are two arterial classes:

- Class I: Arterials with a posted speed of 40 mph or greater
- Class II: Arterials with a posted speed of 35 mph or less

## 4.2. Area Type

Four broad area type groupings are used in this Q/LOS Handbook, as shown in **Figure 4-1**:

- Core Urbanized areas (areas with a population of 1,000,000+) and Urbanized areas (other urbanized areas with a population of 50,000+)
- Transitioning areas (transitioning into urbanized areas)
- Urban areas (areas with a population of more than 5,000 not in urbanized areas)
- Rural areas (rural undeveloped areas or developed areas with less than 5,000 population)

**Figure 4-1: Area Types**


The area types in the Generalized Service Volume Tables correspond well with FDOT's LOS targets; however, there are a few special cases**. FDOT District LOS Coordinators should be consulted for applicable boundaries within their districts.**

There may be small lengths of roadways (e.g., approximately 6 miles for freeways, 3 miles for nonfreeways) between area types or adjacent to an area type that, from a logical and analytical sense, should be combined into one area type or another.

These situations typically occur with adjacent interchanges or in transitioning areas, but may also occur elsewhere. FDOT districts have the flexibility to adjust the area type boundaries or designate a roadway with a certain area type under these circumstances.

**As Florida's population grows, area types may change for a specific location or roadway in future years.** FDOT's district offices (contact information available at http://www.fdot.gov/info/moreDOT/districts/district.shtm) should be consulted if analysts believe different area types are appropriate for a future study period.

## 4.2.1. Core Urbanized and Urbanized Areas

Core urbanized and urbanized areas are defined as approved boundary, which encompasses the entire Census Urbanized Area, as well as the surrounding geographic area likely to become urbanized within the next 20 years, as agreed on by FDOT, Federal Highway Administration (FHWA), and the Metropolitan/Transportation Planning Organization (MPO/TPO). **Core urbanized area types are distinguished by whether the area's population is more or less than 1 million.** Currently, the grouping of more than 1 million applies to the MPO areas that include central cities: Fort Lauderdale, Jacksonville, Miami, Orlando, St. Petersburg, Tampa, and West Palm Beach. These are referred to as "core urbanized." **The minimum population for an urbanized area is 50,000.**

Previously, core urbanized thresholds were developed by applying a different K factor to the urbanized design hourly volume (DHV) thresholds, but after careful consideration, it was noted that additional factors could be applied in the analysis process for a core urbanized area, such as speed and ramp density, and these should be considered. As a result, new DHV, directional design hourly volume (DDHV), and annual average daily traffic (AADT) thresholds were developed for core urbanized areas based on separate analysis from the urbanized thresholds. **The urbanized areas with less than 1 million population are referred to as "other urbanized."**

## 4.2.2. Transitioning Areas

**Transitioning areas are fringe areas that exhibit characteristics between rural and urbanized/urban. Transitioning areas are intended to include areas that, based on their growth characteristics, are anticipated to become urbanized or urban in the next 20 years.**

Frequently, the Metropolitan Planning Area is used for the transitioning area adjacent to an FHWA Urbanized Area (Adjusted Census Urbanized Area Boundary). The definition of Metropolitan Planning Area mentions the "contiguous area expected to become urbanized with the 20-year forecast period." It is the contiguous area that should be considered the transitioning area. However, in practice, most MPOs have not delineated those contiguous or transitioning areas, and many of the Metropolitan Planning Areas extend to remote rural areas of counties. When the MPO does not identify these transitioning areas, or areas adjacent to urban (but not urbanized) areas, FDOT districts, in cooperation with local governments, may delineate transitioning areas for LOS purposes.

Keeping the boundaries relatively consistent over time is desirable to achieve understanding by all potential parties. The transitioning boundary should be reviewed and adjusted as a part of the census cycle update, consistent with the setting of the FHWA Urbanized Area boundaries. It is appropriate to review the transitioning boundary in conjunction with a Long-Range Transportation Plan update. The FDOT District LOS Coordinators should be consulted for transitioning boundaries within their districts. It is recommended that boundaries for transitioning areas be based on the location of major roadways or at interchanges. This avoids portions of a freeway changing from transitioning to urbanized or rural between interchanges. It is desirable for an urban street to have the same designation between major roadways and not change mid-block when aligning the boundary with major roads is impractical.

### 4.2.3. Urban Areas

**An urban area has a population between 5,000 and 50,000 and is not within an urbanized area.** The boundaries for cities with populations over 5,000 and not within urbanized areas are primarily set by existing city limits and must be agreed upon by FDOT, the local government, and FHWA. However, the 5,000 population threshold is primarily a surrogate for areas that exhibit urban traffic characteristics. When a city has a population of less than 5,000 but the surrounding area has a population of more than 5,000 and the city has an urban character, then it is reasonable to classify it with a population of more than 5,000 in the Generalized Service Volume corresponding to a population of over 5,000. These are Generalized Service Threshold Volume Tables 2, 5 and 8 at the end of this handbook following the Glossary.

Other situations exist in which an area has a population of over 5,000 and yet, the area is more characteristic of a rural developed area. In this situation, it is reasonable to use the "developed areas less than 5,000 population" sections of Generalized Service Threshold Volume Tables 3, 6, and 9 included at the end of this handbook following the Glossary. In both of these situations, FDOT District Planning Offices, after consultation with the Central Office Systems Implementation Office, should determine the appropriate designation to use.

### 4.2.4. Rural Areas

Rural areas consist of two types:

- Rural undeveloped: areas in which there is no or minimal population or development
- Rural developed: areas consisting of cities and other populated areas with populations of less than 5,000 or along coastal roadways

Generally, the portion for cities or developed areas in Generalized Service Threshold Volume Tables 3, 6, and 9 should be applied to areas with a population between 500 and 5,000 and not immediately adjacent to urbanized, urban, or transitioning areas. This portion of the tables also should be generally applied to coastal roads not in urbanized, urban, or transitioning areas.

## 4.3. Number of Through Lanes

The number of through lanes is one of the most important variables to analyze a roadway's capacity and LOS. Emphasis is placed on through lanes, or lanes that directly accommodate through traffic. The number includes shared lanes (e.g., through/right), but does not include exclusive turn lanes or two-way left-turn lanes on arterials, auxiliary lanes on freeways, or passing lanes on two-lane highways. Arterials are often described as having an odd number of lanes when two-way left-turn lanes are present. However, for highway capacity and LOS analyses, that is not appropriate. The two-way left-turn lane does not accommodate through vehicles, and the facility is more appropriately characterized as having an even number of lanes with a non-restrictive median.

Usually the total number of through lanes in both directions is used to describe roadways. However, this Q/LOS Handbook bases analyses upon a single peak direction. As an example, an LOS analysis for a six-lane freeway is based on three lanes, using the higher directional traffic volume. Similarly, an LOS analysis for a four-lane urban street would be based on two directional lanes.

A common question when using the Generalized Service Volume Tables is how do we handle odd number lanes along the facility. The Generalized Service Volume Tables contain adjustment factors based on certain characteristics of the facility (i.e., turn lanes, medians, etc.). Any applicable adjustment factors are first applied and then the average service volumes are averaged.

For example, a rural undivided 5-lane arterial facility with exclusive left-turn lanes and without exclusive right-turn lanes will have an adjusted LOS C threshold of 35,388. This is calculated using the Generalized Service Volume Table 3. The LOS C thresholds for an undivided 4 and 6-lane arterial in a rural area is 29,300 and 45,200, respectively. To calculate the 5-lane LOS C threshold, first account for any applicable adjustment factors. For this example, the LOS thresholds must be adjusted by -5% for multilane arterials that have exclusive left-turn lanes and no exclusive right-turn lanes. After this adjustment is applied, the new 4 and 6-lane LOS C thresholds are 27,835 and 42,940, respectively. To obtain the final 5-lane LOS C threshold, the newly adjusted 4 and 6-lane LOS C thresholds, 27,835 and 42,940, are averaged to obtain the 5-lane LOS C threshold of 35,388 to be used in the analysis.

### 4.3.1. Arterials

An important aspect of this Q/LOS Handbook is the methodology for determining an arterial's number of through lanes. The ultimate result of the LOS analysis is a facility estimation of the LOS, and **it is widely recognized that signalized intersections are the arterial's primary capacity constraint; therefore, it is appropriate to place more emphasis on the intersections' characteristics than the mid-block characteristics.** Generally, mid-block segments have capacities far exceeding those of major intersections, and it is rare for significant delays to occur mid-block. By weighting the effects of intersections more heavily, a more accurate aggregate estimation is possible.

Site-specific characteristics (e.g., intensity and type of land use, driver behavior, speed, etc.) can dramatically affect the viability of add-on/drop-off pairs as through lanes; therefore, each approach should be examined on a case-by-case basis. Analysts are strongly cautioned to review all pertinent characteristics prior to adjusting the number of through lanes used. The reviews should be conducted during peak travel conditions. Analysts are encouraged to consult with their FDOT District LOS Coordinators prior to applying this concept. The following guidelines are offered as a capacity estimating tool only. This process should never be used for the design or redesign of an expanded intersection.

For any capacity estimation to be considered, two conditions should be met:

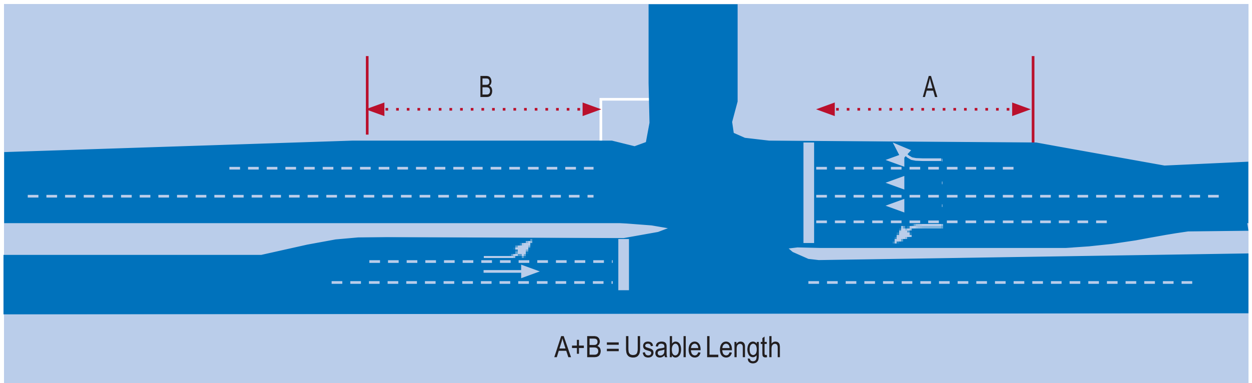
- The add and drop lanes must each be at least 800 feet in length
- The add-on/drop-off pair combined must be at least 1,760 feet in length

If either of these conditions is not met, then no additional capacity is assumed.

If the add-on/drop-off pair is at least one-third of a mile in length (roughly divided equally between approach and departure and exclusive of tapers and cross-street width, as represented by A+B in **Figure 4-2**), it may be reasonable to consider an additional one-half lane for capacity purposes. For example, in the accompanying diagram, if A = 1,000 feet and B = 1,000 feet, then it would be reasonable to consider that the intersection approach has 2.5 effective through lanes.

With a length of at least one-half mile (roughly divided equally between the add and drop lanes), it may be reasonable to consider the add-on/drop-off pair as adding up to one full through lane.

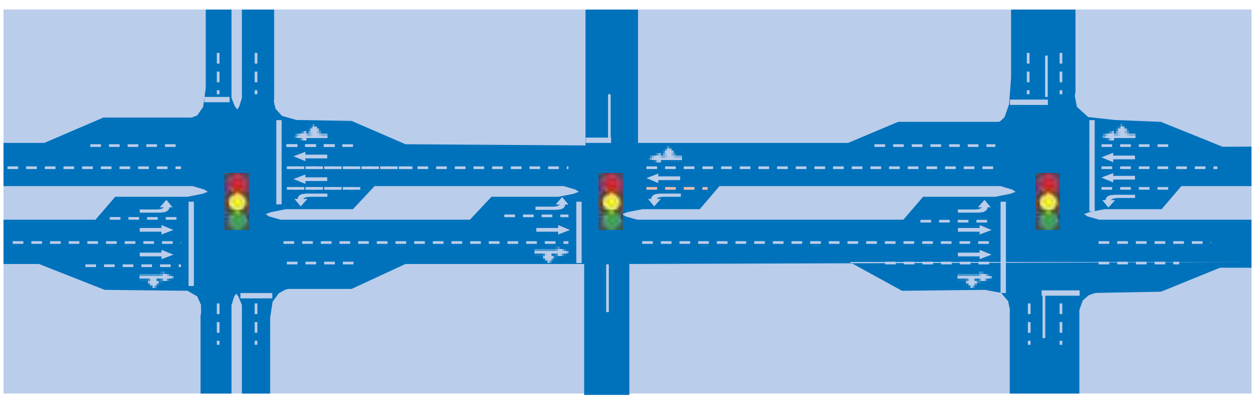
Figure 4-2: Usable Length




**When using the Generalized Service Volume Tables, the number of through lanes on a facility is typically determined by the through and shared through/right lanes at major intersections rather than mid-block.** Figure 4-3 shows the mid-block segments with four lanes, with two lanes in each direction. The major intersections each have six lanes, with two through and one shared through/right add-on/drop-off lane with tapers adequate for safe merging.

In this illustration, as in many cases, minor signalized intersections have green times so heavily weighted to the major urban street that they do not cause significant delays to through traffic. When this is the case, it is sometimes acceptable to disregard the number of lanes at these minor intersections; instead, the determination should be based on the lanes at major intersections. So in terms of the LOS, this particular facility has six lanes.

Figure 4-3: Example of Six-Lane Roadway



## 4.3.2. Highways

For uninterrupted flow highway facilities, the number of lanes is the basic segment or mid-block laneage. For example, a two-lane highway, which is widened to four lanes at major intersections, should be considered a two-lane highway.

## 4.4. Speed

### 4.4.1. Posted Speed

The maximum speed at which vehicles are legally allowed to travel over a roadway segment.

### 4.4.2. Free-Flow Speed

**Free-flow speed is the average speed of vehicles not operating under the influence of speed reduction conditions. In general, free-flow is the average speed under low-flow conditions and not influenced by control conditions, such as signalized intersections. The assumption used in this handbook is that the free-flow speed is 5 mph above the posted speed.** As an example, if an arterial has a posted speed of 40 mph, the default free-flow speed used is 45 mph; however, if a more accurate free-flow speed is available, it should be used.

## 4.5. Median Type

### 4.5.1. Arterials

As used in this document, medians may be classified in one of three ways:

- restrictive median (r)
- non-restrictive median (nr)
- no median (n)

**A restrictive median is a raised or grassed area normally at least 10 feet in width separating opposing mid-block traffic lanes and includes left-turn lanes.**

**A non-restrictive median is a painted at-grade area normally at least 10 feet in width separating opposing mid-block traffic lanes, and for arterials, accommodates mid-block left-turning vehicles to exit from through lanes.** Continuous two-way left-turn lanes are considered a non-restrictive median under this definition. Situations in which restrictive or non-restrictive medians are less than 10 feet wide are considered as having no median.

FDOT included the median factor to account for lowering mid-block average travel speeds when no median is present. From the aspect of getting left-turning vehicles out of the traffic stream, the difference between a restrictive and a non-restrictive median is relatively inconsequential. Thus, in determining automobile LOS, restrictive and non-restrictive medians are treated the same.

From a pedestrian point of view, there is a significant difference between non-restrictive medians and restrictive medians. Restrictive medians give pedestrians a much safer mid-block crossing. Thus, this type of median is a consideration in determining the pedestrian crossing factor that enters the bus LOS analysis. **A non-restrictive median provides no pedestrian refuge.**

**A pedestrian refuge is an area at least 5 feet but less than 10 feet in width (not a full, raised median) separating opposing mid-block traffic lanes and allowing pedestrians to cross the roadway** more safely and comfortably. From a pedestrian point of view, a pedestrian refuge has nearly the same benefit as a restrictive median. In terms of pedestrian crossing difficulty, the difference between a restrictive median and pedestrian refuge is relatively small; therefore, in determining pedestrian crossing difficulty, the two may be treated the same.

Pedestrian refuges are not included as a distinct category. If an analyst needs to evaluate the effects of a pedestrian refuge, it should be treated as a restricted median for transit analysis, but as no median for automobile analysis.

# 4.6. Exclusive Turn Lanes

## 4.6.1. Arterials

### EXCLUSIVE LEFT-TURN LANES

The exclusive left-turn lanes are reserved for the exclusive use of left-turning vehicles. The length of these lanes must accommodate turning demand such that left-turn traffic (1) is able to enter the turn lanes behind through queues or (2) can be stored in the turn lane to ensure the through lane traffic is not blocked. When left-turn lanes are not present, a shared lane exists which is included in the number of through lanes.

When analyzing arterials without left-turn lanes, the use of the Generalized Service Volume Tables is discouraged in all but the most basic analyses. If used, the Generalized Service Volume Tables include adjustment factors for the absence of left turn-lanes. To account for the absence of left-turn lanes, adjustment factors provided in the Generalized Service Volume Tables must be manually applied to the service volumes. However, the user is cautioned that research indicates that the true value of the reduction is highly dependent on the distribution of traffic volumes among all the various movements, and a constant reduction factor, as used in the tables is not accurate.

**Storage length refers to the total amount of storage available for left-turning vehicles, measured in feet.** The default value is 235 feet. For new turn lanes, FDOT Design Standards must be consulted (found at https://www.fdot.gov/design/standardplans/DS.shtm).

### EXCLUSIVE RIGHT-TURN LANES

**Exclusive right-turn lanes are storage areas designated to exclusively accommodate right-turning vehicles.**

The length of these lanes must be able to accommodate turning demand to allow for the free flow of the through movement. The number of pedestrians crossing at these locations should also be considered and accommodated.

# 4.7. Roadway Lengths

To properly apply the Generalized Service Volume Tables, it is necessary to partition roadways into appropriate lengths for analysis. Setting lengths too short may not adequately capture traffic flow characteristics. Vehicles will not achieve the same average running speed on a segment as over a longer facility length. Short lengths would also be subject to bias caused by signal control delay.

Furthermore, analysis results would not conform to the concept of LOS that is based on the driver perception of the operation of roadways and may not show where the most significant impact of proposed development traffic will occur. Conversely, setting lengths too long may dilute the impact of hot spots by averaging them into other portions that operate better.

**FDOT District LOS Coordinators have primary responsibility for the segmentation of the State Highway System (SHS) for LOS purposes.** FDOT Central Office may combine smaller segmentation lengths of a facility for statewide reporting and other purposes.

In general, the partitioning of roadways for facility analyses should be based on the following considerations, ranked in order:

- Highway system structure (including facility type, number of lanes, etc.)
- Area type boundaries
- Lengths
- AADTs

At the local level, government agencies frequently make highway capacity and LOS termini at their own jurisdictional boundaries, regardless of the appropriate facility length and termini considerations described above. Jurisdictional boundaries by themselves are usually not appropriate termini for capacity and LOS analyses. Local governments are encouraged to consult with FDOT District LOS Coordinators for applicable segmentation within their jurisdictional boundaries.

### 4.7.1. Arterials

For an arterial facility analysis, the general recommendation is that the facility be at least two (2) miles in length to use the service measure of average travel speed. Major intersecting arterials frequently serve as logical breaks in segmenting the arterial facility. In downtown areas, the general recommended length is at least one (1) mile.

When evaluating arterial section or facility LOS for planning, the roadway should begin and end at a signalized intersection. The following guidance is provided for some special cases:

(1) Interchanges along an arterial: At a generalized planning level, it is typically appropriate to make a break at an interchange (highway system structure criterion) that does not include a signalized intersection.

(2) Boundaries, especially urbanized area boundaries: When a signalized intersection lies just outside the boundary, it is proper to extend an analysis to the next signalized intersection if within 2 miles of a boundary for a conceptual planning analysis. For example, if a signalized intersection lies 1 mile beyond the existing urbanized boundary in a transitioning area, it is appropriate to include that signalized intersection and the 1 mile of transitioning area as part of an urbanized area analysis.

