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STATEWIDE MULTIMODAL ACCESS MANAGEMENT AND TRANSPORTATION SITE IMPACT

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WEBINAR SERIES 2023-2024

FDOT

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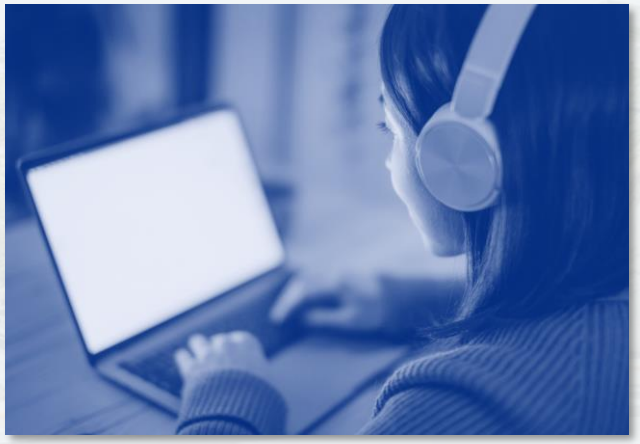
Agenda



CREDITS AND WEBINAR MATERIAL

MULTIMODAL QUALITY/LEVEL OF SERVICE

CONTACT INFO

Credits Information

Certificates will be distributed through email.

Your participation will be recorded by GoToWebinar.

- You will need to attend to the entire webinar with the unique link provided by GoToWebinar.


STATEWIDE MULTIMODAL ACCESS MANAGEMENT AND TRANSPORTATION SITE IMPACT WEBINAR SERIES 2023-24

FLORIDA DEPARTMENT OF TRANSPORTATION

This certifies that

Name Last Name

has successfully completed the

Webinar #1

Course Number: XXXX

FBPE Provider number: XXXXXXX

Presented on: XX/XX/XX

And has qualified for 1.5 CE credits

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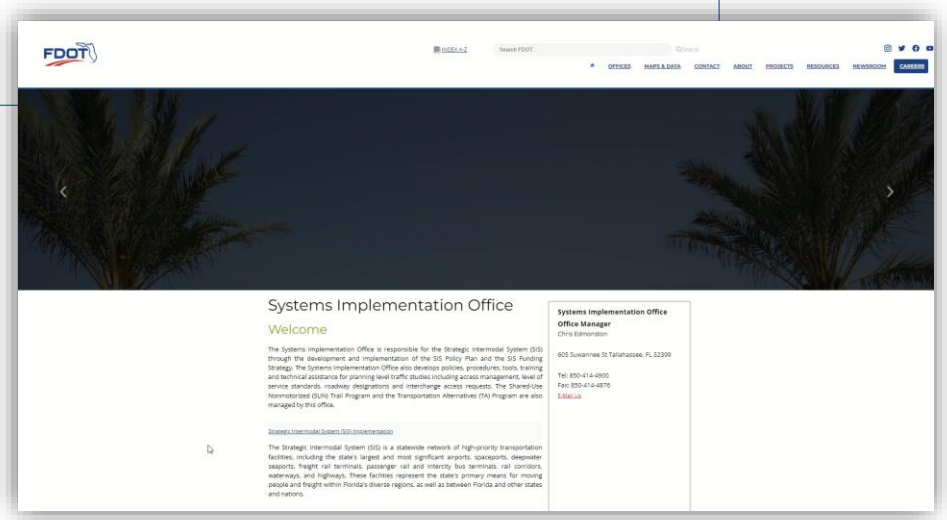


What organization do you represent?

FDOT

Local Government

Private Firm

Other

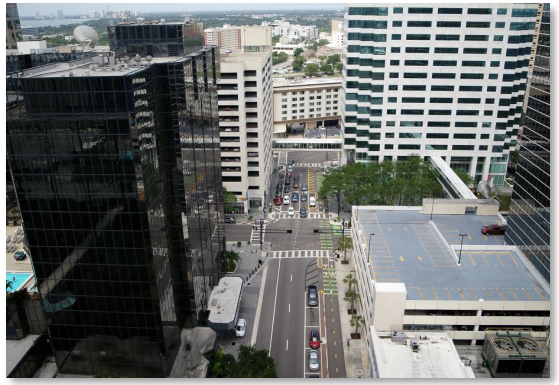
Statewide Multimodal Access Management And Transportation Site Impact

WEBINAR SERIES 2023-2024

Webinar #1

Multimodal Site Impact Analysis

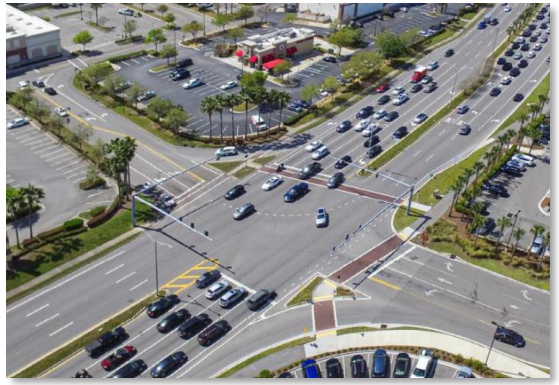
Tuesday, August 15, 2023



Webinar #2

Multimodal Quality Level of Service

Tuesday, November 14, 2023



Webinar #3

Multimodal Access Management

Tuesday, February 20, 2024

Webinar #4

Trip Generation Research on High-Volume Fast-Food Restaurants and Coffee Shops

Tuesday, May 21, 2024

Statewide Multimodal Access Management And Transportation Site Impact

WEBINAR SERIES 2023-2024

Today's Webinar

Multimodal Quality Level of Service

Tuesday, November 14, 2023

2:00PM – 3:30PM

Credits: 1.5

How familiar are you with Multimodal Quality/Level of Service?

VERY FAMILIAR

SOMEWHAT FAMILIAR

NOT FAMILIAR

Quality/Level of Service and Level of Traffic Stress

Statewide Access Management and Traffic Site Impact
Webinar Series 2023-2024

Agenda

Automobile Level of Service

- MMDQLOS Handbook Changes between 2020-23
- Definitions
- LOS Letter Grades
- LOS Target Policy

Generalized Service Volume Tables

- What They Are
- How They Are Developed
- How To Select And Use The Tables

EXAMPLES

Bicycle and Pedestrians Levels of Traffic Stress

- Overview
- Background

Bicycle and pedestrian Level of Traffic Stress

- LTS Descriptions
- Bicycle and Pedestrians LTS Inputs
- Level of Traffic Stress Flowcharts

EXAMPLES

Multimodal Quality/Level of Service Handbook

- Retitle and Reorganized
- Context Classification
- Bike and Ped Level of Traffic Stress
- Highway Capacity Manual Methodology

Definitions

Quality of Service

- A **traveler-based assessment** of how well a service or facility is operating

Level of Service

- A quantitative stratification of the "quality of service" of a service or facility into **six letter grade levels** with "A" describing the highest quality and "F" describing the lowest quality

Multimodal

- More than one highway mode (auto, bicycle, bus, pedestrian, truck)

Definitions

Capacity

- The maximum number of vehicles that can pass a point during a specified time period under **prevailing** roadway, traffic, and control conditions

Maximum Service Volumes

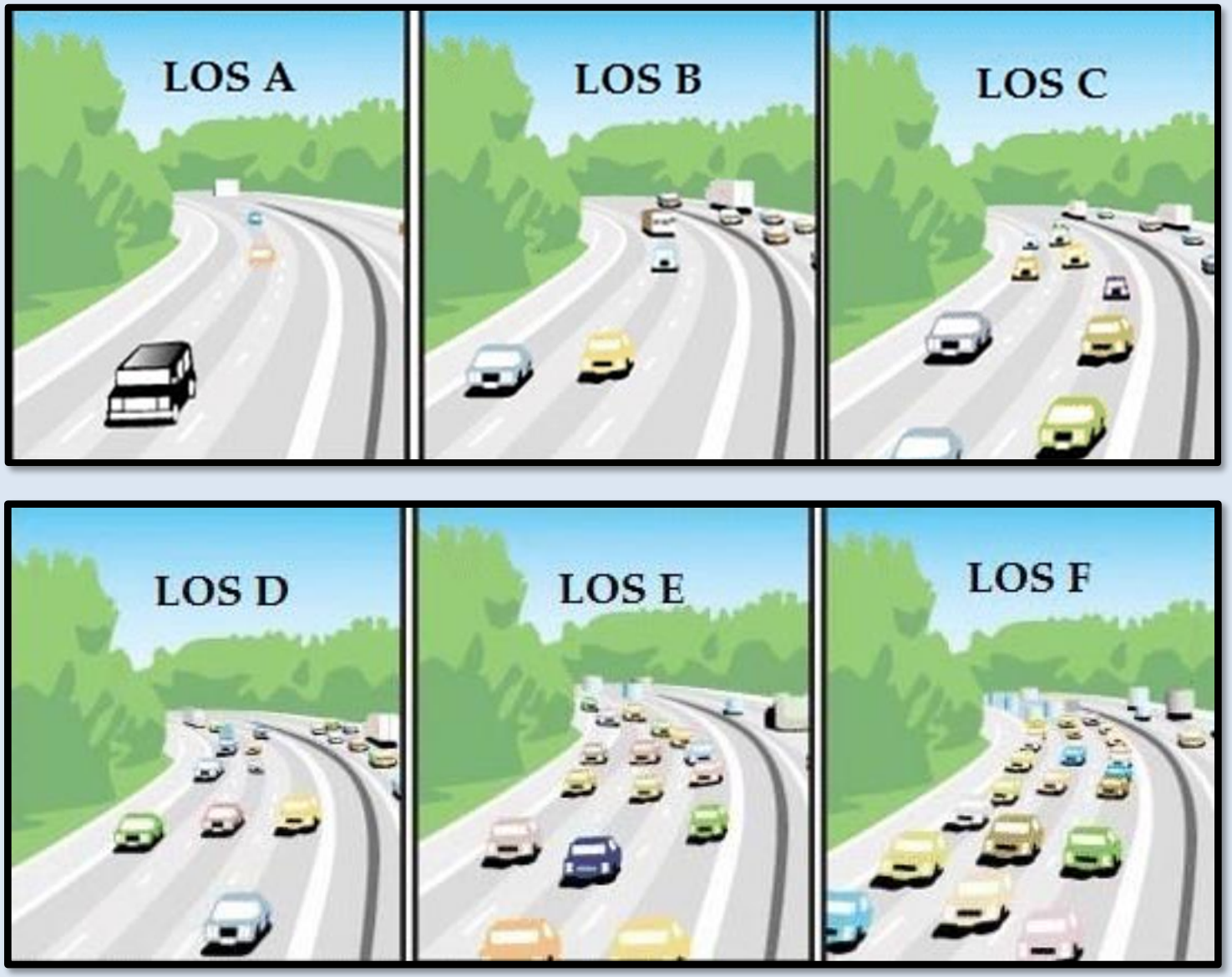
- The **highest number** of vehicles for a given level of service