# 5 Traffic Variables

This chapter provides an overview of key traffic variables used in the development and use of the Generalized Service Volume Tables.

## 5.1. Volume and Demand

**Traffic volume is the most basic of all traffic parameters and is generally defined as the number of vehicles passing a point on a transportation facility during a specified time period.** Traffic volumes typically are developed separately from capacity/LOS analyses and provide input to those analyses. Various sources that determine traffic data include:

- FDOT's Florida Traffic Online (FTO) Web Application
- Extrapolation of historical growth trends
- FDOT's travel demand forecasting models
- Institute of Transportation Engineers (ITE) Trip Generation Manual

The sources listed below provide guidance on traffic forecasting and analysis:

- FDOT's Project Traffic Forecasting (PTF) Handbook
- HCM, Sixth Edition
- FDOT's Traffic Analysis Handbook

Volume is the parameter most often used to quantify traffic demand. **Traffic demand is the number of vehicles with drivers who desire to traverse a particular highway during a specified time period. While traffic demand expresses a desire, volume typically represents actual measurement.**

Misuse of measured volumes often occurs in capacity/LOS analysescausing traffic studies to report the observation and measurement of conditions as they presently exist. Current observations do not reflect constraints in the existing highway system that may prevent vehicles from accessing a desired segment of the system at any given point in time. Observed volumes on congested facilities are more a reflection of capacity constraints than of true demand.

Measured traffic volume cannot theoretically exceed roadway capacity, but traffic demand volume can exceed capacity. An example of a common misinterpretation of these two distinct terms typically occurs while collecting traffic data at an oversaturated intersection. The traffic volume that can physically be processed through a traffic signal is a measure of the capacity (or supply). When traffic volumes approach roadway capacity, the transportation system may experience abnormally long vehicle queues and excess vehicular delay. The length of the vehicle queue upstream of a traffic signal is a more accurate measure of the traffic demand that cannot be processed in the one-hour analysis period.

The impact of bottlenecks, alternative routes, latent demand, and future growth further complicates the relationship between measured traffic volume and traffic demand. **If questions arise as to the appropriateness of using measured volumes or demand volumes for capacity and LOS analyses, it is clear demand volumes should be used.**

## 5.2. Annual Average Daily Traffic (AADT)

**AADT is the total volume of vehicle traffic on a highway or roadway segment for one year divided by the number of days in the year.** Most planning applications require AADT volumes. Determining AADT values is a separate process and distinct from capacity/LOS analyses. FDOT routinely provides AADT values for state roads.

AADT values are easy to confuse with two other traffic count numbers that are used to estimate AADT. **The average daily traffic (ADT) is the total traffic volume during a given time period, more than a day and less than a year, divided by the number of days in that time period.** ADT is generated from a short-term traffic count and can be used to estimate AADT. Ensuring ADT counts are reflective of the normal average traffic is an important consideration when using them to estimate AADT on the roadways. Traffic taken during a four-day holiday, long weekend, or Saturday night when 50,000 or more football fans gather is not a normal occurrence.

**Peak season weekday average daily traffic (PSWADT) is the average weekday traffic during the peak season.** PSWADT numbers are normally generated by travel demand forecasting planning models, such as Florida Standard Urban Transportation Model Structure (FSUTMS). Like ADT, they can be converted to AADT by an adjustment factor.

FDOT operates two types of traffic monitoring programs: 1) continuous monitoring at selected locations using permanently installed equipment and 2) coverage counts at many temporary or short term sites using portable equipment. Further information about the traffic monitoring programs can be found in the FDOT PTF Handbook.

There are two count adjustment factors used to calculate AADT. The first, **axle correction factors are used to compensate for an axle counter's tendency to count more vehicles than are actually present.** For example, an axle counter would show a count of two when a four-axle truck runs over the sensor, even though only one vehicle is present. The second, **seasonal adjustment factors have been developed to adjust for the variation in traffic over the course of a year.** The peak season is the 13 consecutive weeks with the highest volumes. The weekly seasonal factors for those weeks will be the lowest, and the factors will be the highest for the weeks with the lowest volumes. The seasonal factor is used as follows:

**AADT = (short-term traffic count) x (seasonal factor) x (axle correction factor)**

Although, for planning purposes AADT is usually used, actual capacity and LOS analyses are conducted on an hourly or sub-hourly directional basis. All of FDOT's Generalized Service Volume Tables are based on peak hour directional roadway, traffic, control, and multimodal characteristics. FDOT's hourly directional tables may be viewed as the most fundamental of the tables, because the daily tables are created by dividing the peak hour directional values by the directional distribution factor (D) and the planning analysis hour factor (K). Although the determination of AADT is outside the capacity/LOS analyses, the determination of K and D is a fundamental part of capacity/LOS analyses in planning stages because of the need to convert AADT to peak hour directional volumes.

## 5.3. Planning Analysis Hour Factor (K)

**The K factor is the ratio of the traffic volume in the study hour to AADT.** Historically, FDOT has used a variety of study hours and K factors depending on the application. Frequently used K factors included the 30th highest volume hour of the year (K30), 100th highest volume hour of the year (K100), highest hourly volume to daily volume (Kp/d), 5–6 p.m. weekday volume to AADT (K5-6pm), average p.m. weekday peak volume to AADT (Kpm), average a.m. peak weekday volume to AADT (Kam), and noon weekday volume to AADT (Knoon). In general, K factors are used for peak hour traffic analyses, but analyses can also be based on low-volume conditions, such as the analysis of truck travel in early morning hours. Roadway, traffic, and control conditions vary considerably during the day, potentially affecting capacity values and service volume thresholds.

**Standard K is the primary planning analysis hour factor used in Florida, and the value is set based on the area type and facility type.** The use of Standard K represents a design approach in which the K factor for a roadway is established from the planning phase through the design phase of the project development process. Rather than being a variable, Standard K values are a fixed, cost-effective parameter, much like the use of 12-foot through lanes on major, high-speed roadways. Unless otherwise noted, all references in this Q/LOS Handbook that refer to a study hour or K factor refer to Standard K.

The Standard K factor is used to convert a peak hour volume to an AADT and vice versa. The Standard K factors used in the Generalized Service Volume Tables were obtained through a methodical process to obtain representative Standard K factors. On the freeways in the seven largest urbanized areas in Florida (Fort Lauderdale, Jacksonville, Miami, Orlando, St. Petersburg, Tampa, and West Palm Beach), Standard K represents a peak study period. For all other facilities, Standard K represents a peak hour not within the peak season. Standard K Factors for planning and design analysis are not directly applicable to the Turnpike, other toll roads, and managed lanes. For more information on the K Factors, refer to FDOT's PTF Handbook.

**The K factor generally drops as an area becomes more urbanized and high traffic volumes are spread out over longer time periods.** If adequate documentation is provided, FDOT would consider deviations from the Standard K table for special facility types.

The recommended Standard K factors can be found in the FDOT PTF Handbook and the analyst must refer to the PTF Handbook for use of appropriate K factors in projects. The K values used in development of the Generalized Service Volume Tables included in this handbook are consistent with the PTF Handbook. They are listed below:

- Urbanized (Core urbanized/Core freeways)
  - Freeways: 0.09 (0.085)
  - Highways: 0.090
  - Arterials: 0.090
- Transitioning
  - Freeways: 0.098 (average of Transitioning to Urbanized Areas and Urban)
  - Highways and arterials: 0.090
- Rural developed and rural undeveloped
  - Freeways: 0.105
  - Highways and arterials: 0.095

Standard K values on freeways in large urbanized areas range from 8.0 to 9.0 percent, while Standard K values on these "core freeways" in large urbanized areas are typically lower in this range. The lower K values signify a peak period, as opposed to a peak hour. The urban core freeway K values in large urbanized areas are available on FDOT FTO Web Application managed by FDOT's Transportation Data and Analytics (TDA) Office.

### 5.3.1 Multimodal Transportation Districts (MMTD)

The purpose of MMTDs is to encourage desirable transportation environments for all users, including transit passengers, pedestrians, cyclists, and motorists. The designation of such districts recognizes the inherent, integral relationship between transportation, land use, and urban design and the degree to which each of these elements affect the others. Local governments opting to designate an MMTD assign secondary priority to vehicle mobility and primary priority to assuring a safe, comfortable, and attractive pedestrian environment, with convenient connections to transit. FDOT supports local governments that are committed to such efforts. Implementing MMTDs should help foster the use of multiple modes of transportation, leading to a reduction in automobile use while maintaining high mobility characteristics in the area.

The primary way FDOT supports these designated areas is through its LOS targets. FDOT promotes lower acceptable automobile travel speeds for longer durations in the planning, design, and operations of its facilities.

## 5.4. Directional Distribution Factor (D)

**The peak hour D factor is the proportion of an hour's total volume occurring in the higher volume direction.**

The preferred approach to obtain D factor data is from the FTO Web Application, which provides a D factor for all state roads. The FTO Web Application reports the average of measured D values around the 200th highest hour from nearby and comparable roadway sites. The statewide minimum acceptable D factor is 0.51 ( this is not the default valueand should only be used in an LOS analysis if adequate justification is provided for the specific roadway). The D factor of 0.55 was used in the Generalized Service Volume Tables for all facility and area types. Using such an approach provides statewide consistency and reasonable accuracy in the values indicated and at a minimum cost. Additional guidance and the recommended range of D factors can be found in the FDOT PTF Handbook.

## 5.5. Peak Hour Factor (PHF)

**The peak hour factor (PHF) is the hourly volume divided by the peak 15-minute rate of flow within the peak hour, specifically:**

$$\boldsymbol{PHF = \frac{(Hourly\ Volume)}{4(Peak\ 15 - minute)}}$$

The planning-level approach for addressing volume variations within the study hour has been adopted within this handbook. PHF based on area type were used to develop the vehicular service volumes in this Q/LOS Handbook. The PHF associated with each area type is:

- Urbanized areas: 0.95
- Transitioning/urban areas: 0.92
- Rural areas: 0.88

The PHF associated with the area type is consistent with the sixth edition of the HCM. For more information on the PHF, refer to FDOT's PTF Handbook.

## 5.6. Base Saturation Flow Rate

The HCM uses the term “base saturation flow rate” for interrupted flow roadways and capacity, or base capacity, for uninterrupted flow roadways to describe the maximum steady flow. **Base saturation flow rate is the maximum steady flow rate, expressed in pcphpl, at which passenger cars can cross a point on interrupted flow roadways.** These are not the same as capacity, as normally used to define how many vehicles a roadway can reasonably accommodate. The base saturation flow rates/capacities for Florida’s roadway facilities are:

- Arterials and other interrupted flow facilities: 1,950 pcphpl (assuming 100 percent green time)
- Basic freeway segment (70 mph free flow speed): 2,400 pcphpl
- Uninterrupted flow multilane highway segments (60 mph free flow speed): 2,200 pcphpl
- Uninterrupted flow two-lane highway segments: 1,700 pcphpl

## 5.7. Heavy Vehicle Percent

The FHWA has a vehicle classification scheme in which vehicles larger than a pickup truck are considered heavy vehicles. This includes vehicles with more than four wheels or a classification group of four or higher. **The percentage of these heavy vehicles in a given hour is frequently referred to as a truck factor (T).** However, to be more consistent with HCM terminology and to overcome some definitional problems with the common understanding of the meaning of a truck, this Q/LOS Handbook uses the term “heavy vehicle” and makes use of the percent of heavy vehicles in a given hour.

The heavy vehicle percentage varies dramatically by the time of day, day of week, roadway type, and adjacent land uses. Operational characteristics of heavy vehicles also vary dramatically by type of heavy vehicle (e.g., a relatively small delivery truck compared to a fully loaded 18-wheel semi-truck) and whether they are operating on an uncongested freeway or on signalized roadways. The blast effect of heavy vehicles on bicyclists also varies significantly based on the type and speed of heavy vehicles.

## 5.8. Speed and Capacity Adjustment Factors

**The HCM 6th Edition has replaced the local adjustment factor (LAF) with the SAF and CAF. The LAF previously provided an adjustment to capacity to account for driver aggression, hurriedness, and familiarity with the facility.**

The SAF is used to adjust the speed of a facility based on a combination of sources, including weather and construction work zone effects. The SAF may also be used to calibrate the estimated free-flow speed for local conditions or other effects that contribute to a reduction in free-flow speed.

The CAF is used to adjust the capacity of a facility for reduced-capacity situations or to match field measurements. The capacity can be reduced to represent situations such as construction and maintenance activities, adverse weather, traffic incidents, and vehicle breakdowns.

The SAF and CAF can be used to adjust for driver familiarity (or unfamiliarity) with the facility. Additionally, these adjustment factors are used to calibrate a roadway to existing conditions. For the Generalized Service Volume Tables analysis, an SAF of 0.975 and a CAF of 0.968 was assumed for all analyses and area types. These values are derived from the HCM 6th Edition.

## 5.9. Percent Turns from Exclusive Turn Lanes

Percent turns from exclusive turn lanes is the percent of vehicles approaching an intersection served by an exclusive turn lane or lanes. More specifically, the percent left turns is the percentage of vehicles performing a left-turning movement at a signalized intersection, and the percent right turns is the percentage of vehicles performing a right-turning movement at a signalized intersection. Typically, the percent turns from an exclusive lane is the percent of traffic using an exclusive left-turn lane, with traffic predominantly moving straight ahead.

Some of the most complicated calculations within the HCM chapter on signalized intersections deal with accommodating left-turn movements. **The Generalized Service Volume Tables assume that left-turn lanes adequately serve left-turning vehicles.** In other words, the base condition assumes there is no queue spillback from the left-turn lane into the adjacent through lanes. If this assumption cannot be made, results obtained from the planning analysis tools are possibly inaccurate. For these reasons and more, the tables should not be used for intersection design or detailed traffic operations analysis.

The automobile LOS methodology described in this Q/LOS Handbook applies the HCM procedures to through traffic at each signalized intersection. Turning movement adjustments are made internally, based on the user-specified value of percent turns from exclusive lanes. Turning volumes are added to the through volumes to determine the overall service volumes shown in the Generalized Service Volume Tables.

**The accuracy of LOS calculations is highly dependent on the percent turns from exclusive turn lanes.** Although it is typically of moderate importance, at some key intersections, it may be one of the most significant variables. While FDOT does not routinely suggest acquiring percent turns from exclusive turn lanes, data collection should be considered at key intersections. Furthermore, some FDOT districts may require specific counts. If the percent turns at key intersections are obtained in the field, a value of 10 percent may be assumed for the other intersections, assuming an exclusive left-turn lane and no exclusive right-turn lane. If the percentage of turns from exclusive turn lanes is acquired, the turning movement count should be conducted during the peak hour, as illustrated in **Table 5-1**.

**Table 5-1: Calculation of Percent Turns from Exclusive Turn Lanes**

| Measured Day | Peak Hour | Signalized Intersection | Total Peak Hour Predominant Approach Volume | Exclusive Lane Volume | % Turns from Exclusive Turn Lanes | |
|---|---|---|---|---|---|---|
| | | | | | A | B |
| 22-Jan | 4-5 PM | A | 884 | 130 | 14.7% | 16.7% |
| | | B | 900 | 150 | | |
| 23-Jan | 5-6 PM | A | 1,152 | 150 | 13.0% | 13.0% |
| | | B | 1,150 | 150 | | |
| 24-Jan | 5-6 PM | A | 1,102 | 150 | 13.6% | 14.7% |
| | | B | 1,090 | 160 | | |
| Totals | – | A | 3,138 | 430 | 13.7% | 14.6% |
| | | B | 3,140 | 460 | | |

## SPECIAL TURNING MOVEMENT CASES

There are two special cases when dealing with turns from exclusive lanes. The first is when the predominant movement is a turn movement instead of the straight-ahead movement. The second involves T intersections.

In **Figure 5-1**, the predominant movement is the left-turning movement, and the 550 vehicles turning left should be considered the through movement.The 200 vehicles going straight ahead should be treated as left-turning vehicles with 20 percent left turns [(200/(550 + 200 + 250)] from an exclusive left-turn lane. The 250 vehicles turning right should be treated normally, with 25 percent right turns [(250/(550 + 200 + 250)] from an exclusive right-turn lane.

In **Figure 5-2**, all vehicles are turning from exclusive turn lanes at a T intersection. The 600 vehicles turning right is the predominant movement and should be considered through vehicles. The 400 vehicles turning left should be treated normally, which is to say there are 40 percent left-turns [400/(400 + 600)] from an exclusive left-turn lane.

In **Figure 5-3**, another T intersection is shown, featuring a shared left/through lane in addition to the predominant movement served by the exclusive right lane. Normally, a shared left/through lane does not have the same capacity as a through lane because of the effect of opposing vehicles blocking permitted left turns for the main movement. However, in this case, there is no opposing movement, and the capacity of this shared lane is virtually the same as a typical through lane. In this situation, an analyst should assume one through lane and one shared through lane with 20 percent left turns [(200/(200 + 200 + 600].

**Figure 5-1: Predominant Turning Movement**

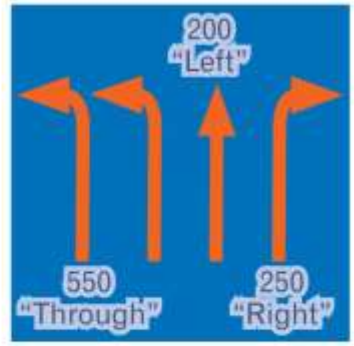



**Figure 5-2: Through Movement at a T Intersection with Exclusive Lanes**

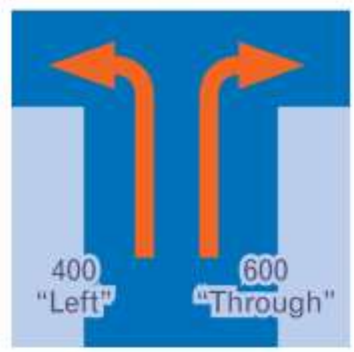
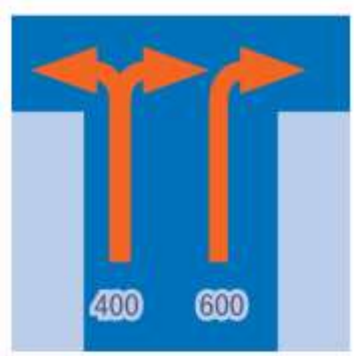



**Figure 5-3: Through Movement at a T Intersection with Shared Lanes**



# 6 Control Variables

This chapter provides an overview of each control variable used to generate the Generalized Service Volume Tables.

**Control variables refer to roadway or area traffic controls and regulations in effect for a roadway point or segment, including the type, phasing, and timing of traffic signals, stop signs, lane use and turn controls, and other similar measures.** In this Q/LOS Handbook, control variables refer to those regularly occurring at signalized intersections, unless otherwise noted. For uninterrupted flow facilities, such as freeways and highways, the LOS can readily be derived from the volume of vehicles and roadway capacity, and control variables are not applicable. For signalized roadways (interrupted flow), however, v/c is not sufficient to determine the LOS, and control variables must be considered. These include:

- Number of signals
- Arrival type
- Cycle length
- Effective green ratio (g/C)

The Generalized Service Volume Tables use default control variables that are representative of typical conditions on Florida roadways. The default control variables (or characteristics) — along with the roadway, traffic, and multimodal variables assumed in the creation of each table — are provided on the back of the Generalized Service Volume Tables.

**Table 6-1** provides an overview of the control variable input requirements within the Generalized Service Volume Tables.

**Table 6-1: Control Variable Input Requirements**

| | Input Variable | Generalized Service Volume Tables |
|---|---|---|
| CONTROL | Number of Signals | D |
| | Arrival Type | D |
| | Signal Type | D |
| | Cycle Length (C) | D |
| | Through Effective Green Ratio (g/C) | D |
| | Exclusive Left Effective Green Ratio | D |

Legend: D Default variables that cannot be altered

The effects that individual variables have on the computational process vary. **Table 6-2** indicates the sensitivity of the control variables on capacity and LOS.