Generalized Planning

- **A broad type of planning application** that includes statewide analyses, initial problem identification, and future year analyses

Depictions of Levels of Service

A	Free Flow
B	Reasonably Free Flow
C	Stable Operations
D	Unstable Operations
E	Extremely Unstable
F	Breakdown



Source: Performance Evaluation of a 'Priority-Controlled' Intersection Converted to Signal-Controlled Intersection, Ezenwa Chinenye Amanamba, Vol:10, No:7, 2016

Level of Service Target Policy

Policy No 000-525-006

- Effective April 2017
- Reviewed August 2019

LEVEL OF SERVICE TARGETS FOR THE STATE HIGHWAY SYSTEM

It is the Department's intent to plan, design and operate the State Highway System at an acceptable level of service for the traveling public. The automobile mode level of service targets for the State Highway System during peak travel hours are "D" in urbanized areas and "C" outside urbanized areas. The Department shall work with local governments to establish appropriate level of service targets for multimodal mobility and system design. The targets shall be responsive to all users, for context, roadway function, network design, and user safety.

Why don’t we build for LOS A?

Larger lanes

More lanes

Higher speeds

Less space for bike and pedestrian facilities

Unfavorable conditions for speed reduction and bike and ped user comfort

About the Generalized Service Volume Tables

Generalized Service Volume Tables
What are they?

C2T, C4, C5, & C6 — Motor Vehicle Arterial Generalized Service Volume Tables


(C2T-Rural Town)

Peak Hour Directional

	B	C	D	E
1 Lane	*	720	940	**
2 Lane	*	1,140	1,640	**
3 Lane	*	2,120	2,510	**

Peak Hour Two-Way

	B	C	D	E
2 Lane	*	1,310	1,710	**
4 Lane	*	2,070	2,980	**
6 Lane	*	3,850	4,560	**

AADT

	B	C	D	E
2 Lane	*	13,800	18,000	**
4 Lane	*	21,800	31,400	**
6 Lane	*	40,500	48,000	**


(C4-Urban General)

	B	C	D	E
1 Lane	*	*	870	1,190
2 Lane	*	1,210	1,790	2,020
3 Lane	*	2,210	2,810	2,990
4 Lane	*	2,590	3,310	3,510

	B	C	D	E
2 Lane	*	*	1,580	2,160
4 Lane	*	2,200	3,250	3,670
6 Lane	*	4,020	5,110	5,440
8 Lane	*	4,710	6,020	6,380

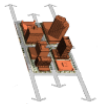
	B	C	D	E
2 Lane	*	*	17,600	24,000
4 Lane	*	24,400	36,100	40,800
6 Lane	*	44,700	56,800	60,400
8 Lane	*	52,300	66,900	70,900


(C5-Urban Center)

	B	C	D	E
1 Lane	*	*	690	1,080
2 Lane	*	1,290	1,900	2,130
3 Lane	*	1,410	2,670	3,110
4 Lane	*	2,910	3,560	3,640

	B	C	D	E
2 Lane	*	*	1,250	1,960
4 Lane	*	2,350	3,450	3,870
6 Lane	*	2,560	4,850	5,650
8 Lane	*	5,290	6,470	6,620

	B	C	D	E
2 Lane	*	*	13,900	21,800
4 Lane	*	26,100	38,300	43,000
6 Lane	*	28,400	53,900	62,800
8 Lane	*	58,800	71,900	73,600


(C6-Urban Core)

	B	C	D	E
1 Lane	*	***	790	1,030
2 Lane	*	***	1,490	1,920
3 Lane	*	***	2,730	2,940
4 Lane	*	***	3,250	3,490

	B	C	D	E
2 Lane	*	***	1,440	1,870
4 Lane	*	***	2,710	3,490
6 Lane	*	***	4,960	5,350
8 Lane	*	***	5,910	6,350

	B	C	D	E
2 Lane	*	***	16,000	20,800
4 Lane	*	***	30,100	38,800
6 Lane	*	***	55,100	59,400
8 Lane	*	***	65,700	70,600

Adjustment Factors

The peak hour directional service volumes should be adjust by multiplying by 1.2 for one-way facilities
The AADT service volumes should be adjusted by multiplying 0.6 for one way facilities 2 Lane Divided Roadway with an Exclusive Left Turn Lane(s): Multiply by 1.05
2 lane Undivided Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.80

Exclusive right turn lane(s): Multiply by 1.05
Multilane Undivided Roadway with an Exclusive Left Turn Lane(s): Multiply by 0.95
Multilane Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.75
Non-State Signalized Roadway: Multiply by 0.90

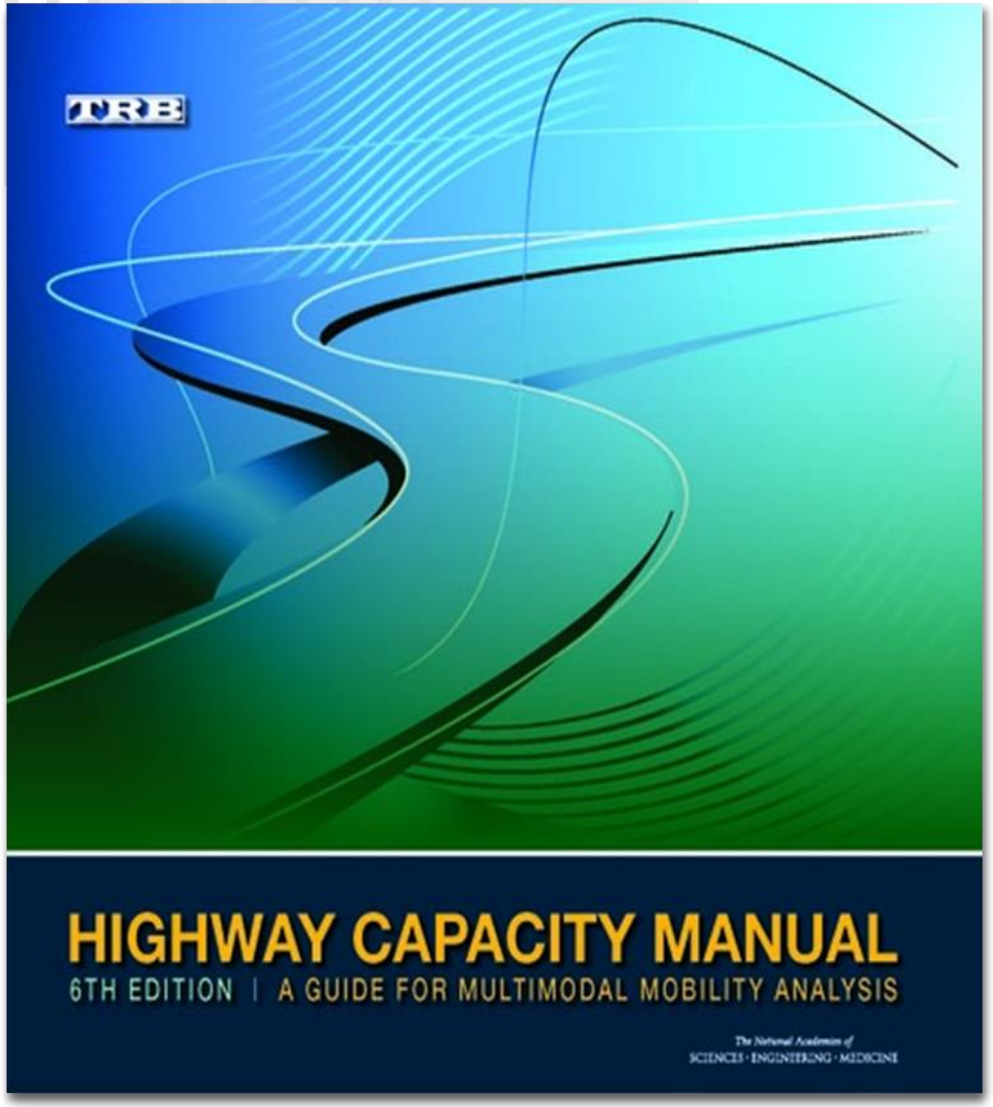
This table does not constitute a standard and should be used only for general planning applications. The table should not be used for corridor or intersection design, where more refined techniques exist.
*Cannot be achieved using table input value defaults. **Not applicable for that level of service letter grade. For the automobile mode, volumes greater than level of service D become F because intersection capacities have been reached.
***LOS C thresholds are not applicable for C6 as C6 roadway facilities are neither planned nor designed to achieve automobile LOS C.