**Table 6-2: Sensitivity of Control Variables on Service Volumes**

| Control Variable | Sensitivity on Service Volumes |
|---|---|
| Number of Signals | high |
| Arrival Type | medium |
| Signal Type | low |
| Cycle Length (C) | medium |
| Through Effective Green Ratio (g/C) | high |
| Exclusive Left Effective Green Ratio | medium |

Traffic variables, including AADT, Standard K, and D data, should be obtained from FDOT's FTO, PTF Handbook and field counts. Although turning movement counts at key intersections may be necessary, as discussed previously, FDOT does not recommend the use of travel time studies for LOS planning applications.

Field visits should be conducted to collect traffic and other items needed for analyses. Up-to-date aerial or satellite imagery may be sufficient for most of the data entry items. Signalization information is often available from the applicable traffic operations agency's signal timing plans. The applicable transit agency should be contacted for transit data.

## 6.1. Number of Signals

The cumulative effect of numerous traffic signals, lack of green time, and lack of effective signal progression often have a detrimental effect on the LOS of arterials. An important feature of FDOT's Generalized Service Volume Tables is the inclusion of the number of signals on the determination of the LOS.

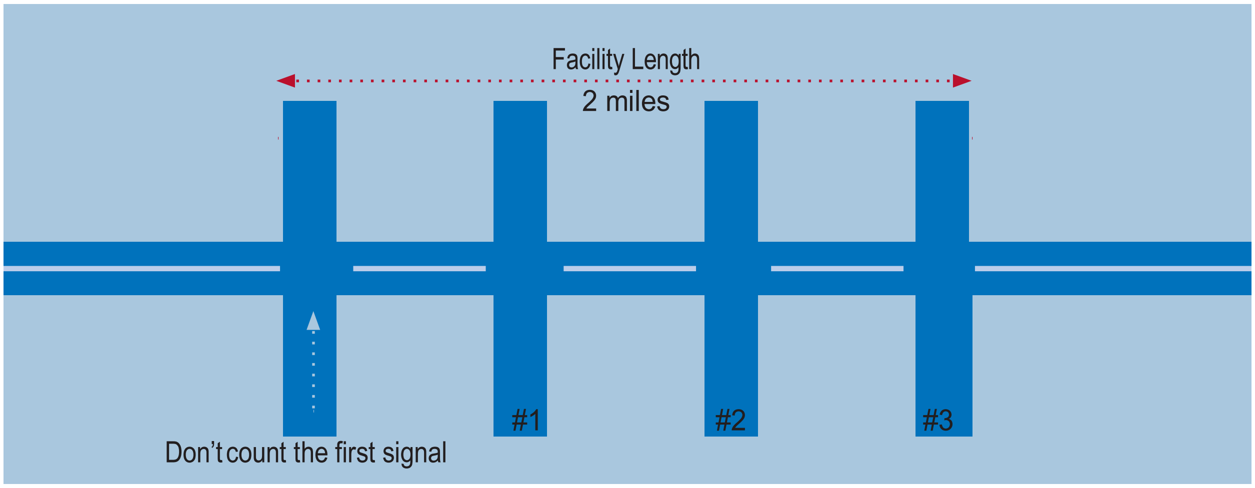
The distance between signalized intersections is required to determine specific service volumes for a roadway. FDOT's Generalized Service Volume Tables use signalized intersections per mile as an input and assume uniform spacing. While this approach may be acceptable for an areawide analysis, precise distances between signalized intersections should be determined when an individual roadway is analyzed at the conceptual planning level.

**For analysis purposes, 100 feet between signalized intersections is considered the minimum distance.** When the actual distance is less than 100 feet (e.g., side streets with wide medians), it is reasonable to consider these together as one signalized intersection.

Roadway and traffic characteristics often change over time. The number of signals per mile is frequently the most significant change. As development takes place and an area becomes more urbanized, the number of signals per mile is likely to increase. The LOS analysis of future conditions should, therefore, take into account changes in roadway and signalization characteristics.

To avoid double counting when determining the number of signals, only one intersection at the ends of the facility should be counted, as shown in **Figure 6-1**. In general, FDOT recommends including the last intersection within the analysis and ignoring the first, or entry, intersection. This allows the analysis to include the effects of delay, backup, and the LOS from the last intersection for the facility under study.

**Figure 6-1: Total Number of Signals**




For example, in southeast Florida, principal arterials are often spaced 1 mile apart, with other signalized intersections in between. In this situation, only one of the signalized intersections at the ends of the roadway, plus the signals in between, should be counted when determining the number of signals per mile. In general, the last signalized intersection in the peak flow direction would be counted, ignoring the first signalized intersection.

As discussed previously, the arterial should begin and end at a signalized intersection. In unusual situations when this assumption is not applicable (e.g., lane drops, ramp junctions, etc.), the following guidance is provided:

- For the Generalized Service Volume Tables, do not count the unsignalized terminus as a signalized intersection.

**In general, only fixed, periodic interruptions should be considered in determining the number of signals.** Only one intersection at the ends of the facility should be counted. Draw bridges, at-grade railroad crossings, school zones, pedestrian crossings, and median openings should not be counted. Depending on the site-specific conditions or analysis desired, there may be exceptions to this general guidance.

When using the Generalized Service Volume Tables, an intersection with a stop sign for the through movement is considered a signalized intersection for a state-signalized arterial. When analyzing a Non-State signalized roadway, the roadway must have at least one signalized intersection.

## 6.2. Arrival Type

**Arrival type is a general categorization of the quality of signal progression.** The HCM defines six arrival types, with Type 1 representing the worst progression quality and Type 6 representing the best. Uncoordinated operation, or random arrivals, is represented by Type 3 and is appropriate for actuated signals. Arrival Type 4 is FDOT's default for coordinated signal systems. A more favorable progression (Types 5 or 6) may be appropriate when progression design strongly favors the peak direction of travel, and all signals are coordinated for the length of the facility. One-way facilities tend to have better quality progression than two-way facilities. A higher level of progression may also be appropriate around freeway interchanges, where signals are typically highly coordinated. The arrival type may vary significantly from one signal to the next, even in coordinated signal systems. Actuated-coordinated signals have varying green times, with breaks between groups of coordinated signals.

The assumption of very good progression in one direction does not imply efficient progression in the other direction. Even with less traffic volume, off-peak direction speeds could be lower, if favorable progression has been established for the peak direction only.

## 6.3. Signal Type

The signal type indicates the degree to which a traffic signal's cycle length, phase plan, and phase times are preset or actuated. The three main types are:

- Actuated
- Actuated-coordinated
- Pretimed

It should be noted that modern traffic signals can handle multiple settings and can vary by time of day. Consequently, a traffic signal's operation (actuated, coordinated-actuated, or pretimed) can change by the time of day to best meet traffic demands.

### 6.3.1. Actuated

**Actuated, or fully actuated signals, use vehicle detection for all signal phases on the main and side street approaches.** Each phase is subject to a minimum and maximum green time, and some phases may be skipped if there is no demand for the phase. The length of the green time observed in the field generally depends on the amount of vehicular demand for the phase. If there is little demand, then a relatively short green time will be allocated to the phase. If there is significant demand, a relatively long green time will be allocated, subject to the maximum green time for that phase. The minimum and maximum green times for each phase can be easily changed by entering new values into the traffic signal controller.

Because phases can be skipped, and the amount of green time for each phase generally depends on demand, the cycle length will often vary substantially from cycle to cycle. The exception occurs during periods of heavy vehicular demand, when all phases consistently reach their maximum values, making it seem as if the cycle length is fixed. Actuated signal operations are most frequently used when the signalized intersection is isolated, or when there is a desire to minimize delay without concern for progression.

### 6.3.2. Actuated-Coordinated

A subset of actuated control is referred to as actuated-coordinated control. **In this type of signal operation, the cycle length is typically fixed, while the amount of green time for the main street through phase varies.** It consists of a minimum amount of green time plus any unused time from the minor phases. Holding the main street green in this manner at all of the signals along a facility allows platoons of vehicles to move relatively unimpeded along the main street with decent progression. Actuated-coordinated signal operations are typically used in Florida's developed areas, especially during peak travel times. This type of operation typically offers the best balance of capacity and progression for the main street through movement.

### 6.3.3. Pretimed

**Pretimed signals use a preset sequence of phase times in a repetitive order and make no use of vehicle detection. Each phase is green for a fixed period of time, irrespective of vehicular demand, and none of**

**the phases can be skipped. Thus, the cycle length is fixed.** This type of signal operation is most frequently used in downtown areas with high signal density, or when the desire is to maximize progression without extensive concern about maximizing capacity for the through movement.

## 6.4. Cycle Length (C)

**Cycle length (C) is the total time for a signal to complete a sequence of signal indications for all traffic movements.** The cycle lengths used in the development of the arterial service volume tables were based on representative cycle lengths for different functional classifications of arterials and for different area types. Cycle lengths are typically highest on principal arterials in urbanized areas, where the primary purpose of the facility is to provide a high level of mobility to through movements on the mainline and where roadways are typically at or near capacity during peak periods. Lower cycle lengths are typically used for the less saturated conditions typical of rural areas to provide better access and service to all directions. The cycle lengths used to develop the Generalized Service Volume Tables are provided on the back of each table.

## 6.5. Effective Green Ratio (g/C)

**One of the most significant variables used in calculating the highway capacity and LOS on a signalized roadway is the through movement's effective green time (g) to signal cycle length ratio (g/C).** It is the amount of time allocated for the through movement (typically calculated as the green plus yellow plus all-red indication times less the lost time) divided by C. Along with the number of through lanes, it is usually one of the two most important factors for determining the capacity of a roadway's through movement at any given intersection and for the roadway as a whole. Despite this, for generalized analyses, g/C is often ignored, because:

- g/C ratio typically varies from intersection to intersection along an arterial
- g/C ratio typically varies by time of day

Ignoring g/C undermines any arterial LOS analysis at a generalized planning level. This Handbook includes guidance to provide default g/Cs for generalized planning arterial analyses.

A major simplifying assumption that is essential to the development of the Generalized Service Volume Tables is the selection of one g/C for all intersections on an arterial. The g/C ratio of 0.44 was used for arterial analysis for all area types. FDOT has determined that for generalized planning analyses, the weighted average g/C ratio yields the closest results to actual conditions. **The weighted g/C ratio of an arterial is the average of the critical intersection through movement g/C ratio and the average of all the other intersections through movement g/C ratios for urban streets.** For example, if there are four signals with a through g/C ratio of 0.50 and one signal with a through g/C ratio of 0.40, then the weighted average g/C ratio for urban street is 0.45 (Refer to HCM for additional information). Essentially, the worst intersection is given equal weight to all the other intersections combined.

As an example, for the through movement phase, G is the green displayed time, Y the yellow displayed time (typically 3 or 4 seconds), R the all-red indication (typically 1 or 2 seconds), and C the cycle length. The most representative situation in Florida is for cycles to consist of four phases and 12 indications: one phase each to accommodate the main road through movement, the side road left movement, the side road through movement, and the main road left movement, with G, Y, and R indications for each of the four phases. The effective green time, which includes the effects of vehicular startup and clearance lost times is g.

FDOT's preferred approach for g/C determination for current year analyses is to use the actual signal timing plan from the traffic operations agency for the p.m. peak hour (typically 5–6 p.m.) for each signalized intersection. This is a consistent and cost-effective approach that provides reasonable accuracy. If the signal is actuated, (G + 4)/C should be used for the through movement. This assumes the typical Y + R time of 4 seconds as additional time allocated to the through movement as a result of unused time from the other movements. If the signal is pretimed, the g/C for the through movement should be used.

For consistency and ease of review, FDOT recommends using signal timing plans from the applicable traffic operations agency.

Analysts should be aware that signal timing plans come in a variety of forms, use many notations, and are not designed to directly address the determination of g/C. It may be necessary to coordinate with the operating agency directly to interpret the output values.

Analysts should calculate and input g/C for the through movement at all intersections. The g/C for left turning movements need only be collected at major intersections. A 10 percent value can be assumed as the left g/C for other intersections.

In previous FDOT guidance, FDOT offered two other methods for determining g/C:

- actual signal timings from the traffic operations agency
- field studies

Both approaches have some merit; however, after FDOT analyzed and tested both approaches, the preferred approach of using signal timing plans in general offers the best combination of consistency, accuracy, and cost-effectiveness. The use of field studies for g/C is discouraged, unless an early agreement by the affected parties is reached. The maximum acceptable facility through movement g/C ratios during the peak hour typically should not exceed:

- State principal arterials
    - Current year: 0.50
    - Long term (≥ 10 years out): 0.47
- Other roadways: 0.44

Under most circumstances, arterial facilities are 1.5–5.0 miles in length and include principal arterials as terminus points. The g/C value of 0.50 approximates FDOT's maximum allowable arterial capacity volumes of 1,000 vehicles per hour per lane (vphpl) and 950 vphpl in large urbanized areas and other urbanized areas, respectively.

# 7 Multimodal Variables

This chapter provides an overview of each multimodal variable used within Generalized Service Volume Tables to allow the user to recognize these variations and analyze multimodal LOS on specific roadways. Where applicable, generally acceptable ranges are provided. Multimodal variables describe the various geometric and demand characteristics that are needed to determine pedestrian, bicycle, and bus LOS. As with the control variables, multimodal variables are only applicable for arterial analyses:

- Paved shoulder/bicycle lane
- Outside lane width
- Pavement condition
- Sidewalk
- Sidewalk/roadway separation
- Sidewalk protective barrier
- Bus frequency
- Bus stop amenities
- Bus stop type
- Passenger loads

**Table 7-1** provides an overview of the multimodal variable input requirements within the Generalized Service Volume Tables.

**Table 7-1: Multimodal Variable Input Requirements**

| Input Variable | Generalized Service Volume Tables |
|---|---|
| Paved Shoulder/Bicycle Lane | R |
| Outside Lane Width | D |
| Pavement Condition | D |
| Sidewalk | R |
| Sidewalk/Roadway Separation | D |
| Sidewalk/Roadway Protective Barrier | D |
| Bus Frequency | R |
| Bus Stop Amenities | D |
| Bus Stop Type | D |
| Passenger Loads | D |

Legend: R Required table input
D Default cannot be altered

The effects that individual variables have on the computational process vary. **Table 7-2** indicates the sensitivity of the multimodal variables on the capacity and LOS.

**Table 7-2: Sensitivity of Multimodal Variables on Service Volumes**

| Control Variable | Sensitivity on Service Volumes |
|---|---|
| Paved Shoulder/Bicycle Lane | high |
| Outside Lane Width | low |
| Pavement Condition | low |
| Sidewalk | high |
| Sidewalk/Roadway Separation | medium |
| Sidewalk/Roadway Protective Barrier | medium |
| Bus Frequency | high |
| Bus Stop Amenities | low |
| Bus Stop Type | low |
| Passenger Loads | low |

## 7.1. Paved Shoulder/Bicycle Lane

Within this Q/LOS Handbook, a bicycle lane is a designated or undesignated (paved shoulder) portion of a roadway for bicycles adjacent to vehicle lanes. Painted lines separate paved shoulders/bicycle lanes from vehicle lanes.

**For planning purposes, a designated bicycle lane is usually 4 to 5 feet in width and has a bicycle logo. An undesignated bicycle lane is usually 4 feet in width and does not have a bicycle logo.** To be considered a paved shoulder/bicycle lane, at least 3 feet of paved shoulder must exist outside the painted line. Facilities with striped shoulders between 1 and 3 feet should be considered as having wide outside lane widths.

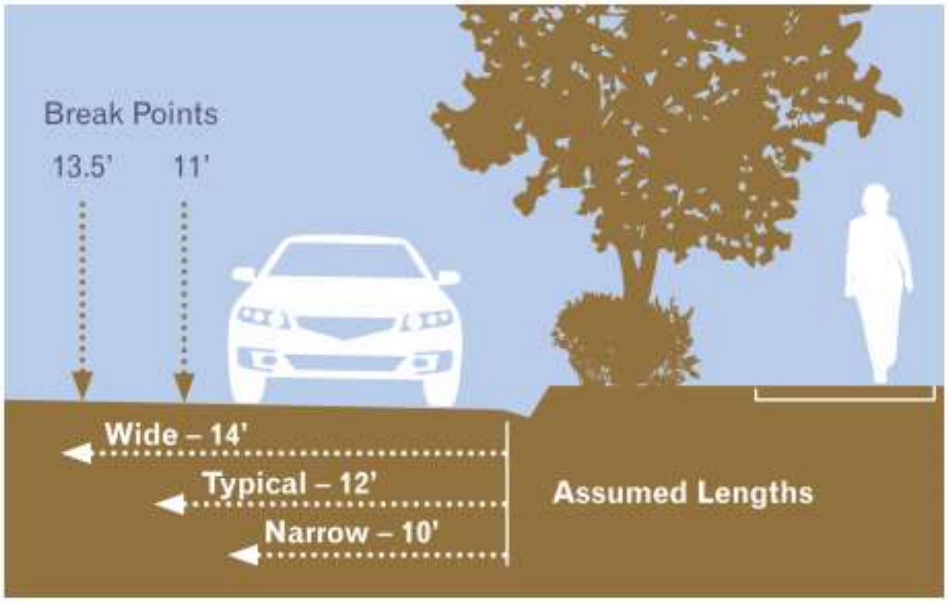
## 7.2. Outside Lane Width

Within this Q/LOS Handbook, **the outside lane width is the width, in feet, of a roadway's outside vehicle through lane, not including the gutter.** This factor is usually important in the determination of a roadway's BLOS. The majority of the SHS lane widths are 12 feet. Many local roads and some state highways have 14-foot outside lanes; these are sometimes referred to as wide curb lanes. Many other local roads and some state facilities have outside lane widths less than 12 feet.

These dimensions as shown in **Figure 7-1,** are for planning analyses only:

- Wide: greater than or equal to 13.5 feet.
- Typical: greater than or equal to 11 feet and less than 13.5 feet.
- Narrow: less than 11 feet.

**Figure 7-1: Outside Lane Width**




## 7.3. Pavement Condition

**Pavement condition for BLOS analysis is a general classification of the roadway surface where bicycling usually occurs, not necessarily that drivers of vehicles experience.** Three general classifications are used: desirable, typical, and undesirable. These general classifications are used in lieu of detailed pavement surface grades found in the operational model on which this planning technique is based.

- Desirable pavement condition is new or recently resurfaced pavement. The pavement still maintains a dark black color, is free of cracks, and rides smoothly.
- Typical pavement condition is the most common type of pavement condition of Florida's roadways and is used in the Generalized Service Volume Tables. Generally, the pavement has a light gray color, the surface appears worn, and may have some cracks; however, the ride for the bicyclist is smooth.
- Undesirable pavement condition consists of pavement with noticeable cracks, broken pavement, or ruts. There may be existing or partially filled potholes, or drainage grates hazardous to bicycles. When the bicycle riding surface contains loose dirt, gravel, or debris, even if the roadway surface is typical or desirable, then it would be considered undesirable.

In general, FDOT recommends the use of a typical pavement condition for most analyses, especially those involving future years.

For analysts familiar with FHWA's PAVECON factors, "desirable" would equate to a 4.5 or 5.0 rating, "typical" would equate to a 3.0 to 4.0 rating, and "undesirable" would equate to 2.5 or less.

## 7.4. Sidewalk

Within this Q/LOS Handbook, a sidewalk is a paved walkway for pedestrians at the side of a roadway, typically 5 feet in width. Paved roadway shoulders are not considered sidewalks. Because LOS analyses are directional, the existence of a sidewalk is based on the directional side of the arterial being analyzed.