The Multimodal Q/LOS Handbooks **main generalized planning tool**

It shows **maximum service volumes** for each letter grade based on

- Averaged Variables
- Area Type
- Context Classification
- Other Defaults

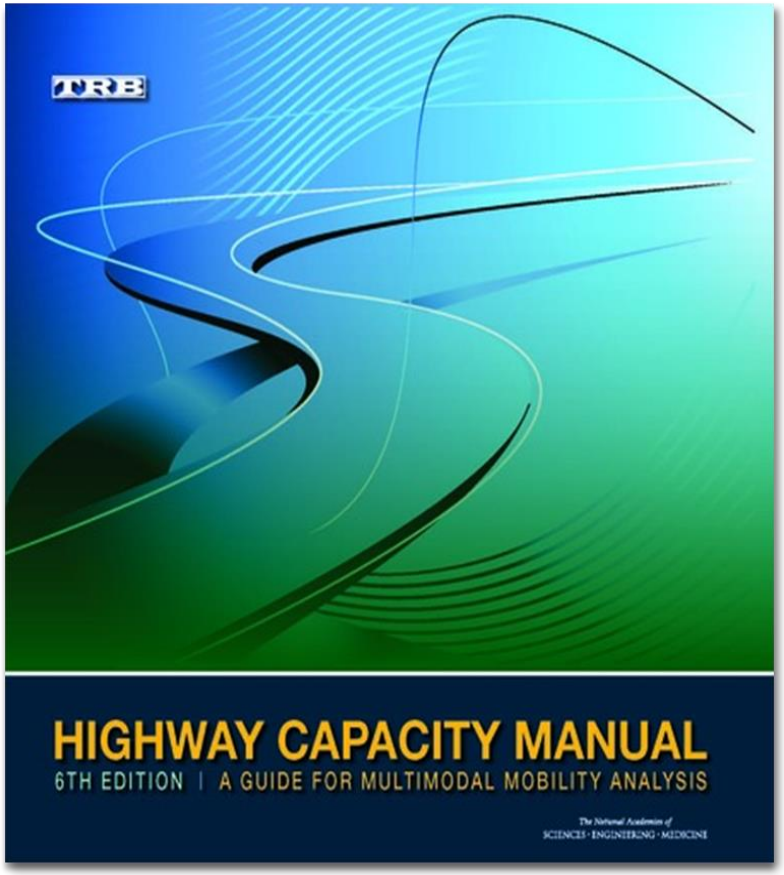
Generalized Service Volume Tables
How were they developed?



The HCM is the most widely recognized and acceptable analysis tool for motorized vehicles.

Generalized Service Volume Tables
How were they developed?

Based on the Highway Capacity Manual (HCM) methodologies using Highway Capacity Software (HCS) analysis



Highway Capacity Manual

Statewide/National Defaults

Highway Capacity Software

Maximum Service Volumes

Defaults

The generalized planning tool used in the Quality Level of Service Handbook uses many defaults including…

- Signal Density
- Lane Width
- Median Type
- Cycle Length
- Peak Hour Factor
- Directional Factor
- K Factor
- Shoulder Width
- g/c Ratio
- Posted Speed Limit
- Shoulder Width

Source: Alexander Sparteni / Getty Images

Defaults

C2T, C4, C5, & C6

Motor Vehicle Arterial Generalized Service Volume Tables

Input Parameters

Roadway Characteristics

	C2T	C4	C5	C6
Number of Lanes (one direction)	1-3	1-4	1-4	1-4
Posted Speed (mph)	40	45	35	30
Facility Length (miles)	0.78	1.83	1.18	0.74
Number of Signals	4	9	9	7

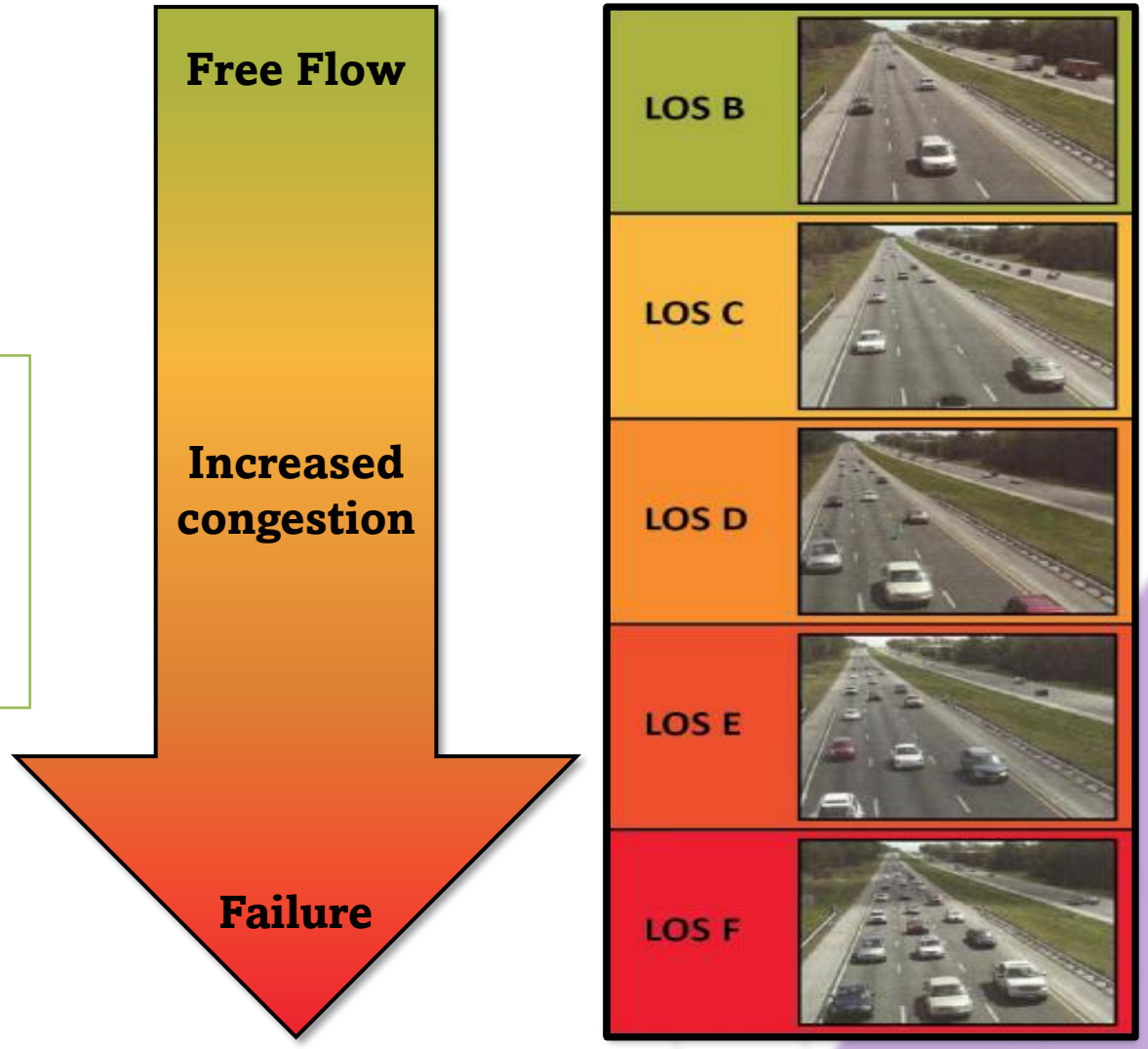
Traffic Characteristics

	C2T	C4	C5	C6
Planning Analysis Hour Factor (K)	0.095	0.09	0.09	0.09
Directional Distribution Factor (D)	0.55	0.55	0.55	0.55
Peak Hour Factor (PHF)	0.92	0.95	0.95	0.95
Base Saturation Flow Rate	1,700	1,950	1,950	1,950
Heavy Vehicle Percent (%)	5	3	2	2
Lane Width	11	11	10	10
Median Type	Non Restrictive	Non Restrictive	Non Restrictive	Non Restrictive
Roadway Edge Type	Curb	Curb	Curb	Curb
On-Street Parking	50%	100%	100%	100%