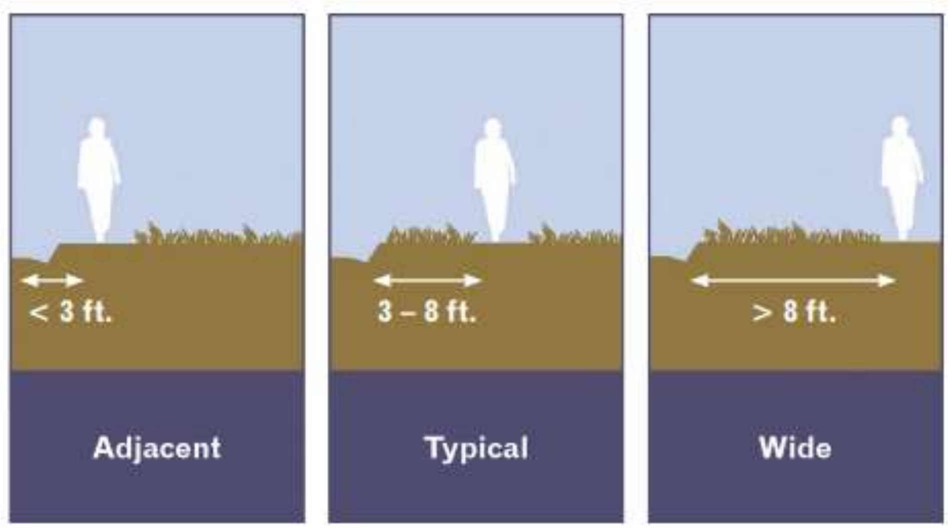
### SIDEWALK/ROADWAY SEPARATION

Sidewalk/roadway separation is the lateral distance in feet from the outside edge of pavement to the inside edge of the sidewalk. Within this Q/LOS Handbook, sidewalk/roadway separation is classified in three ways, as shown in **Figure 7-2**:

- Adjacent: less than or equal to 3.0 feet
- Typical: greater than 3.0 feet and less than or equal to 8.0 feet
- Wide: greater than 8.0 feet

In general, pedestrians tend to walk toward the outer half of sidewalks, away from traffic.

**Figure 7-2: Sidewalk/Roadway Separation**




In downtown environments, sidewalks frequently extend at least 10-12 feet from the curb. When there are no tree plantings or other sidewalk/roadway protective barriers, sidewalks should be classified as adjacent. When there are tree plantings or some other barrier between where people walk and the outside edge of the travel lane, sidewalks are assumed to have typical separation.

**When on-street parking and sidewalks both exist, the sidewalk/roadway separation should be considered wide, regardless of how close the sidewalk is to the edge of the pavement.** Essentially, on-street parking adds approximately 8 additional feet between pedestrians and vehicles.

## 7.5. Sidewalk Protective Barrier

In addition to sidewalk width, this Q/LOS Handbook adds an overall sidewalk protective barrier factor to include the added benefits of trees, on-street parking, or other barriers.

## 7.6. Bus Frequency

**Bus frequency, also known as headway, refers to the number of scheduled, fixed-route buses that have a potential to stop on a given roadway segment in one direction of flow in a one-hour time period.** Express buses with no potential of stopping along a roadway are not included.

## 7.7. Bus Stop Amenities

**The bus stop is often the first component of any transit system a passenger will encounter, and available amenities for comfort or safety can greatly influence the perceived QOS along a route.** Rather than quantify all potential bus stop components, this Q/LOS Handbook creates four categories of bus stop amenities: excellent, good, fair, and poor. Having shelter from the weather and a place to sit is the most desirable condition at any bus stop, regardless of type, and is considered an excellent condition. A shelter without a bench represents a good condition, because rain, wind, and sun could otherwise deter choice riders. A stop with only a bench is less desirable than a stop with only a shelter and is considered a fair condition. A stop with no bench and no shelter is considered a poor condition. Because excellent bus stops may improve a user's perception of the system, the bus stop amenity factor is used to increase the adjusted bus frequency value. Bus stops with no amenities are uninviting and discourage use, and the variable is, therefore, used to decrease the adjusted bus frequency value, as shown in **Table 7-3**.

**Table 7-3: Bus Stop Amenity Factors**

| Bus Stop Amenities | Adjustment Factor |
|---|---|
| Excellent | 1.1 |
| Good | 1.0 |
| Fair | 1.0 |
| Poor | 0.9 |

## 7.8. Bus Stop Type

Bus travel speed depends not only on distances and congestion along the route, but also the number of stops and the dwell time at each stop. Typical bus stops delay a bus for around 15 seconds, while major stations with numerous boardings and alightings can add around 35 seconds of delay.

## 7.9. Passenger Loads

Just as traffic congestion contributes to the degradation of the LOS, crowding on buses can affect the QOS. Because overcrowded buses may reduce the overall desirability of a route, a passenger load factor is used to modify the adjusted bus frequency value, as shown in **Table 7-4**.

**Table 7-4: Passenger Load Factor**

| Passenger Load Factor | Adjustment Factor |
|---|---|
| < 30% | 1.05 |
| < 70% | 1.00 |
| ≤ 100% | 0.95 |
| > 100% | 0.85 |

# 8 Future Year Analyses

Traffic and development conditions change on roadways over time. This raises questions about what input values, analysis tools, and LOS targets should be used for capacity and LOS analyses in future years. Analysis years and planning horizons vary appreciably in transportation planning. To help with understanding and for simplification in this text, **"long term" means 10 or more years from the current year, and "short term" means less than 10 years from the current year.** However, for a specific application, FDOT district LOS coordinators should be consulted for more detailed guidance.

For future year analyses, it is important to consider changes in the appropriate roadway, traffic volumes, land use, signal control, and multimodal characteristics. For example, under existing conditions in a transitioning area, signalization may be very infrequent; however, as development occurs, more signalized intersections can be anticipated and should be accounted for in future year capacity and LOS analyses. The traffic and control variables relevant to this handbook are discussed in the following sections. Refer to the FDOT PTF Handbook and the Traffic Analysis Handbook for further guidance on future year traffic development and analyses.

## 8.1. Change in Traffic Variables

### 8.1.1. AADT

Historical growth trends and the state's travel demand forecasting models are typically used for long-term traffic projections. Analysts and reviewers of capacity and LOS analyses need to agree on what future AADT values to use. Additional information can be found in the PTF Handbook.

For site impact analyses, volumes are frequently presented in terms of trips generated by the site rather than roadway-specific AADT, K, and D values. Institute of Transportation Engineer's (ITE's) Trip Generation Handbook is typically used for trip generation for site impact analyses; however, FDOT should be consulted about supplemental material. In all cases, care should be given to ensure final values are compatible with statewide Standard K and D factors.

### 8.1.2. Planning Analysis Hour Factor (K)

As areas become more developed, measured K values often drop, primarily for two reasons. The first is that more urban situations typically are not subject to highly volatile volumes, such as holiday traffic in rural areas. Generally, more developed areas are subject to frequent recurring volumes, such as weekday commuter traffic. The second is that as congestion develops, the spreading of the peak travel hour traffic also occurs. Refer to FDOT PTF Handbook for Standard K values used by facility type.

For future year generalized planning analyses, the Standard K values for the assumed area and facility types on the backs of FDOT's Generalized Service Volume Tables are appropriate. In the longer term, it may be necessary to determine if the area is projected to transition into a different area type over the analysis period.

### 8.1.3. Directional Distribution Factor (D)

**For future year generalized planning analyses performed in this handbook, the D factor value for all area**

**and facility types is 0.55.** If a site-specific analysis is conducted in the short term, FDOT's preferred approach is to use the FDOT's 200th Highest Hour Traffic Count Report from the FTO Web Application. In the longer term, some lowering of the factor may be appropriate. The analyst should refer to the D factors and their acceptable range in FDOT PTF Handbook.

## 8.2. Change in Control Variables

Making traffic and roadway projections into the future is a well-accepted practice for generalized planning analysis. For reasonable generalized planning analysis of signalized roadways, control variables must be addressed in the short and long terms. **Typically, the two most important control variables are the through movement g/C and signal density.**

### 8.2.1 g/C

Determining current and future g/Cs for a roadway is complicated, and judgments must be made. In the short and long terms:

- For Class II arterials, using the existing g/Cs is appropriate
- For Class I arterials not subject to significant development pressure, using the existing g/Cs is appropriate
- For Class I arterials incurring significant new development pressure, it is appropriate to lower through movement g/Cs
- For new individual signals, through movement g/Cs will vary greatly; however, for planning purposes, none should be assumed to be higher than 0.55

Within the HCS, an acceptable method to estimate future g/C ratios is by conducting intersection capacity analyses. The HCS will determine the required g/C ratios to progress through traffic movements on the major street, while simultaneously minimizing the delay to the minor street approaches.

### 8.2.2 Signal Density

As areas grow in population, additional traffic signals are frequently installed. Usually, these new signals do not significantly affect the capacity of roadways, unless they are in a previously undeveloped area or are so closely spaced that queue spillback occurs. They can play a major role in the determination of the LOS if stops occur more frequently and average travel speeds drop.

In short- and long-term analyses, it is appropriate to consider the probability of new traffic signals, especially based on proposed new developments. In the absence of specific development plans or intersecting traffic volume cross-product signalization criteria, general guidance should be used in developed areas.

In the short term:

- For Class II arterials, using the existing signalized intersection locations is appropriate
- For Class I arterials not subject to significant development pressure, using the existing signalized intersection locations is appropriate
- For Class I arterials incurring significant new development pressure, one additional signalized intersection per mile may be assumed

In the long term:

- For Class II arterials, one additional signalized intersection per mile may be assumed
- For Class I in small towns, one additional signalized intersection per mile may be assumed

Because of the wide variety of circumstances along generally uninterrupted flow highways in rural areas, no specific guidance can be given on future signal locations. However, for capacity and LOS purposes, the possibility of new signalized intersections should be considered. Because of the importance of signal density on the LOS on state roadways, for site impact applications, the number of new signals should be reviewed and approved by the FDOT district prior to use in an analysis.

Typically, other roadway, traffic, control, and multimodal variables do not have as large of an effect on the capacity and LOS as the ones addressed above. If some of these other inputs (e.g., turning movement percentages) were determined in a current year analysis, they can usually be applied to future year analysis. If these other variables were not determined for a current year analysis, the statewide default values on the backs of the Generalized Service Volume Tables may be assumed.

# 9 Maximum Capacity Volumes

The use of highway capacity and LOS analysis, whether applied appropriately or not, has resulted in projected traffic volumes beyond normal capacity ranges found on Florida facilities. There are multiple reasons for this, but to aid analysts and reviewers on what capacity values will normally be acceptable, FDOT has adopted a set of general guidelines. The values provided below are based on site-specific freeway studies and counts, as well as arterial maximum acceptable g/C ratios.

## 9.1. Arterials

For arterials, the maximum generally acceptable per-lane approach volumes are:

- Large urbanized: 1,000 vehicles per hour per lane (vphpl)
- Other urbanized: 950 vphpl
- Transitioning: 920 vphpl
- Urban: 920 vphpl
- Rural: 850 vphpl

The Maximum volumes may vary due to widely varying g/C, turning movements at intersections, and the segmentation of roadways. The maximum volumes represent a weighted g/C of approximately 0.50, which is the average of the critical g/C and the average of all other g/Cs along an urban street facility. Typically, there will be at least one principal arterial intersecting an urban street being analyzed. Such intersections are usually the critical intersections (hot spots) for an arterial analysis, and g/C ratios for the through movements are in the range of about 0.40. Although these intersections are frequently flared out to achieve greater capacity, the through movement g/C ratios cannot increase appreciably if all intersection movements are included. Therefore, the use of a 0.50 g/C ratio for determining the capacity of an urban street should represent the upper bounds of what can be reasonably expected.

Arterial facility analyses typically involve intersecting principal arterials, but section analyses may not have intersecting principal arterials. Under these circumstances, urban street through movements during peak travel hours may feature g/C ratios in the 0.50 to 0.60 range. Such values may be appropriate for segment or section analyses; however, the use of such high g/C ratios is not normally acceptable for a facility analysis and may represent an inappropriate segmentation of roadways.

Another situation in which g/C ratios may be above 0.50 is in the outlying parts of urbanized areas or in transitioning areas for both arterials and generally uninterrupted flow highways. In these areas, signals have typically been recently installed, and side traffic has not yet reached the high levels that it will in future years. Therefore, although current maximum volumes per lane may be higher than those shown above, in the future, such values will likely not be sustained and should be avoided in the arterial analysis.

## 9.2. Freeways

For freeway facilities and sections, the maximum volumes at 70 mph free flow speed are 2,400 pcphpl as per HCM.

Freeway operational measures such as ramp metering may result in higher volumes.

In general, the implementation of ramp metering could have a 5 percent or less improvement on capacity.

## 9.3. Highways

For highway segments (generally uninterrupted flow highways), the maximum per-lane approach volumes as per HCM are:

- Two-lane
  - Developed: 1,700 pcphpl
  - Undeveloped: 1,700 pcphpl
- Multilane
  - Developed (55 mph free flow speed): 2,100 pcphpl
  - Undeveloped (60 mph free flow speed): 2,200 pcphpl

# 10 Florida's LOS Policy

## REQUIREMENTS FOR LOS TARGETS FOR THE STATE HIGHWAY SYSTEM

It is FDOT's intent to plan, design, and operate the SHS at an acceptable LOS for the traveling public. The LOS targets are consistent with FDOT's Policy on Level of Service Targets for the SHS, Topic No. 000-525-006. The policy outlines the automobile mode LOS target for urbanized areas and outside urbanized areas. The automobile mode LOS targets for the SHS during peak travel hours are D in urbanized areas and C outside urbanized areas. FDOT shall work with local governments to establish appropriate LOS targets for multimodal mobility and system design. The targets shall be responsive to all users, for context, roadway function, network design, and user safety.

# 11 Generalized Planning Analysis

## 11.1. Introduction

FDOT's Generalized Service Volume Tables found at the end of this Q/LOS Handbook are the primary analysis tool in conducting this type of planning analysis. **Although considered a good generalized planning tool, the Generalized Service Volume Tables are not detailed enough for project development and environment (PD&E) traffic analysis, final design, or operational analysis work, and should not be used for those purposes.** In addition, the Generalized Service Volume Tables cannot be relied upon when approaching LOS E and LOS F thresholds, because of operational fluctuations at the thresholds. More detailed analysis should be performed in these situations.

Specific applications of the Generalized Service Volume Tables include:

- Generalized comprehensive plan amendment analyses
- Statewide highway system deficiencies and needs
- Statewide mobility performance measure reporting
- Areawide baseline capacity (e.g., MPO boundaries) and service volume values for travel demand forecasting models
- Areawide influence areas (e.g., impact areas) for major developments
- Future year analyses (e.g., SIS Needs Plans, MPO LRTPs which have a 10 to 25-year planning horizon)
- Baseline capacity and service volumes for concurrency management systems

Generalized Service Volume Tables must be appropriately applied using the right area type and facility type designations and interpreted selecting the right values from the tables. The adjustment factors must be applied, as applicable.

It is quite possible that no single roadway has the exact values for all the roadway, traffic volumes, land use, signal control, and multimodal variables used in the Generalized Service Volume Tables. The tables must be applied with care to roadway facilities and in the determination of the LOS grade.

The automobile, bicycle, and pedestrian parts of the Generalized Service Volume Tables were developed based on the definitions and methodology of the HCM. Nationally the TCQSM is the comparable document to the HCM for bus analyses.

FDOT's Generalized Service Volume Tables consist of five area types grouped into three tables:

- Urbanized areas
- Areas transitioning into urbanized/urban areas, or cities with population of more than 5,000 not in urbanized areas
- Rural undeveloped areas, or cities and developed areas with population of less than 5,000

Most planning applications begin with AADT volumes given as an input, or end with AADT as a calculated output. Therefore, the generalized daily service volumes shown in Tables 1 through 3 depict the AADT based on a standard peak hour. Some local and regional entities have adopted two-direction peak hour standards.

Tables 4 through 6 provide generalized peak hour two-way service volumes. Generalized peak hour directional volumes (Tables 7 through 9) are provided, because traffic engineering analyses are conducted on an hourly directional basis. These hourly directional tables may be viewed as the most fundamental of the tables, because the two-way tables are simply the peak hour directional values divided by D, and the daily tables are simply the peak hour directional values divided by the D and K factors.

All three sets of tables are internally consistent. All of the volumes within the tables are based on the Standard K factors. The urban/transitioning freeways are based on the average of urbanized and rural Standard K factors. The PHFs of 0.95, 0.92, and 0.88 were used in the creation of the urbanized, transitioning/urban, and rural tables, respectively. The 200th highest hour for the directional distribution variable is approximately equivalent to the typical peak hour of a day during a peak season in a developed area. Again, it is stressed that the daily, peak hour two-way, and peak hour directional tables are internally consistent and based on the same time period and directional flow of traffic.

The input values used to generate the Generalized Service Volume Tables can be found on the backs of Tables 1 through 9 and yield the results on the fronts of the Tables.

The Generalized Service Volume Tables present maximum service volumes, or the highest numbers of vehicles, for a given LOS. Any number greater than the value shown for a roadway with a given number of lanes would drop the LOS to the next letter grade.

**The Generalized Service Volume Tables should not be referred to as capacity tables.** In general, the values shown are the maximum service volumes for a given LOS based on roadway, traffic, control, and multimodal conditions during the peak hour in the peak travel direction. Whereas the maximum service volume deals with the highest number of vehicles for a given LOS, capacity deals with the maximum number of vehicles or persons that can pass a point during a specified time period under prevailing roadway, traffic, and control conditions. Many of the LOS E service volumes in the hourly directional tables also represent the capacity of the roadway, but in general, most of the values do not reflect a roadway's capacity.

A clear case of not representing capacity values is the daily tables. Roadway capacities for the day far exceed the volumes shown in the daily tables. All roadways are underutilized in the early morning hours and many heavily congested roads will have volumes higher than the highest volumes shown in the daily tables, because traffic is backed up for more than a one-hour time period.

Another case of not representing capacity is the arterial LOS E service volumes. **The primary criterion for the LOS on arterials is the average travel speed, not the capacity of the roadway.** The average travel speed along arterials is made of many control variables (e.g., progression, cycle length), not just the capacity (i.e., v/c ratios) of signalized intersections. Only in the special case of when the capacity of signalized intersections controls how many vehicles can pass through the intersections does capacity essentially dictate the lowest acceptable average travel speeds along arterials.

FDOT's Generalized Service Volume Tables are:

- Annual Average Daily Service Volume Tables
  - Table 1: urbanized areas
  - Table 2: transitioning into urbanized areas or urban areas

- Table 3: rural undeveloped or rural developed areas

- Peak hour two-way service volume
  - Table 4: urbanized areas
  - Table 5: transitioning into urbanized areas or urban areas
  - Table 6: rural undeveloped or rural developed areas
- Peak hour directional service volume tables
  - Table 7: urbanized areas
  - Table 8: transitioning into urbanized areas or urban areas
  - Table 9: rural undeveloped or rural developed areas

## 11.2. Special Cases

The volumes in the Generalized Service Volume Tables should be considered as average volumes over the facility under analysis.

For example: If a 4-mile facility has AADT counts of:

- Segment 1 - 23,000
- Segment 2 - 22,000
- Segment 3 - 25,000
- Segment 4 - 23,000 and
- Segment 5 - 27,000

FDOT recommends the use of the average value 24,000 for comparison to the tables to determine the LOS.

The use of the average volume works reasonably well, unless there is one segment that has a widely disparate value, in which case a median value may be more appropriate.

### 11.2.1. Mid-Block Considerations

In general, Q/LOS analyses for interrupted flow facilities primarily focus on signalized intersections. The majority of motorist aggravation is generally attributable to delay, which primarily occurs at signalized intersections on arterials. Therefore, when using the Generalized Service Volume Tables, the number of lanes for arterials and other interrupted flow facilities should be determined at major intersections rather than mid-block.