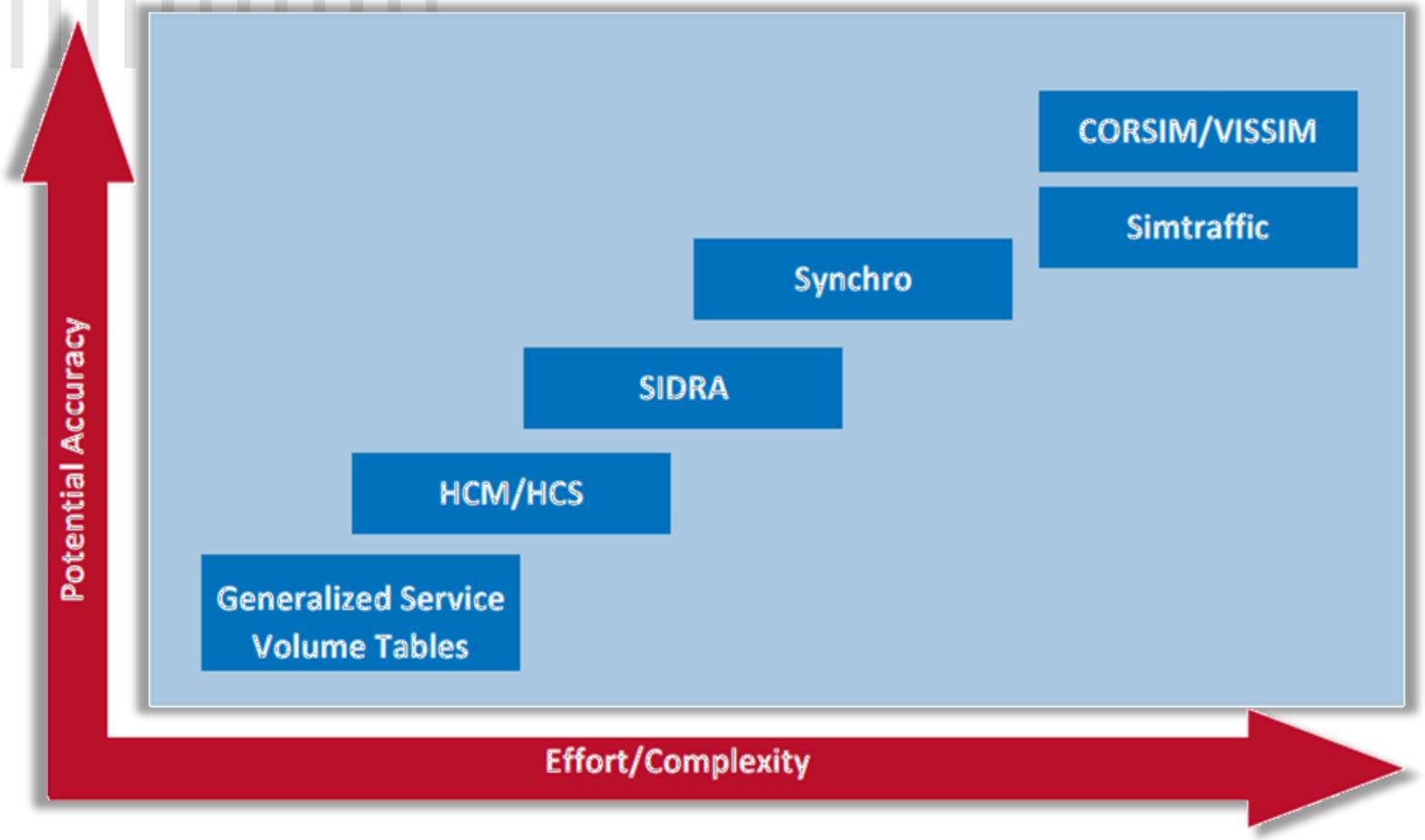
Generalized Planning

Generalized planning is imprecise in nature:

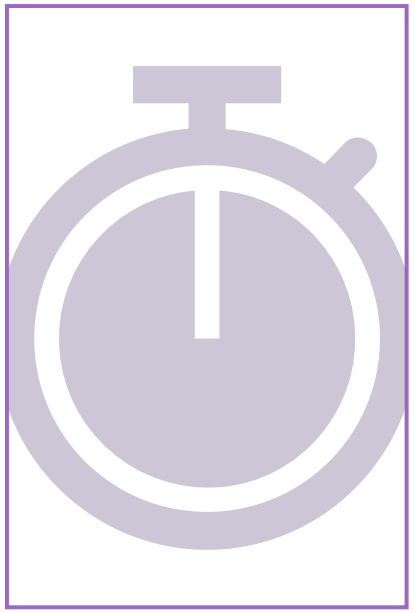
In generalized planning, one solution fits for multiple planning scenarios.