Travelers place a greater emphasis on mid-block considerations while traveling on uninterrupted flow facilities and non-automobile modes. **For example, on two-lane highways in rural undeveloped areas, the LOS is largely determined by the ability to pass other vehicles.** For freeways, most travelers are concerned about the operation of the whole facility and not the operation of particular interchanges. For bicycle and pedestrian movements, the BLOS and PLOS models are calibrated for mid-block conditions. For bus LOS, the emphasis is on the ability to travel by bus over the length of facility, with less importance placed on individual intersections. Therefore, in general, the number of lanes for these situations reflect mid-block considerations.

## 11.2.2. Non-State Signalized Roadways Adjustment

The primary purpose of this Q/LOS Handbook is to compute the LOS for state facilities. However, the Generalized Service Volume Tables are structured and are reasonably well-suited to local governments that desire to use them to evaluate roads under local jurisdiction. A feature of the urbanized and transitioning/urban Generalized Service Volume Tables is that Non-State roadways are addressed. The only types of roadways not addressed in the tables are unsignalized local streets and unpaved roads.

The mere fact that roadways are operated and maintained by different governmental entities has no effect on the capacity or LOS of the roadways. **However, in general, Non-State roadways have lower capacities and service volumes than state facilities, because they have lower green times at signalized intersections.** The Generalized Service Volume Tables contain a 10 percent adjustment factor for Non-State roadways.

The HCM LOS criteria address arterials rather than collectors or local streets. FDOT considers it appropriate for local governments to decide how to analyze collectors.

Uninterrupted flow facilities are analyzed the same, regardless of whether they are state facilities or not.

## 11.2.3. Variations in Levels of Service

Higher Q/LOS for the automobile, bicycle, and pedestrian modes may not be achieved, even with extremely low traffic volumes, given the default values used in the Generalized Service Volume Tables. In the case of automobiles, the higher Q/LOS cannot be achieved primarily because the control characteristics simply will not allow vehicles to attain relatively high average travel speeds. In the case of bicycles and pedestrians, it is primarily caused by the lack of facilities serving those modes. The tables have adequate footnotes to reflect this unachievable concept.

Lower Q/LOS for the automobile, bicycle, and pedestrian modes may not be applicable, even with extremely high traffic volumes, given the default values used in the Generalized Service Volume Tables. In the case of automobiles, the lower Q/LOS are not applicable, primarily because the control characteristics do not allow enough vehicles to pass through an intersection in an hour. If vehicles could get through the intersection, they could obtain the applicable LOS speed threshold, but there is not enough capacity at the intersection to let them pass through.

In the case of bicycles and pedestrians, it is primarily caused by the existence of facilities adequately serving those modes. For example, if a sidewalk exists, it is very difficult to establish a set of conditions in which the LOS to the pedestrian is F.

Essentially, once the maximum service volume is reached, the next LOS grade is F. For example, in Service Volume Table 1 for multilane Class I arterials, if demand volumes are greater than the LOS D threshold, then the LOS is F, and if the volume is at the LOS D threshold, the LOS is D; essentially, LOS E does not exist.

## 11.2.4. Median and Turn Lane Adjustment (Divided/Undivided Roadways)

For simplicity, the Generalized Service Volume Tables have factors to adjust for the effects of mid-block medians and exclusive turn lanes at intersections. The cumulative effects of medians and exclusive turn lanes from common occurrences are shown in the Generalized Service Volume Tables.

**A median has the effect of changing the adjusted saturation flow rate or service volume by 5 percent.** In Florida, most two-lane roadways do not have a median (e.g., a two-way left turn lane), so the tables assume no median for those facilities. However, if there is a median, appropriate service volumes should be increased 5 percent. Most multilane arterials and highways in Florida have medians, so the tables are set up to assume medians for those facilities. However, if there is no median, appropriate service volumes should be decreased 5 percent.

Most major roadways in Florida have exclusive left-turn lanes at intersections, except those with very low volumes. **If a roadway does not have left-turn lanes at major intersections, its service volume drops 20 to 25 percent, depending on the number of lanes, as indicated in the table.** The common design practice in Florida is to use shared through/right-turn lanes to accommodate right-turning vehicles. However, exclusive right-turn lanes have large capacity and service volume impacts for vehicles at major intersections.

## 11.2.5. One-Way Facility Adjustments

For simplicity, the urbanized and transitioning/urban area Generalized Service Volume Tables have an intuitive factor for the effects of one-way streets on vehicles. **Essentially, one-way pairs are assumed to have a 20 percent higher service volumes than corresponding two-way roadways with the same number of lanes.**

However, the Generalized Service Volume Tables treat each facility of a one-way pair separately. To account for that, the volumes in the daily and hourly two-way Tables 1 through 6 should be multiplied by 0.6, while the volumes in the hourly directional Tables 7 through 9 should be multiplied by 1.2, to obtain the correct volume and LOS.

For example, the AADT LOS D threshold for a 2-lane Class I arterial one-way facility in a transitioning area would be 9,720. This example is calculated using the Generalized Service Volume Table 2. The AADT LOS D threshold for a 2-lane Class I arterial in a transitioning area is 16,200. To calculate the LOS D threshold for a one-way facility, multiply 16,200 by the one-way facility adjustment, 0.6, to calculate the one-way facility LOS D threshold of 9,720.

## 11.2.6. Auxiliary Lane Adjustment

Freeway auxiliary lanes (lanes connecting on- and off-ramps) usually have significant capacity and LOS benefits. The values contained in the tables indicate their importance in a general way. To apply the values, simply add the volume shown in the freeway adjustment to the maximum service volume shown in the table.

## 11.2.7. Ramp Metering Adjustment

Freeway ramp metering has the benefit of smoothing out traffic demand entering a freeway during peak travel times. This benefit is reflected by increasing the service volumes shown on the tables by 5 percent.

## 11.2.8. Bicycle LOS (BLOS)

The bicycle portions of the Generalized Service Volume Tables make primary use of the two most important factors in determining the LOS for bicyclists: the existence of paved shoulders/bicycle lanes and vehicle volumes. **It is important to note that the volumes shown in the tables are not the number of bicyclists; rather, they are the number of vehicles in the outside lane.** Unlike automobile LOS, which is highly dependent on the number of other vehicles on the roadway, **BLOS is not determined by how many other bicyclists are on road; rather, it is primarily determined by the bicycle accommodations on the roadway and volume of vehicles.**

The other factor used in the Generalized Service Volume Tables is the volume of vehicles in the outside lane. For analysis purposes, vehicle volumes are assumed to be equally spread across the number of directional roadway lanes. Unlike the automobile entries in the table, in which the number of lanes is an entry into the tables, a step of multiplying the volume by the number of lanes is needed to use the volume (hourly directional, hourly two-way, or daily) of vehicles. For example, in Table 7, the LOS C threshold for zero percent bicycle lane coverage is 150 vehicles for the outside lane. If the roadway has four lanes, then the 150 vehicles would be multiplied by 2 (number of directional lanes) to determine the maximum volume of vehicles for BLOS C in one direction of flow. The additional step was included to simplify the appearance of the tables and save space.

## 11.2.9. Pedestrian LOS (PLOS)

**The pedestrian portions of the Generalized Service Volume Tables make primary use of the two most important factors in determining the LOS for pedestrians: the existence of a sidewalk and vehicle volumes. It is important to note that the volumes shown in the tables are not the number of pedestrians; rather, they are the number of vehicles in the outside lane.** Unlike automobile LOS, which is highly dependent on the number of other vehicles on the roadway, PLOS is not determined by how many other pedestrians use the facility; rather, it is primarily determined by the presence of sidewalks and the volume of vehicles.

The other factor used in these tables is the volume of vehicles in the outside lane. For analysis purposes, vehicle volumes are assumed to be equally spread across the number of directional roadway lanes. Unlike the automobile entries in the table, in which the number of lanes is an entry into the tables, a step of multiplying the vehicle volume by the number of lanes is needed to use the volume (hourly directional, hourly nondirectional, or daily) of vehicles. For example, in Table 7, the LOS C threshold for 100 percent sidewalk coverage is 540 vehicles for the outside lane. If the roadway has four lanes, then the 540 vehicles would be multiplied by 2 (number of directional lanes) to determine the maximum volume of vehicles for PLOS C in one direction of flow. The additional step was included to simplify the appearance of the tables and save space.

All techniques in this Q/LOS Handbook are based on a directional analysis. For example, in the case of evaluating the automobile LOS on arterials, the LOS is for the peak directional flow, and the LOS for the off-peak direction could be higher, lower, or the same. This directional technique results in some unique perspectives when evaluating PLOS. Sidewalks, whether on one or both sides of a road, serve pedestrians in both directions, unlike facilities for the other modes. Furthermore, analysts should be especially careful when using the Generalized Service Volume Tables for determining PLOS when there is a sidewalk only on one side of the roadway. Because all the Generalized Service Volume Tables are based on peak hour directional analyses, PLOS based on the tables should be considered applicable only to the direction of the peak flow of traffic. When using the tables, there is typically a difference of two LOS grades if the sidewalk is, or is not, on the same side of roadway as the peak flow of traffic. Generally, having sidewalks on both sides of arterials in developed areas is considered desirable; yet, the Generalized Service Volume Tables do not adequately reflect that concept.

## 11.2.10. Bus LOS

**The bus portions of the Generalized Service Volume Tables are primarily dependent on bus frequency,**

**which is the number of scheduled fixed-route buses that have a potential to stop in a given segment in the peak direction of flow in a one-hour time period.** That measure is supplemented by pedestrian accessibility. In the Generalized Service Volume Tables, pedestrian accessibility is represented by two broad ranges of sidewalk coverage.

There are two unique aspects of bus mode entries of the Generalized Service Volume Tables. First, it is important to note that the volumes shown in the tables are the number of buses per hour. Unlike automobile, bicycle, and PLOS thresholds, the bus mode LOS thresholds are not related to the number of vehicles on the roadway. Second, regardless of the table used, all numbers are shown in terms of buses per hour for the peak hour in the peak direction. Thus, even in the daily urbanized table (Table 1), the threshold values shown are still in terms of peak hour directional buses.

## 11.3. Service Volume Calculation Process

**All service volumes and resulting tables are first calculated for the peak hour in the peak direction.** The peak hour two-way values are obtained by dividing the peak hour peak direction service volumes by D. The daily volumes are obtained by dividing the peak hour two-way service volumes by K.

Peak hour directional and peak hour two-way service volumes are rounded to the nearest 10 vehicles. Daily service volumes are rounded to the nearest 100 vehicles.

### 11.3.1. Arterial LOS

For the automobile mode, arterial analyses starts with a volume of 10 vph and then calculates the v/c ratio at each intersection. Then, the speed on each segment is calculated, which also accounts for the signal delay and the overall average speed for the facility. The average speed is checked against the average speed criterion for LOS A. If the speed is below the LOS A threshold, the volume is incremented by either 50 vph (if the difference in the actual speed and LOS threshold speed is large) or 10 vph (if the difference in actual speed and LOS threshold speed is small). This process is repeated until the average facility speed is approximately equal to the LOS A threshold. The volume level at which this occurs is the service volume for LOS A. The volume (i.e., LOS A service volume) is then incremented by 10 vph and incrementally increased until the average facility speed is approximately equal to the LOS B threshold speed. This process repeats for LOS C, D, and E. If at any point during this process the v/c ratio exceeds 1.0 for the full hour, the calculation is stopped. If that condition is met, this volume becomes the service volume for whichever LOS letter grade was being evaluated at the time, as well as for the lower Q/LOS grades.

For the bicycle and pedestrian modes, again the analyses is started with a volume of 10 vph and then BLOS and PLOS scores are calculated based on the BLOS and PLOS models. Then, that score is checked against the LOS A criterion. If the score is below the LOS A threshold value, the volume is incremented by 10 vph. This process is repeated until the facility score is approximately equal to the LOS A threshold. The volume level at which this occurs is then the service volume for LOS A. The volume (i.e., LOS A service volume) is then incremented by 10 vph and incrementally increased until the average facility score is approximately equal to the LOS B threshold volume. This process repeats for LOS C, D, and E. If at any point during this process the vehicle v/c ratio exceeds 1.0 for the full hour, the calculation is stopped. If that condition is met, this volume becomes the service volume for whichever LOS letter grade was being evaluated at the time as well as for the lower Q/LOS grades.

For the bus mode, the LOS service frequency criteria that appear in the TCQSM is used, modified by PLOS, relative auto speed, bus stop amenities, and passenger load factors.

### 11.3.2. Freeway Facilities LOS

For freeways, the HCS7 freeway facilities module was used to obtain the service volume thresholds. The automobile volume is incrementally increased until the demand flow rate to the mean speed of the traffic stream produces an average facility density that is approximately equal to the LOS A threshold. The volume level at which this occurs is the service volume for LOS A. The volume (i.e., LOS A service volume) is then incrementally increased by 10 vph and until the average facility density is approximately equal to the LOS B threshold speed. This process repeats for LOS C, D, and E. If at any point during this process the v/c ratio exceeds 1.0 for the full hour, the calculation stops. If that condition is met, this volume becomes the service volume for whichever LOS letter grade was being evaluated at the time, as well as for the lower Q/LOS grades. The traffic factors and other inputs such as CAF and SAF used in the analyses are discussed in the previous sections of this handbook and listed at the back of the Generalized Service Volume Tables.

### 11.3.3. Highways LOS

For multilane uninterrupted flow highways, HCS7's multilane highways procedure starts with a volume of 10 vph and then calculates density. If the density is below the LOS A threshold density, the volume is incremented by 10 vph. This process is repeated until the average density is approximately equal to the LOS A threshold. The volume level at which this occurs is then the service volume for LOS A. The volume (i.e., LOS A service volume) is then increased by 10 vph until the average facility density is approximately equal to the LOS B threshold density. This process repeats for LOS C, D, and E. If at any point during this process the v/c ratio exceeds 1.0 for the full hour, the calculation stops. If that condition is met, this volume becomes the service volume for whichever LOS letter grade was being evaluated at the time, as well as for the lower Q/LOS grades. The traffic factors and other inputs such as CAF and SAF used in the analyses are discussed in the previous sections of this handbook and listed at the back of the Generalized Service Volume Tables. A different free flow speed is used in the analyses for multilane uninterrupted flow highways passing through undeveloped areas and developed areas.

For two-lane uninterrupted flow highways, the computational process is similar to the process followed for multilane uninterrupted flow highways. The HCS7's two-lane highways module is dependent on the highway class (I, II, or III). The traffic factors and other inputs used in the analyses are discussed in the previous sections of this handbook and listed at the back of the Generalized Service Volume Tables. A different free flow speed is used in the analyses for two-lane uninterrupted flow highways passing through undeveloped areas and developed areas.

# Glossary

| | |
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| **Acceleration lane** | A freeway lane extending from the on-ramp gore to where its taper ends. |
| **Accessibility** | The dimension of mobility that addresses the ease in which travelers can engage in desired activities. |
| **Actuated control** | All approaches to the signalized intersection have vehicle detectors, with each phase subject to a minimum and maximum green time, and some phases may be skipped if no vehicle is detected. Same as *actuated* and *fully actuated control*. |
| **Actuated-Coordinated control** | The fixed-cycle signal control of an intersection in which the through movement on the designated main roadway gets the unused green time from side movements because of limited or no vehicle activation from side movements. Same as *coordinated-actuated*. |
| **Add-on/drop-off lanes** | The roadway lanes added before an intersection and dropped after the intersection. Same as *expanded intersections*. |
| **Adjusted saturation flow rate** | In this Q/LOS Handbook, the base saturation flow rate times the effect of many roadway variables and traffic variables. |
| **Adjustment factor** | In the Generalized Service Volume Tables: additive or multiplicative factors to adjust service volumes. |
| **All-way stop control** | An intersection with a stop sign at all approaches. |
| **Annual average daily traffic** | The volume passing a point or segment of a roadway in both directions for one year, divided by the number of days in the year. |
| **Areawide analysis** | An evaluation within a geographic boundary. |
| **Arrival type** | A general categorization of the quality of signal progression. |
| **Arterial** | A signalized roadway that primarily serves through traffic with average signalized intersection spacing of 2 miles or less; a type of roadway based on FDOT's functional classification. |
| **Auxiliary lane** | An additional lane on a freeway connecting an on-ramp of one interchange to the off-ramp of the downstream interchange. |
| **Average daily traffic** | The total traffic volume during a given time period (more than a day and less than a year) divided by the number of days in that time period. |
| **Average travel speed** | The facility length divided by the average travel time of all vehicles traversing the facility, including all stopped delay times. |
| **Axle correction factors** | The adjustment factors used to calculate the annual average daily traffic by compensating for an axle counter's tendency to count more vehicles than are present. |
| **Base conditions** | The best possible characteristic in terms of capacity for a given type of facility. |

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| **Base saturation flow rate** | The maximum steady flow rate, expressed in passenger cars per hour per lane, at which passenger cars can cross a point on interrupted flow roadways. |
| **Basic segment** | In this Q/LOS Handbook, the length of a freeway in which operations are unaffected by interchanges. Same as *basic freeway segment*. |
| **Basic two-lane highway Segments** | A highway segment upstream of the intersection influence area and downstream of the affected downstream highway segment, and thus not affected by signalized intersections. |
| **Bicycle lane** | In this Q/LOS Handbook, a designated or undesignated portion of roadway for bicycles adjacent to vehicle lanes. |
| **Bicycle level of service score** | A numerical value calculated by the BLOS Model that corresponds to a BLOS. |
| **Bus frequency** | The number of buses per hour serving one direction of a roadway facility. |
| **Bus stop** | An area where bus passengers wait for, board, alight, and transfer. |
| **Bus stop amenities** | Enhancements for comfort or safety that can greatly influence the perceived QOS along a route. Four categories of bus stop amenities exist: excellent, good, fair, and poor. |
| **Bus stop amenity factors** | Factors used to determine the adjusted bus frequency value by applying a factor commensurate to the quality of bus stop amenities. |
| **Bus stop type adjustment factors** | Factors that adjust travel times along bus routes by adding 15 to 35 seconds of delay per route for typical and major bus stops, respectively. |
| **Capacity** | The maximum sustainable flow rate at which persons or vehicles reasonably can be expected to traverse a point or a uniform section of roadway during a given time period under prevailing conditions. As typically used in this Q/LOS Handbook, the maximum number of vehicles that can pass a point in one hour under prevailing roadway, traffic and control conditions. |
| **Capacity adjustment factor** | An adjustment factor used in the HCS7 freeways and multilane highways module to adjust the capacity of a facility for reduced capacity situations or to match field measurements. The capacity can be reduced to represent incident situations, such as construction and maintenance activities, adverse weather, traffic incidents, and vehicle breakdowns. |
| **Capacity constrained** | A condition in which traffic *demand* exceeds the capacity of a roadway. |
| **Capacity utilization** | The dimension of mobility that addresses the quantity of operations relative to capacity. |
| **Captive rider** | A transit rider who is limited by circumstances to use transit as a primary source of transportation. |
| **Choice rider** | A transit rider who chooses to take transit over other readily available transportation options. |
| **Class I arterial** | A roadway that has posted speeds of 40 mph or higher. |

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| **Class II arterial** | A roadway that has posted speeds of 35 mph or less. |
| **Collector** | A roadway providing land access and traffic circulation with residential, commercial and industrial areas. |
| **Concurrency** | A systematic process utilized by local governments to ensure new development does not occur unless adequate infrastructure is in place to support growth. |
| **Context classification** | A classification assigned to a roadway that broadly identifies the various built environments in Florida, based on existing or future land use characteristics, development patterns, and the roadway connectivity of an area. |
| **Control delay** | The component of delay that results when a signal causes traffic to reduce speed or stop. |
| **Control variables** | The parameters associated with roadway controls. |
| **Core freeways** | The major, non-toll freeways going through the urbanized core areas of the largest metropolitan areas, such as Interstate 4 in Orlando. FDOT has adopted lower K values for these freeways to represent a peak period, as opposed to a peak hour analysis. The lower K values affect daily service volumes only in the Generalized Service Volume Tables. |
| **Critical signalized intersection** | The signalized intersection with the lowest volume-to-capacity ratio (v/c), typically the one with the lowest effective green ratio (g/C) for the through movement. Same as *critical signalized intersection*. |
| **Cycle length** | The time it takes a traffic signal to go through one complete sequence of signal indications. |
| **Deceleration lane** | A freeway lane extending from the taper to the off-ramp gore. |
| **Delay** | The additional travel time experienced by a traveler. |
| **Demand** | The number of persons or vehicles desiring service on a roadway. Same as *demand traffic*. |
| **Density** | The number of vehicles, averaged over time, occupying a given length of lane or roadway; usually expressed as vehicles per mile or vehicles per mile per lane. |
| **Developed areas** | All areas not rural undeveloped. Same as rural developed areas. |
| **Directional distribution factor** | The proportion of an hour's total volume occurring in the higher volume direction. |
| **Effective green ratio** | Typically in this Q/LOS Handbook, the ratio of the effective green time (g) for the through movement at a signal intersection to its cycle length (C). |
| **Effective green time** | The time allocated for the through movement to proceed; calculated as the through movement green plus yellow plus all-red indication times less the lost time. |
| **Exclusive left-turn storage length** | The total amount of storage length, in feet, for exclusive left-turn lanes. |
| **Exclusive right-turn lanes** | A storage area designated to only accommodate right-turning vehicles. |

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| **Exclusive turn lane** | A storage area designated to only accommodate left- or right-turning vehicles; in this Q/LOS Handbook, the turn lane must be long enough to accommodate enough turning vehicles to allow the free flow of the through movement. |
| **Five-lane section** | A roadway with four through lanes, two in each direction, separated by a two-way left turn lane; in the Generalized Service Volume Tables, a five-lane section is treated as a roadway with four lanes and a median. |
| **Flow rate** | In this Q/LOS Handbook, the equivalent hourly rate at which vehicles pass a point on a roadway for a 15-minute period. |
| **Free flow speed** | In this Q/LOS Handbook, the average speed of vehicles under low-flow traffic conditions and not under the influence of signals, stop signs, or other fixed causes of interruption, generally assumed to be 5 mph over the posted speed limit. |
| **Freeway** | A multilane, divided highway with at least two lanes for the exclusive use of traffic in each direction and full control of ingress and egress. |
| **Freeway segment** | In this Q/LOS Handbook, a basic segment, interchange or toll plaza. |
| **FSUTMS** | Florida Standard Urban Transportation Model Structure; Florida's software that forecasts travel demand. |
| **Functional classification** | The assignment of roads into systems according to the character of service they provide in relation to the total road network. |
| **Generalized Service Volume Tables** | Maximum service volumes based on areawide roadway, traffic, and control variables and presented in tabular form. |
| **Generalized planning** | A broad type of planning application that includes statewide analyses, initial problem identification, and future year analyses. In this Q/LOS Handbook, typically performed by using the Generalized Service Volume Tables. |
| **Gore** | The point located immediately between the left edge of a ramp pavement and the right edge of the roadway pavement at a merge or diverge area. |
| **Headway** | The time, in seconds, between two successive vehicles as they pass a point on a roadway. |
| **Heavy vehicle** | An FHWA vehicle classification of 4 or higher; essentially, vehicles with more than 4 wheels touching the pavement during normal operation. |
| **Heavy vehicle factor** | The adjustment factor for heavy vehicles. |
| **Heavy vehicle percent** | The percentage of heavy vehicles in the traffic stream. |
| **Highway capacity analysis** | An examination of the maximum of vehicles or persons that can reasonably be expected to pass a point on a roadway during a specified time period under prevailing roadway, traffic, and control conditions. Same as *capacity analysis*. |
| **Highway Capacity Manual** | The Transportation Research Board's document on highway capacity and QOS. |
| **Highway Capacity Software 7** | Software that replicates the HCM, Sixth Edition. |

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| **Interchange** | In this Q/LOS Handbook, the influence area associated with the off-ramp influence area, overpass/underpass, and on-ramp influence area of a connection to a freeway. Same as *freeway interchange influence area*. |
| **Interrupted flow** | A category of roadways characterized by signals, stop signs, or other fixed causes of periodic delay or interruption to the traffic stream, with average spacing less than or equal to 2.0 miles. |
| **Intersection influence area** | In this Q/LOS Handbook, a segment of an uninterrupted flow highway influenced by an isolated intersection. |
| **Interval** | A period of time in which all traffic signal indications remain constant. |
| **Isolated intersection** | An intersection occurring along an uninterrupted flow highway. |
| **Large urbanized area** | A Metropolitan Planning Organization urbanized area greater than 1 million in population; in Florida, these seven areas consist of the following central cities: Fort Lauderdale, Jacksonville, Miami, Orlando, St. Petersburg, Tampa, and West Palm Beach. |
| **Lateral clearance** | Clearance distance from edges of outside lanes to fixed obstructions. |
| **Level of service** | A quantitative stratification of the QOS to a typical traveler of a service or facility into six letter-grade levels, with A describing the highest quality and F describing the lowest quality; a discrete stratification of a QOS continuum. |
| **Level of service targets** | The same as the statewide minimum LOS targets for the State Highway System. |
| **Load factor** | The ratio of passengers actually carried to the total passenger capacity of a bus. |
| **Local adjustment factor** | In the 2013 Q/LOS Handbook, an adjustment factor FDOT used to adjust base saturation flow rates or base capacities to better match actual Florida traffic volumes; mostly consisted of a driver population factor and an area type factor. |
| **Maximum service volume** | The highest number of vehicles for a given LOS. |
| **Median** | In this Q/LOS Handbook, areas at least 10 feet wide that are restrictive or non-restrictive, which separate opposing-direction mid-block traffic lanes and, on arterials, contain turn lanes that allow left-turning vehicles to exit from the through traffic lanes. |
| **Median type** | A classification of roadway medians as restrictive, non-restrictive, or no median. |
| **Mid-block** | In this Q/LOS Handbook, the part of a roadway between two signalized intersections. |
| **Mobility** | The movement of people and goods. |
| **Mode** | A method of travel; in this Q/LOS Handbook, either automobile, bus, bicycle, or pedestrian. |
| **Motorized mode** | A method of travel by automobile or bus. |

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| **MPO/TPO** | Metropolitan/Transportation Planning Organization. |
| **Multilane highway** | A nonfreeway roadway with two or more lanes in each direction and, although occasional interruptions to flow at signalized intersections may exist, is generally uninterrupted flow. |
| **Multimodal** | In this Q/LOS Handbook, more than one mode. |
| **Multimodal Transportation District** | An area in which secondary priority is given to vehicle mobility, and primary priority is given to ensuring a safe, comfortable, and attractive pedestrian environment, with convenient interconnection to transit (F.S. 163.3180[15]). |
| **No passing zone** | In this Q/LOS Handbook, a segment of a two-lane highway along which passing is prohibited in the analysis direction. |
| **Non-restrictive median** | A painted, at-grade area separating opposing mid-block traffic lanes. |
| **Non-State signalized roadway** | A signalized roadway not on the State Highway System. |
| **Number of effective lanes** | In terms of capacity, the equivalent number of through lanes. Typically, the number is expressed as a fraction (e.g., 2.7) to reflect the partial beneficial effects of freeway auxiliary lanes or arterial add-on/drop-off lanes. |
| **Number of through lanes** | The number of lanes relevant to an analysis of a roadway's LOS.<br>FOR ARTERIALS<br>▪ Usually at the signalized intersection, not mid-block<br>▪ Usually through and shared right-turn lanes<br>▪ Maybe a fractional number reflecting add-on/drop-off lanes or other special lane utilization considerations<br>▪ Using the Generalized Service Volume Tables, the number at major signalized intersections<br>FOR FREEWAYS AND UNINTERRUPTED FLOW HIGHWAYS<br>▪ Does not include auxiliary lanes between two points<br>▪ Usually the predominant number of through lanes between two points |
| **Off-ramp influence area** | The geographic limits affecting the capacity of a freeway associated with traffic exiting a freeway. Same as *diverge area*. |
| **On-ramp influence area** | The geographic limits affecting the capacity of a freeway associated with traffic entering a freeway. Same as *merge area*. |
| **One-way** | A type of roadway in which vehicles are allowed to move in only one direction. |
| **Operational analysis** | A detailed analysis of a roadway's present or future LOS, as opposed to a generalized planning. |
| **Other urbanized area** | A Metropolitan Planning Organization urbanized area with less than 1 million in population. |
| **Oversaturated** | A traffic condition in which demand exceeds capacity. |
| **Passenger load factors** | Factors used to determine the adjusted bus frequency value by applying a factor commensurate to the level of passenger crowding. |

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| **Passing lane** | A lane added to provide passing opportunities in one direction of travel on a two-lane highway. Two-way left-turn lanes are not considered passing lanes. |
| **Paved shoulder/bicycle lane** | In this Q/LOS Handbook, pavement at least 3 feet in width separated by a solid pavement marking from the outside vehicle through lane to the edge of the pavement. |
| **Peak direction** | The course of the higher flow of traffic. |
| **Peak hour** | In this Q/LOS Handbook, a one-hour time period with high volume. |
| **Peak hour factor** | The ratio of the hourly volume to the peak 15-minute flow rate for that hour; specifically, hourly volume/(4 x peak 15-minute volume). |
| **Peak period** | A multi-hour analysis period with high volume; peak periods rather than peak hours are typically used for the analysis of core freeways or roadways within a Multimodal Transportation District. |
| **Peak season** | The 13 consecutive weeks with the highest daily volumes for an area. |
| **Peak season weekday average daily traffic** | The average daily traffic for Monday through Friday during the peak season. |
| **Pedestrian** | An individual traveling on foot and other non-motorized modes such as skateboards, scooters and both motorized and non-motorized wheelchairs. |
| **Pedestrian accessibility** | In this Q/LOS Handbook, the ease in which a pedestrian can reach a bus stop. |
| **Pedestrian LOS Model** | The operational methodology from which this Q/LOS Handbook's pedestrian Q/LOS analyses are based. |
| **Pedestrian level of service score** | A numerical value calculated by the PLOS Model that corresponds to a PLOS. |
| **Pedestrian/sidewalk/roadway separation** | The lateral distance, in feet, from the outer edge of the pavement to where a pedestrian walks on a sidewalk. |
| **Percent time spent following** | The average percent of total travel time that vehicles must travel in platoons behind slower vehicles because of the inability to pass on a two-lane highway. |
| **Performance measure** | A qualitative or quantitative factor used to evaluate a particular aspect of travel quality. |
| **Person flow** | The capacity on uninterrupted and interrupted flow facilities, defined in terms of persons per hour. |
| **Phase** | The part of a traffic signal's cycle allocated to any combination of traffic movements receiving the right of way simultaneously during one or more intervals. |
| **Planning analysis hour factor** | The ratio of the traffic volume in the study hour to the annual average daily traffic. |
| **Planning horizon** | A time period, typically 20 years, applicable to the analysis of a project, roadway or service. |
| **Platoon** | A group of vehicles traveling together as a group, either voluntarily or |

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| | involuntarily because of signal control, geometrics, or other factors. |
| **Point** | A boundary between links. In this Q/LOS Handbook, usually a signalized intersection, but maybe other places where modal users enter, leave, or cross a facility, or roadway characteristics change. |
| **Posted speed** | The maximum speed at which vehicles are legally allowed to travel over a roadway segment. |
| **Pretimed control** | Traffic signal control in which the cycle length, phase plan, and phase times are preset and repeated continuously, according to a preset plan. |
| **Prevailing conditions** | Existing circumstances that primarily include roadway, traffic, and control conditions, but may also include weather, construction, incidents, lighting, and area type. |
| **Principal arterial** | A signalized roadway that primarily serves through traffic between centers of metropolitan areas and provides a high degree of mobility. In this Q/LOS Handbook, principal arterials have approximately one signal every half mile and a posted speed limit of 50 mph. |
| **Quality of service** | A traveler-based perception of how well a service or facility is operating. |
| **Quality/level of service** | A combination of the broad QOS and more detailed LOS concepts. |
| **Queue spillback** | When a link's queue of vehicles extends to upstream links. |
| **Ramp overlap segment** | The length for which the upstream on-ramp influence area and the downstream off-ramp influence area overlap. |
| **Restrictive median** | A raised or grassed area that restricts crossing movements. |
| **Roadway** | A general categorization of an open way for persons and vehicles to traverse; in this Q/LOS Handbook, it encompasses streets, arterials, freeways, highways, and other facilities. |
| **Roadway class** | The categories of two-lane highways; two-lane highways are primarily grouped by area type. Same as *class*. |
| **Roadway variables** | The parameters associated with roadways. Also known as *roadway characteristics*. |
| **Rolling terrain** | A combination of horizontal and vertical alignments causing heavy vehicles to reduce their running speeds substantially below that of passenger cars, but not to operate at crawl speeds for a significant amount of time. |
| **Route** | As used in the TCQSM, a designated, specified path to which a bus is assigned. |
| **Route segment** | As used in the TCQSM, a portion of a bus route ranging from two stops to the entire length of the route. |
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| **Running speed** | The distance a vehicle travels divided by the travel time the vehicle is in motion. |
| **Rural area** | In the Generalized Service Volume Tables, areas that are not |

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| | urbanized areas, transitioning areas, or urban areas. |
| **Rural developed areas** | The portions of rural areas that are along coastal roadways or in generally populated areas with a population of less than 5,000. |
| **Rural undeveloped areas** | Portions of rural areas with no or minimal population or development. |
| **Scheduled fixed route** | In this Q/LOS Handbook, bus service provided on a repetitive, fixed-schedule basis along a specific route, with buses stopping to pick up and deliver passengers to specific locations. |
| **Seasonal adjustment factor** | A factor used to adjust for the variation in traffic over the course of a year. |
| **Section** | A group of consecutive segments that have similar roadway characteristics, traffic characteristics and, as appropriate, control characteristics for a mode of travel. A characteristic describing laneage (e.g., three-lane section, five-lane section, seven-lane section). |
| **Segment** | A portion of a facility defined by two boundary points; usually the length of roadway from one signalized intersection to the next signalized intersection. |
| **Service measure** | A specific performance measure used to assign a LOS to a set of operating conditions for a transportation facility or service. |
| **Service volume table** | Maximum service volumes based on roadway, traffic and control variables and presented in tabular form. |
| **Seven-lane section** | A roadway with six through lanes, three in each direction separated by a two-way left-turn lane; in the Generalized Service Volume Tables, a seven-lane section is treated as a roadway with six lanes and a median. |
| **Shared lane** | A roadway lane shared by two or three traffic movements; in Florida, a shared lane usually serves through and right-turning traffic movements. |
| **Sidewalk** | A paved walkway for pedestrians at the side of a roadway. |
| **Sidewalk/roadway protective barrier** | Physical barriers separating pedestrians on sidewalks and vehicles. |
| **Sidewalk/roadway separation** | The lateral distance in feet from the outside edge of the pavement to the inside edge of the sidewalk. |
| **Signal** | In this Q/LOS Handbook, a traffic control device regulating the flow of traffic with green, yellow, and red indications. A traffic control device that routinely stops vehicles during the study period; excluded from this definition are flashing yellow lights, railroad crossings, draw bridges, yield signs, and other control devices. |
| **Signal density** | The number of signals intersections per mile. |
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| **Signal type** | The kind of traffic signal (actuated, pretimed or coordinated-actuated) with respect to the way its cycle length, phase plan, and phase times are operated. |

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| **Signalized intersection** | A place where two roadways cross and have a signal controlling traffic movements. |
| **Signalized intersection spacing** | The distance between signalized intersections. |
| **Simple average** | An average that gives equal weight to each component. |
| **Speed** | In this Q/LOS Handbook, the same as average travel speed, unless specifically noted. |
| **Speed adjustment factor** | An adjustment factor in HCS 7's freeways and multilane highways module, used to adjust the speed of a facility to account for the effects of adverse weather and construction work zones. The SAF also may be used to calibrate estimates of free-flow speed for local conditions or other effects that contribute to a reduction in free-flow speed. |
| **Standard K** | FDOT's standard peak hour to annual average daily traffic ratio (K), based on a roadway's characteristics (facility type) and location (area type). Values of less than 9 percent essentially represent a multi-hour peak period rather than a peak hour. |
| **State Highway System** | All roadways that FDOT operates and maintains; the State Highway System consists of the Florida Intrastate Highway System and other state roads. |
| **Stochastic** | A description of a type of model that incorporates variability and uncertainty into analysis. |
| **Strategic Intermodal System** | Florida's system of transportation facilities and services of statewide and interregional significance. |
| **Termini** | In this Q/LOS Handbook, the beginning and endpoints of a facility. |
| **Three-lane section** | A roadway with two through lanes separated by a two-way left-turn lane. In the Generalized Service Volume Tables, a three-lane section is treated as a roadway with two lanes and a median. An exclusive passing lane on a two-lane highway is not considered a three-lane section. |
| **Threshold** | The breakpoints between LOS differentiations. |
| **Threshold delay** | The additional travel time represented by the difference between the time associated with a roadway's generally accepted speed (LOS D threshold in urbanized areas and LOS C threshold in nonurbanized areas) and average travel speed. Same as LOS threshold delay. |
| **Through movement** | In this Q/LOS Handbook, the traffic stream with the greatest number of vehicles passing directly through a point. Typically, this is the straight-ahead movement, but occasionally it may be a turning movement. |
| **Traffic demand** | The number of vehicles with drivers who desire to traverse a particular highway during a specified time period. |
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| **Traffic volume** | The number of vehicles passing a point on a highway during a specified time period. |
| **Transit** | In this Q/LOS Handbook, the same as *bus*. |

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| **Transit Capacity and Quality of Service Manual (TCQSM)** | The document and operational methodology from which this Q/LOS Handbook's bus Q/LOS analyses are based. |
| **Transitioning area** | An area adjacent to an urbanized area that exhibits characteristics between rural and urbanized/urban, and will be urbanized in the next 20 years. |
| **Transportation planning boundaries** | Precisely defined lines that delineate geographic areas. These boundaries are used throughout transportation planning in Florida. Their mapping is described in Urban Boundaries and Functional Classification of Roadways FDOT's Procedure Topic No. 525-020-311. |
| **Travel time** | The average time spent by vehicles traversing a roadway. |
| **Two-lane highway** | A roadway with one lane in each direction on which passing maneuvers must be made in the opposing lane and, although occasional interruptions to flow at signalized intersections may exist, is generally uninterrupted flow. |
| **Two-way** | Movement allowed in either direction. |
| **Two-way left-turn lane** | A lane that simultaneously serves left-turning vehicles traveling in opposite directions. Same as continuous left-turn lane. |
| **Two-way stop control** | The type of traffic control at an intersection where drivers on the minor street, or a driver turning left from the major street, wait for a gap in major-street traffic to complete a maneuver. |
| **Undesignated bicycle lane** | A lane, usually 4 feet in width, that does not contain a bicycle logo. |
| **Undivided** | As used in the Generalized Service Volume Tables, a roadway with no median. |
| **Uninterrupted flow** | A category of roadway not characterized by signals, stop signs, or other fixed causes of periodic delay or interruption to traffic stream. |
| **Uninterrupted flow highway** | A nonfreeway roadway that generally has uninterrupted flow, with average signalized intersection spacing of greater than 2.0 miles; a two-lane highway or a multilane highway. |
| **Urban area** | A place with a population between 5,000 and 50,000 and not in an urbanized area. The applicable boundary includes the census' urban area and the surrounding geographical area agreed on by the FDOT, the local government, and the FHWA. The boundaries are commonly called FHWA Urban Area Boundaries and include areas expected to develop medium density before the next decennial census. |

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| **Urbanized area** | An area within a Metropolitan Planning Organization's (MPO) designated urbanized area boundary. The minimum population for an urbanized area is 50,000 people. Based on the census, any area the U.S. Bureau of Census designates as urbanized, together with any surrounding geographical area agreed on by the FDOT, the relevant MPO, and the FHWA, commonly called the FHWA Urbanized Area Boundary. |
| **Volume-to-capacity ratio** | The ratio of demand flow rate to capacity of a signalized intersection, segment or facility. |
| **Weaving distance** | A length of freeway over which traffic streams across paths through lane-changing maneuvers. Same as *weaving segment*. |
| **Weighted effective green ratio** | In this Q/LOS Handbook, the average of the critical intersection's through effective green ratio and the average of all the other signalized intersections' through effective green ratios along the arterial facility. |

TABLE 1 Generalized **Annual Average Daily** Volumes for Florida's Urbanized Areas

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 16,800 | 17,700 | ** |
| 4 | Divided | * | 37,900 | 39,800 | ** |
| 6 | Divided | * | 58,400 | 59,900 | ** |
| 8 | Divided | * | 78,800 | 80,100 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 7,300 | 14,800 | 15,600 |
| 4 | Divided | * | 14,500 | 32,400 | 33,800 |
| 6 | Divided | * | 23,300 | 50,000 | 50,900 |
| 8 | Divided | * | 32,000 | 67,300 | 68,100 |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 2,900 | 7,600 | 19,700 |
| 50-84% | 2,100 | 6,700 | 19,700 | >19,700 |
| 85-100% | 9,300 | 19,700 | >19,700 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 2,800 | 9,500 |
| 50-84% | * | 1,600 | 8,700 | 15,800 |
| 85-100% | 3,800 | 10,700 | 17,400 | >19,700 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

**Core Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 47,600 | 66,400 | 83,200 | 87,300 |
| 6 | 70,100 | 97,800 | 123,600 | 131,200 |
| 8 | 92,200 | 128,900 | 164,200 | 174,700 |
| 10 | 115,300 | 158,900 | 203,600 | 218,600 |
| 12 | 136,500 | 192,400 | 246,200 | 272,900 |

**Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 45,900 | 62,700 | 75,600 | 85,400 |
| 6 | 68,900 | 93,900 | 113,600 | 128,100 |
| 8 | 91,900 | 125,200 | 151,300 | 170,900 |
| 10 | 115,000 | 156,800 | 189,300 | 213,600 |

### Freeway Adjustments

| Auxiliary Lanes Present in Both Directions | Ramp Metering |
|---|---|
| + 20,000 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 11,700 | 18,000 | 24,200 | 32,600 |
| 4 | Divided | 36,300 | 52,600 | 66,200 | 75,300 |
| 6 | Divided | 54,600 | 78,800 | 99,400 | 113,100 |

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1] Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 1
(continued)

# Generalized **Annual Average Daily** Volumes for Florida's Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | State Arterials | | | | Class I | |
| | Freeways | Core Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | urban | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 4-12 | 2 | 4-6 | 2 | 4-8 | 2 | 4-8 | 4 | 4 |
| Posted speed (mph) | 70 | 65 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 70 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary Lanes (n,y) | n | n | | | | | | | | |
| Median (d, twlt, n, nr, r) | | | | d | n | r | n | r | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | | 80 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | n | n | n | n | n | n |
| Facility length (mi) | 3 | 3 | 5 | 5 | 2 | 2 | 1.9 | 1.8 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.090 | 0.085 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.560 | 0.565 | 0.560 | 0.565 | 0.565 |
| Peak hour factor (PHF) | 0.95 | 0.95 | 0.95 | 0.95 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 4.0 | 4.0 | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.5 | 2.0 |
| Speed Adjustment Factor (SAF) | 0.975 | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | 4 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | | 3 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | | 120 | 150 | 120 | 120 | 120 | 120 |
| Effective green ratio (g/C) | | | | | 0.44 | 0.45 | 0.44 | 0.44 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | | | |
| Sidewalk (n, y) | | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation(a, t, w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | Density | Two-Lane | Multilane | Class I | Class II | Score | Score | Buses/hr. |
| | | %ffs | Density | ats | ats | | | |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

# TABLE 2

## Generalized **Annual Average Daily** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 14,400 | 16,200 | ** |
| 4 | Divided | * | 34,000 | 35,500 | ** |
| 6 | Divided | * | 52,100 | 53,500 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 6,500 | 13,300 | 14,200 |
| 4 | Divided | * | 9,900 | 28,800 | 31,600 |
| 6 | Divided | * | 16,000 | 44,900 | 47,600 |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 2,600 | 6,100 | 19,500 |
| 50-84% | 1,900 | 5,500 | 18,400 | >19,500 |
| 85-100% | 7,500 | 19,500 | >19,500 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 2,800 | 9,400 |
| 50-84% | * | 1,600 | 8,600 | 15,600 |
| 85-100% | 3,800 | 10,500 | 17,100 | >19,500 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 45,100 | 59,000 | 70,300 | 72,600 |
| 6 | 65,300 | 86,600 | 104,100 | 108,900 |
| 8 | 85,900 | 114,500 | 138,100 | 145,300 |
| 10 | 101,600 | 135,600 | 161,900 | 181,800 |

### Freeway Adjustments

| Auxiliary Lanes Present in Both Directions | Ramp Metering |
|---|---|
| + 20,000 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 11,300 | 17,300 | 23,400 | 31,600 |
| 4 | Divided | 34,600 | 49,900 | 63,000 | 71,700 |
| 6 | Divided | 51,700 | 74,800 | 94,600 | 107,400 |

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable le for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 2
(continued)

## Generalized **Annual Average Daily** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | State Arterials | | | | Class I | |
| | Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | |
| Area type (urban, rural) | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 |
| Posted speed (mph) | 70 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | |
| Median (d, n, nr, r) | | | d | n | y | n | y | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 60 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | n | n | n | n | n | n |
| Facility length (mi) | 6 | 5 | 5 | 1.8 | 2 | 2 | 2 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | |
| Planning analysis hour factor (K) | 0.098 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.550 | 0.570 | 0.570 | 0.565 | 0.570 | 0.570 |
| Peak hour factor (PHF) | 0.92 | 0.92 | 0.92 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 9.0 | 4.0 | 4.0 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | |
| Number of signals | | | | 5 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | 4 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | 120 | 150 | 120 | 150 | 120 | 120 |
| Effective green ratio (g/C) | | | | 0.44 | 0.45 | 0.44 | 0.45 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | n | n |
| Sidewalk (n, y) | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation (a, t, w) | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | | Two-Lane | Multilane | Class I | Class II | | | |
| | Density | %ffs | Density | ats | ats | Score | Score | Buses/hr. |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

TABLE 3

# Generalized **Annual Average Daily** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 12,900 | 14,200 | ** |
| 4 | Divided | * | 29,300 | 30,400 | ** |
| 6 | Divided | * | 45,200 | 45,800 | ** |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

#### Rural Undeveloped

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 1,300 | 2,000 | 3,200 |
| 50-84% | 1,000 | 2,100 | 3,200 | 10,600 |
| 85-100% | 2,600 | 3,900 | 18,500 | >18,500 |

#### Developed Areas

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 2,300 | 4,900 | 15,600 |
| 50-84% | 1,700 | 4,500 | 13,300 | 18,500 |
| 85-100% | 5,900 | 18,500 | >18,500 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 2,700 | 9,200 |
| 50-84% | * | 1,500 | 8,400 | 14,900 |
| 85-100% | 3,600 | 10,200 | 16,700 | >19,200 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 34,800 | 48,000 | 56,700 | 63,200 |
| 6 | 48,900 | 69,000 | 82,600 | 94,800 |
| 8 | 62,900 | 90,400 | 108,400 | 126,400 |

### Freeway Adjustments

Auxiliary Lanes Present in Both Directions

+ 20,000

### UNINTERRUPTED FLOW HIGHWAYS

#### Rural Undeveloped

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 4,600 | 8,600 | 14,000 | 28,500 |
| 4 | Divided | 31,200 | 44,900 | 55,700 | 62,700 |
| 6 | Divided | 46,800 | 67,600 | 83,500 | 94,200 |

#### Developed Areas

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 10,300 | 15,700 | 21,300 | 28,500 |
| 4 | Divided | 29,300 | 42,300 | 54,000 | 61,600 |
| 6 | Divided | 44,000 | 63,600 | 81,200 | 92,400 |

### Passing Lane Adjustments

Alter LOS B-D volumes in proportion to the passing lane length to the highway segment length

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as two-way annual average daily volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 3
(continued)

# Generalized **Annual Average Daily** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | | Interrupted Flow Facilities | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freeways | Highways Undeveloped | | Highways Developed | | Arterials | | Bicycle | | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | rural | | | | | | | | | |
| Number of through lanes (both dir.) | 4-8 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 | 2 |
| Posted speed (mph) | 70 | 55 | 55 | 50 | 50 | 45 | 45 | 55 | 45 | 45 |
| Free flow speed (mph) | 75 | 60 | 60 | 55 | 55 | 50 | 50 | 60 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | | |
| Median (d, n, nr, r) | | | d | | d | n | r | r | r | n |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 20 | | 60 | | | | | | |
| Exclusive left turn lanes (n, y) | | [n] | y | [n] | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | | n | n | n | n | n |
| Facility length (mi) | 18 | 10 | 10 | 5 | 5 | 1.9 | 2.2 | 4 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.105 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.550 | 0.570 | 0.570 | 0.550 |
| Peak hour factor (PHF) | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 12.0 | 5.0 | 12.0 | 5.0 | 8.0 | 3.0 | 3.0 | 6.0 | 3.5 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | 0.975 | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | 0.968 | | | | | |
| % left turns | | | | | | 12 | 12 | | 12 | 12 |
| % right turns | | | | | | 12 | 12 | | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | | 5 | 6 | 2 | 4 | 4 |
| Arrival type (1-6) | | | | | | 3 | 3 | 3 | 3 | 3 |
| Signal type (a, c, p) | | | | | | c | c | a | a | a |
| Cycle length (C) | | | | | | 90 | 90 | 60 | 90 | 90 |
| Effective green ratio (g/C) | | | | | | 0.44 | 0.44 | 0.37 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n,50%,y | n,50%,y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | t | |
| Sidewalk (n, y) | | | | | | | | | | n,50%,y |
| Sidewalk/roadway separation(a, t,w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | | | |
|---|---|---|---|---|---|---|
| | | Two-Lane ru | | Two-Lane rd | Multilane ru | Multilane rd |
| | Density | %tsf | ats | %ffs | Density | Density |
| B | ≤ 14 | ≤ 50 | ≤ 55 | > 83.3 | ≤ 14 | ≤ 14 |
| C | ≤ 22 | ≤ 65 | ≤ 50 | > 75.0 | ≤ 22 | ≤ 22 |
| D | ≤ 29 | ≤ 80 | ≤ 45 | > 66.7 | ≤ 29 | ≤ 29 |
| E | ≤ 36 | > 80 | ≤ 40 | > 58.3 | ≤ 34 | ≤ 34 |

| Level of Service | Arterials | Bicycle | Pedestrian |
|---|---|---|---|
| | Major City/Co.(ats) | Score | Score |
| B | > 31 mph | ≤ 2.75 | ≤ 2.75 |
| C | > 23 mph | ≤ 3.50 | ≤ 3.50 |
| D | > 18 mph | ≤ 4.25 | ≤ 4.25 |
| E | > 15 mph | ≤ 5.00 | ≤ 5.00 |

%tsf = Percent time spent following %ffs = Percent of free flow speed ats = Average travel speed ru = Rural undeveloped rd = Rural developed

TABLE 4

# Generalized **Peak Hour Two-Way** Volumes for Florida's Urbanized Areas[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 1,510 | 1,600 | ** |
| 4 | Divided | * | 3,420 | 3,580 | ** |
| 6 | Divided | * | 5,250 | 5,390 | ** |
| 8 | Divided | * | 7,090 | 7,210 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 660 | 1,330 | 1,410 |
| 4 | Divided | * | 1,310 | 2,920 | 3,040 |
| 6 | Divided | * | 2,090 | 4,500 | 4,590 |
| 8 | Divided | * | 2,880 | 6,060 | 6,130 |

**Non-State Signalized Roadway Adjustments**

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

**Median & Turn Lane Adjustments**

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

**One-Way Facility Adjustment**

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 260 | 680 | 1,770 |
| 50-84% | 190 | 600 | 1,770 | >1,770 |
| 85-100% | 830 | 1,700 | >1,770 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 250 | 850 |
| 50-84% | * | 150 | 780 | 1,420 |
| 85-100% | 340 | 960 | 1,560 | >1,770 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

**Core Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 4,050 | 5,640 | 6,800 | 7,420 |
| 6 | 5,960 | 8,310 | 10,220 | 11,150 |
| 8 | 7,840 | 10,960 | 13,620 | 14,850 |
| 10 | 9,800 | 13,510 | 17,040 | 18,580 |
| 12 | 11,600 | 16,350 | 20,930 | 23,200 |

**Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 4,130 | 5,640 | 7,070 | 7,690 |
| 6 | 6,200 | 8,450 | 10,510 | 11,530 |
| 8 | 8,270 | 11,270 | 13,960 | 15,380 |
| 10 | 10,350 | 14,110 | 17,310 | 19,220 |

**Freeway Adjustments**

| Auxiliary Lanes Present in Both Directions | Ramp Metering |
|---|---|
| + 1,800 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 1,050 | 1,620 | 2,180 | 2,930 |
| 4 | Divided | 3,270 | 4,730 | 5,960 | 6,780 |
| 6 | Divided | 4,910 | 7,090 | 8,950 | 10,180 |

**Uninterrupted Flow Highway Adjustments**

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 4
(continued)

# Generalized **Peak Hour Two-Way** Volumes for Florida's Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | State Arterials | | | | Class I | |
| | Freeways | Core Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | urban | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 4-12 | 2 | 4-6 | 2 | 4-8 | 2 | 4-8 | 4 | 4 |
| Posted speed (mph) | 70 | 65 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 70 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary Lanes (n,y) | n | n | | | | | | | | |
| Median (d, twlt, n, nr, r) | | | | d | n | r | n | r | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | | 80 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | n | n | n | n | n | n |
| Facility length (mi) | 3 | 3 | 5 | 5 | 2 | 2 | 1.9 | 1.8 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.090 | 0.085 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.560 | 0.565 | 0.560 | 0.565 | 0.565 |
| Peak hour factor (PHF) | 0.95 | 0.95 | 0.95 | 0.95 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 4.0 | 4.0 | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.5 | 2.0 |
| Speed Adjustment Factor (SAF) | 0.975 | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | 4 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | | 3 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | | 120 | 150 | 120 | 120 | 120 | 120 |
| Effective green ratio (g/C) | | | | | 0.44 | 0.45 | 0.44 | 0.44 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | | | |
| Sidewalk (n, y) | | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation(a, t, w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | | Two-Lane | Multilane | Class I | Class II | | | |
| | Density | %ffs | Density | ats | ats | Score | Score | Buses/hr. |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

TABLE 5

# Generalized **Peak Hour Two-Way** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 1,300 | 1,460 | ** |
| 4 | Divided | * | 3,060 | 3,200 | ** |
| 6 | Divided | * | 4,690 | 4,820 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 580 | 1,200 | 1,280 |
| 4 | Divided | * | 890 | 2,590 | 2,850 |
| 6 | Divided | * | 1,440 | 4,040 | 4,280 |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 140 | 550 | 1,760 |
| 50-84% | 170 | 500 | 1,650 | >1,760 |
| 85-100% | 670 | 1,760 | >1,760 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 250 | 850 |
| 50-84% | * | 150 | 780 | 1,410 |
| 85-100% | 340 | 950 | 1,540 | >1,760 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 4,420 | 5,780 | 6,890 | 7,110 |
| 6 | 6,400 | 8,490 | 10,200 | 10,670 |
| 8 | 8,420 | 11,220 | 13,530 | 14,240 |
| 10 | 9,960 | 13,290 | 15,870 | 17,820 |

### Freeway Adjustments

| Auxiliary Lanes Present in Both Directions | Ramp Metering |
|---|---|
| + 1,800 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 1,020 | 1,560 | 2,110 | 2,840 |
| 4 | Divided | 3,110 | 4,490 | 5,670 | 6,450 |
| 6 | Divided | 4,650 | 6,730 | 8,510 | 9,670 |

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 5
(continued)

## Generalized **Peak Hour Two-Way** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | State Arterials | | | | Class I | |
| | Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | |
| Area type (urban, rural) | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 |
| Posted speed (mph) | 70 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | |
| Median (d, n, nr, r) | | | d | n | y | n | y | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 60 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | n | n | n | n | n | n |
| Facility length (mi) | 6 | 5 | 5 | 1.8 | 2 | 2 | 2 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | |
| Planning analysis hour factor (K) | 0.098 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.550 | 0.570 | 0.570 | 0.565 | 0.570 | 0.570 |
| Peak hour factor (PHF) | 0.92 | 0.92 | 0.92 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 9.0 | 4.0 | 4.0 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | |
| Number of signals | | | | 5 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | 4 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | 120 | 150 | 120 | 150 | 120 | 120 |
| Effective green ratio (g/C) | | | | 0.44 | 0.45 | 0.44 | 0.45 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | n | n |
| Sidewalk (n, y) | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation (a, t, w) | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | | Two-Lane | Multilane | Class I | Class II | | | |
| | Density | %ffs | Density | ats | ats | Score | Score | Buses/hr. |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

TABLE 6

# Generalized **Peak Hour Two-Way** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | * | 1,220 | 1,350 | ** |
| 4 | Divided | * | 2,790 | 2,890 | ** |
| 6 | Divided | * | 4,300 | 4,350 | ** |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 2 | Divided | Yes | No | +5% |
| 2 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding two-directional volumes in this table by 0.6

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

#### Rural Undeveloped

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 120 | 190 | 300 |
| 50-84% | 100 | 200 | 310 | 1,010 |
| 85-100% | 250 | 370 | 1,760 | >1,760 |

#### Developed Areas

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 220 | 460 | 1,480 |
| 50-84% | 170 | 430 | 1,270 | >1,760 |
| 85-100% | 560 | 1,760 | >1,760 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 220 | 840 |
| 50-84% | * | 120 | 780 | 1,390 |
| 85-100% | 320 | 940 | 1,560 | >1,820 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 4 | 3,650 | 5,040 | 5,950 | 6,640 |
| 6 | 5,130 | 7,250 | 8,670 | 9,950 |
| 8 | 6,600 | 9,490 | 11,380 | 13,270 |

### Freeway Adjustments

Auxiliary Lanes Present in Both Directions

+ 1,800

### UNINTERRUPTED FLOW HIGHWAYS

#### Rural Undeveloped

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 440 | 820 | 1,330 | 2,710 |
| 4 | Divided | 2,960 | 4,270 | 5,290 | 5,960 |
| 6 | Divided | 4,450 | 6,420 | 7,930 | 8,950 |

#### Developed Areas

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 2 | Undivided | 980 | 1,490 | 2,020 | 2,710 |
| 4 | Divided | 2,780 | 4,020 | 5,130 | 5,850 |
| 6 | Divided | 4,180 | 6,040 | 7,710 | 8,780 |

### Passing Lane Adjustments

Alter LOS B-D volumes in proportion to the passing lane length to the highway segment length

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 2 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 6
(continued)

## Generalized **Peak Hour Two-Way** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | | Interrupted Flow Facilities | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freeways | Highways – Undeveloped | | Highways – Developed | | Arterials | | Bicycle | | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | rural | | | | | | | | | |
| Number of through lanes (both dir.) | 4-8 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 | 2 |
| Posted speed (mph) | 70 | 55 | 55 | 50 | 50 | 45 | 45 | 55 | 45 | 45 |
| Free flow speed (mph) | 75 | 60 | 60 | 55 | 55 | 50 | 50 | 60 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | | |
| Median (d, n, nr, r) | | | d | | d | n | r | r | r | n |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 20 | | 60 | | | | | | |
| Exclusive left turn lanes (n, y) | | [n] | y | [n] | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | | n | n | n | n | n |
| Facility length (mi) | 18 | 10 | 10 | 5 | 5 | 1.9 | 2.2 | 4 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.105 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.550 | 0.570 | 0.570 | 0.550 |
| Peak hour factor (PHF) | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 12.0 | 5.0 | 12.0 | 5.0 | 8.0 | 3.0 | 3.0 | 6.0 | 3.5 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | 0.975 | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | 0.968 | | | | | |
| % left turns | | | | | | 12 | 12 | | 12 | 12 |
| % right turns | | | | | | 12 | 12 | | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | | 5 | 6 | 2 | 4 | 4 |
| Arrival type (1-6) | | | | | | 3 | 3 | 3 | 3 | 3 |
| Signal type (a, c, p) | | | | | | c | c | a | a | a |
| Cycle length (C) | | | | | | 90 | 90 | 60 | 90 | 90 |
| Effective green ratio (g/C) | | | | | | 0.44 | 0.44 | 0.37 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n,50%,y | n,50%,y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | t | |
| Sidewalk (n, y) | | | | | | | | | | n,50%,y |
| Sidewalk/roadway separation(a, t,w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | | | |
|---|---|---|---|---|---|---|
| | | Two-Lane ru | | Two-Lane rd | Multilane ru | Multilane rd |
| | Density | %tsf | ats | %ffs | Density | Density |
| B | ≤ 14 | ≤ 50 | ≤ 55 | > 83.3 | ≤ 14 | ≤ 14 |
| C | ≤ 22 | ≤ 65 | ≤ 50 | > 75.0 | ≤ 22 | ≤ 22 |
| D | ≤ 29 | ≤ 80 | ≤ 45 | > 66.7 | ≤ 29 | ≤ 29 |
| E | ≤ 36 | > 80 | ≤ 40 | > 58.3 | ≤ 34 | ≤ 34 |

| Level of Service | Arterials | Bicycle | Pedestrian |
|---|---|---|---|
| | Major City/Co.(ats) | Score | Score |
| B | > 31 mph | ≤ 2.75 | ≤ 2.75 |
| C | > 23 mph | ≤ 3.50 | ≤ 3.50 |
| D | > 18 mph | ≤ 4.25 | ≤ 4.25 |
| E | > 15 mph | ≤ 5.00 | ≤ 5.00 |

%tsf = Percent time spent following %ffs = Percent of free flow speed ats = Average travel speed ru = Rural undeveloped rd = Rural developed

TABLE 7

# Generalized **Peak Hour Directional** Volumes for Florida's Urbanized Areas

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | * | 830 | 880 | ** |
| 2 | Divided | * | 1,910 | 2,000 | ** |
| 3 | Divided | * | 2,940 | 3,020 | ** |
| 4 | Divided | * | 3,970 | 4,040 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | * | 370 | 750 | 800 |
| 2 | Divided | * | 730 | 1,630 | 1,700 |
| 3 | Divided | * | 1,170 | 2,520 | 2,560 |
| 4 | Divided | * | 1,610 | 3,390 | 3,420 |

**Non-State Signalized Roadway Adjustments**

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

**Median & Turn Lane Adjustments**

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 1 | Divided | Yes | No | +5% |
| 1 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

**One-Way Facility Adjustment**

Multiply the corresponding directional volumes in this table by 1.2

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 150 | 390 | 1,000 |
| 50-84% | 110 | 340 | 1,000 | >1,000 |
| 85-100% | 470 | 1,000 | >1,000 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 140 | 480 |
| 50-84% | * | 80 | 440 | 800 |
| 85-100% | 200 | 540 | 880 | >1,000 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

**Core Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 2 | 2,230 | 3,100 | 3,740 | 4,080 |
| 3 | 3,280 | 4,570 | 5,620 | 6,130 |
| 4 | 4,310 | 6,030 | 7,490 | 8,170 |
| 5 | 5,390 | 7,430 | 9,370 | 10,220 |
| 6 | 6,380 | 8,990 | 11,510 | 12,760 |

**Urbanized**

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 2 | 2,270 | 3,100 | 3,890 | 4,230 |
| 3 | 3,410 | 4,650 | 5,780 | 6,340 |
| 4 | 4,550 | 6,200 | 7,680 | 8,460 |
| 5 | 5,690 | 7,760 | 9,520 | 10,570 |

**Freeway Adjustments**

| Auxiliary Lane | Ramp Metering |
|---|---|
| + 1,000 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | 580 | 890 | 1,200 | 1,610 |
| 2 | Divided | 1,800 | 2,600 | 3,280 | 3,730 |
| 3 | Divided | 2,700 | 3,900 | 4,920 | 5,600 |

**Uninterrupted Flow Highway Adjustments**

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 1 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 7
(continued)

# Generalized **Peak Hour Directional** Volumes for Florida's Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | State Arterials | | | | Class I | |
| | Freeways | Core Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | urban | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 4-12 | 2 | 4-6 | 2 | 4-8 | 2 | 4-8 | 4 | 4 |
| Posted speed (mph) | 70 | 65 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 70 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary Lanes (n,y) | n | n | | | | | | | | |
| Median (d, twlt, n, nr, r) | | | | d | n | r | n | r | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | | 80 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | n | n | n | n | n | n |
| Facility length (mi) | 3 | 3 | 5 | 5 | 2 | 2 | 1.9 | 1.8 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.090 | 0.085 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.560 | 0.565 | 0.560 | 0.565 | 0.565 |
| Peak hour factor (PHF) | 0.95 | 0.95 | 0.95 | 0.95 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 4.0 | 4.0 | 2.0 | 2.0 | 1.0 | 1.0 | 1.0 | 1.0 | 2.5 | 2.0 |
| Speed Adjustment Factor (SAF) | 0.975 | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | 4 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | | 3 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | | 120 | 150 | 120 | 120 | 120 | 120 |
| Effective green ratio (g/C) | | | | | 0.44 | 0.45 | 0.44 | 0.44 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | | | |
| Sidewalk (n, y) | | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation(a, t, w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | | Two-Lane | Multilane | Class I | Class II | | | |
| | Density | %ffs | Density | ats | ats | Score | Score | Buses/hr. |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

TABLE 8

# Generalized **Peak Hour Directional** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

**Class I** (40 mph or higher posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | * | 710 | 800 | ** |
| 2 | Divided | * | 1,740 | 1,820 | ** |
| 3 | Divided | * | 2,670 | 2,740 | ** |

**Class II** (35 mph or slower posted speed limit)

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | * | 330 | 680 | 720 |
| 2 | Divided | * | 500 | 1,460 | 1,600 |
| 3 | Divided | * | 810 | 2,280 | 2,420 |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 1 | Divided | Yes | No | +5% |
| 1 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding directional volumes in this table by 1.2

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 140 | 320 | 1,000 |
| 50-84% | 100 | 280 | 940 | >1,000 |
| 85-100% | 380 | 1,000 | >1,000 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 140 | 480 |
| 50-84% | * | 80 | 440 | 800 |
| 85-100% | 200 | 540 | 880 | >1,000 |

### BUS MODE (Scheduled Fixed Route)[3]

(Buses in peak hour in peak direction)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-84% | > 5 | ≥ 4 | ≥ 3 | ≥ 2 |
| 85-100% | > 4 | ≥ 3 | ≥ 2 | ≥ 1 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 2 | 2,430 | 3,180 | 3,790 | 3,910 |
| 3 | 3,520 | 4,670 | 5,610 | 5,870 |
| 4 | 4,630 | 6,170 | 7,440 | 7,830 |
| 5 | 5,480 | 7,310 | 8,730 | 9,800 |

### Freeway Adjustments

| Auxiliary Lane | Ramp Metering |
|---|---|
| + 1,000 | + 5% |

### UNINTERRUPTED FLOW HIGHWAYS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | 560 | 860 | 1,160 | 1,560 |
| 2 | Divided | 1,710 | 2,470 | 3,120 | 3,550 |
| 3 | Divided | 2,560 | 3,700 | 4,680 | 5,320 |

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 1 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

[3] Buses per hour shown are only for the peak hour in the single direction of the higher traffic flow.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 8
(continued)

## Generalized **Peak Hour Directional** Volumes for Florida's Transitioning Areas **and** Areas Over 5,000 Not In Urbanized Areas

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | Interrupted Flow Facilities | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | State Arterials | | | | Class I | |
| | Freeways | Highways | | Class I | | Class II | | Bicycle | Pedestrian |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | |
| Area type (urban, rural) | urban | | | | | | | | |
| Number of through lanes (both dir.) | 4-10 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 |
| Posted speed (mph) | 70 | 50 | 50 | 45 | 50 | 30 | 30 | 45 | 45 |
| Free flow speed (mph) | 75 | 55 | 55 | 50 | 55 | 35 | 35 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | |
| Median (d, n, nr, r) | | | d | n | y | n | y | r | r |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 60 | | | | | | | |
| Exclusive left turn lane impact (n, y) | | [n] | y | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | n | n | n | n | n | n |
| Facility length (mi) | 6 | 5 | 5 | 1.8 | 2 | 2 | 2 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | |
| Planning analysis hour factor (K) | 0.098 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 | 0.090 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.550 | 0.570 | 0.570 | 0.565 | 0.570 | 0.570 |
| Peak hour factor (PHF) | 0.92 | 0.92 | 0.92 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 9.0 | 4.0 | 4.0 | 2.0 | 3.0 | 2.0 | 3.0 | 3.0 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | | | | | |
| % left turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| % right turns | | | | 12 | 12 | 12 | 12 | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | |
| Number of signals | | | | 5 | 4 | 10 | 10 | 4 | 6 |
| Arrival type (1-6) | | | | 4 | 3 | 4 | 4 | 4 | 4 |
| Signal type (a, c, p) | | | | c | c | c | c | c | c |
| Cycle length (C) | | | | 120 | 150 | 120 | 150 | 120 | 120 |
| Effective green ratio (g/C) | | | | 0.44 | 0.45 | 0.44 | 0.45 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n, 50%, y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | |
| On-street parking (n, y) | | | | | | | | n | n |
| Sidewalk (n, y) | | | | | | | | | n, 50%, y |
| Sidewalk/roadway separation (a, t, w) | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | Arterials | | Bicycle | Ped | Bus |
|---|---|---|---|---|---|---|---|---|
| | | Two-Lane | Multilane | Class I | Class II | | | |
| | Density | %ffs | Density | ats | ats | Score | Score | Buses/hr. |
| B | ≤ 17 | > 83.3 | ≤ 17 | > 31 mph | > 22 mph | ≤ 2.75 | ≤ 2.75 | ≤ 6 |
| C | ≤ 24 | > 75.0 | ≤ 24 | > 23 mph | > 17 mph | ≤ 3.50 | ≤ 3.50 | ≤ 4 |
| D | ≤ 31 | > 66.7 | ≤ 31 | > 18 mph | > 13 mph | ≤ 4.25 | ≤ 4.25 | < 3 |
| E | ≤ 39 | > 58.3 | ≤ 35 | > 15 mph | > 10 mph | ≤ 5.00 | ≤ 5.00 | < 2 |

% ffs = Percent free flow speed ats = Average travel speed

TABLE 9

# Generalized **Peak Hour Directional** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population[1]

January 2020

## INTERRUPTED FLOW FACILITIES

### STATE SIGNALIZED ARTERIALS

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | * | 670 | 740 | ** |
| 2 | Divided | * | 1,530 | 1,580 | ** |
| 3 | Divided | * | 2,360 | 2,400 | ** |

### Non-State Signalized Roadway Adjustments

(Alter corresponding state volumes by the indicated percent.)

Non-State Signalized Roadways - 10%

### Median & Turn Lane Adjustments

| Lanes | Median | Exclusive Left Lanes | Exclusive Right Lanes | Adjustment Factors |
|---|---|---|---|---|
| 1 | Divided | Yes | No | +5% |
| 1 | Undivided | No | No | -20% |
| Multi | Undivided | Yes | No | -5% |
| Multi | Undivided | No | No | -25% |
| – | – | – | Yes | + 5% |

### One-Way Facility Adjustment

Multiply the corresponding directional volumes in this table by 1.2

### BICYCLE MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

#### Rural Undeveloped

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 70 | 110 | 170 |
| 50-84% | 60 | 120 | 180 | 580 |
| 85-100% | 140 | 210 | 1,000 | >1,000 |

#### Developed Areas

| Paved Shoulder/Bicycle Lane Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | 120 | 260 | 840 |
| 50-84% | 100 | 240 | 720 | 1,000 |
| 85-100% | 320 | 1,000 | >1,000 | ** |

### PEDESTRIAN MODE[2]

(Multiply vehicle volumes shown below by number of directional roadway lanes to determine two-way maximum service volumes.)

| Sidewalk Coverage | B | C | D | E |
|---|---|---|---|---|
| 0-49% | * | * | 120 | 460 |
| 50-84% | * | 80 | 430 | 770 |
| 85-100% | 180 | 520 | 860 | >1,000 |

## UNINTERRUPTED FLOW FACILITIES

### FREEWAYS

| Lanes | B | C | D | E |
|---|---|---|---|---|
| 2 | 2,010 | 2,770 | 3,270 | 3,650 |
| 3 | 2,820 | 3,990 | 4,770 | 5,470 |
| 4 | 3,630 | 5,220 | 6,260 | 7,300 |

### Freeway Adjustments

Auxiliary Lane

+ 1,000

### UNINTERRUPTED FLOW HIGHWAYS

#### Rural Undeveloped

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | 240 | 450 | 730 | 1,490 |
| 2 | Divided | 1,630 | 2,350 | 2,910 | 3,280 |
| 3 | Divided | 2,450 | 3,530 | 4,360 | 4,920 |

#### Developed Areas

| Lanes | Median | B | C | D | E |
|---|---|---|---|---|---|
| 1 | Undivided | 540 | 820 | 1,110 | 1,490 |
| 2 | Divided | 1,530 | 2,210 | 2,820 | 3,220 |
| 3 | Divided | 2,300 | 3,320 | 4,240 | 4,830 |

### Passing Lane Adjustments

Alter LOS B-D volumes in proportion to the passing lane length to the highway segment length

### Uninterrupted Flow Highway Adjustments

| Lanes | Median | Exclusive left lanes | Adjustment factors |
|---|---|---|---|
| 1 | Divided | Yes | +5% |
| Multi | Undivided | Yes | -5% |
| Multi | Undivided | No | -25% |

[1]Values shown are presented as peak hour directional volumes for levels of service and are for the automobile/truck modes unless specifically stated. This table does not constitute a standard and should be used only for general planning applications. The computer models from which this table is derived should be used for more specific planning applications. The table and deriving computer models should not be used for corridor or intersection design, where more refined techniques exist. Calculations are based on planning applications of the HCM and the Transit Capacity and Quality of Service Manual.

[2] Level of service for the bicycle and pedestrian modes in this table is based on number of vehicles, not number of bicyclists or pedestrians using the facility.

* Cannot be achieved using table input value defaults.

** Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached. For the bicycle mode, the level of service letter grade (including F) is not achievable because there is no maximum vehicle volume threshold using table input value defaults.

*Source:*
Florida Department of Transportation
Systems Implementation Office
https://www.fdot.gov/planning/systems/

TABLE 9
(continued)

# Generalized **Peak Hour Directional** Volumes for Florida's Rural Undeveloped Areas **and** Developed Areas Less Than 5,000 Population

January 2020

| INPUT VALUE ASSUMPTIONS | Uninterrupted Flow Facilities | | | | | Interrupted Flow Facilities | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Freeways | Highways | | | | Arterials | | Bicycle | | Pedestrian |
| | | Undeveloped | | Developed | | | | | | |
| **ROADWAY CHARACTERISTICS** | | | | | | | | | | |
| Area type (urban, rural) | rural | | | | | | | | | |
| Number of through lanes (both dir.) | 4-8 | 2 | 4-6 | 2 | 4-6 | 2 | 4-6 | 4 | 4 | 2 |
| Posted speed (mph) | 70 | 55 | 55 | 50 | 50 | 45 | 45 | 55 | 45 | 45 |
| Free flow speed (mph) | 75 | 60 | 60 | 55 | 55 | 50 | 50 | 60 | 50 | 50 |
| Auxiliary lanes (n,y) | n | | | | | | | | | |
| Median (d, n, nr, r) | | | d | | d | n | r | r | r | n |
| Terrain (l,r) | l | l | l | l | l | l | l | l | l | l |
| % no passing zone | | 20 | | 60 | | | | | | |
| Exclusive left turn lanes (n, y) | | [n] | y | [n] | y | y | y | y | y | y |
| Exclusive right turn lanes (n, y) | | | | | | n | n | n | n | n |
| Facility length (mi) | 18 | 10 | 10 | 5 | 5 | 1.9 | 2.2 | 4 | 2 | 2 |
| **TRAFFIC CHARACTERISTICS** | | | | | | | | | | |
| Planning analysis hour factor (K) | 0.105 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 | 0.095 |
| Directional distribution factor (D) | 0.55 | 0.55 | 0.55 | 0.55 | 0.55 | 0.550 | 0.550 | 0.570 | 0.570 | 0.550 |
| Peak hour factor (PHF) | 0.88 | 0.88 | 0.88 | 0.88 | 0.88 | 1.000 | 1.000 | 1.000 | 1.000 | 1.000 |
| Base saturation flow rate (pcphpl) | 2,400 | 1,700 | 2,200 | 1,700 | 2,200 | 1,950 | 1,950 | 1,950 | 1,950 | 1,950 |
| Heavy vehicle percent | 12.0 | 5.0 | 12.0 | 5.0 | 8.0 | 3.0 | 3.0 | 6.0 | 3.5 | 3.0 |
| Speed Adjustment Factor (SAF) | 0.975 | | 0.975 | | 0.975 | | | | | |
| Capacity Adjustment Factor (CAF) | 0.968 | | 0.968 | | 0.968 | | | | | |
| % left turns | | | | | | 12 | 12 | | 12 | 12 |
| % right turns | | | | | | 12 | 12 | | 12 | 12 |
| **CONTROL CHARACTERISTICS** | | | | | | | | | | |
| Number of signals | | | | | | 5 | 6 | 2 | 4 | 4 |
| Arrival type (1-6) | | | | | | 3 | 3 | 3 | 3 | 3 |
| Signal type (a, c, p) | | | | | | c | c | a | a | a |
| Cycle length (C) | | | | | | 90 | 90 | 60 | 90 | 90 |
| Effective green ratio (g/C) | | | | | | 0.44 | 0.44 | 0.37 | 0.44 | 0.44 |
| **MULTIMODAL CHARACTERISTICS** | | | | | | | | | | |
| Paved shoulder/bicycle lane (n, y) | | | | | | | | n,50%,y | n,50%,y | n |
| Outside lane width (n, t, w) | | | | | | | | t | t | t |
| Pavement condition (d, t, u) | | | | | | | | t | t | |
| Sidewalk (n, y) | | | | | | | | | | n,50%,y |
| Sidewalk/roadway separation(a, t,w) | | | | | | | | | | t |
| Sidewalk protective barrier (n, y) | | | | | | | | | | n |

**LEVEL OF SERVICE THRESHOLDS**

| Level of Service | Freeways | Highways | | | | |
|---|---|---|---|---|---|---|
| | | Two-Lane ru | | Two-Lane rd | Multilane ru | Multilane rd |
| | Density | %tsf | ats | %ffs | Density | Density |
| B | ≤ 14 | ≤ 50 | ≤ 55 | > 83.3 | ≤ 14 | ≤ 14 |
| C | ≤ 22 | ≤ 65 | ≤ 50 | > 75.0 | ≤ 22 | ≤ 22 |
| D | ≤ 29 | ≤ 80 | ≤ 45 | > 66.7 | ≤ 29 | ≤ 29 |
| E | ≤ 36 | > 80 | ≤ 40 | > 58.3 | ≤ 34 | ≤ 34 |

| Level of Service | Arterials | Bicycle | Pedestrian |
|---|---|---|---|
| | Major City/Co.(ats) | Score | Score |
| B | > 31 mph | ≤ 2.75 | ≤ 2.75 |
| C | > 23 mph | ≤ 3.50 | ≤ 3.50 |
| D | > 18 mph | ≤ 4.25 | ≤ 4.25 |
| E | > 15 mph | ≤ 5.00 | ≤ 5.00 |

%tsf = Percent time spent following %ffs = Percent of free flow speed ats = Average travel speed ru = Rural undeveloped rd = Rural developed