Generalized Planning

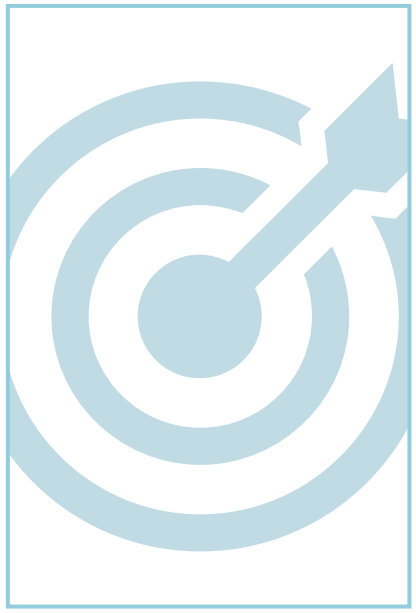


Note: Other operational analysis tools are more complex and precise but may be time-intensive and costly.



When to use generalized planning

- Planning level analysis
- Widescale analysis
- Long range planning studies
- Quick comparison of alternatives



When not to use generalized planning

- Where precision is required
- Where the facility exceeds capacity

How To Select and Use Your Tables

Determine your roadway type

FREEWAYS

High speed multilane facility with limited access

UNINTERRUPTED FLOW HIGHWAYS

Non-freeway facilities with signalized intersection spacing > two miles

ARTERIALS

Interrupted flow facilities have fixed causes of delay with average spacing less than or equal to two miles

Context Classification

For arterials, determine your context classification

Context classification has been applied to highway and arterials generalized service volume tables

Higher stratification than area types

8 context classifications applied to highways and arterials

An implementation of complete streets and supporting system towards target zero

C1- Natural | C2- Rural | C2T- Rural Town | C3R- Suburban Residential | C3C- Suburban Commercial | C4-Urban General | C5- Urban Center | C6- Urban Core

Context Classification

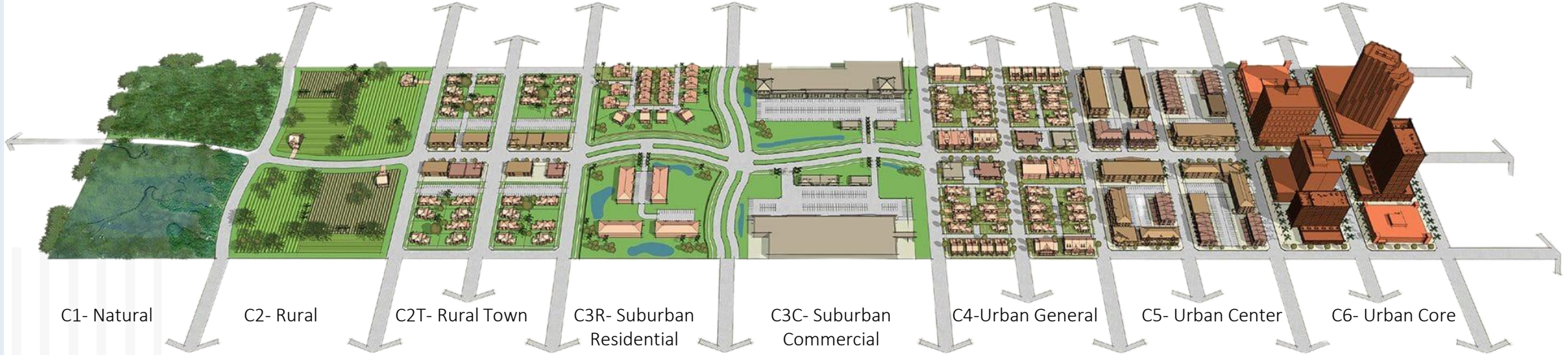
What is context classification?

A classification system which considers land use, connectivity and other factors. Useful in the implementation of complete streets.

How do we determine context classification?

You can find context classification defined in:

- RCI with feature code 126
- On Connect Ped
- The guidance included in the Complete Street's Guidebook table 2



Area Type

For freeways, determine your Area Type

Rural Area

- Population of less than 5,000

Core Urbanized Area

- Population of 1,000,000 or more

Urbanized Area

- Other urbanized areas with a population of 50,000 or more

Transitioning Area

- Transitioning from rural into urbanized areas

Table Layout

Choose your column and row based on the information you have available and the question you are trying to answer

Starting point → **D factor applied** → **K and D factor applied**

Area type or context classification

Peak Hour Directional

	B	C	D	E
2 Lane				
3 Lane				
4 Lane				
5 Lane				
6 Lane				

Peak Hour Two-Way

	B	C	D	E
4 Lane				
6 Lane				
8 Lane				
10 Lane				
12 Lane				

AADT

	B	C	D	E
4 Lane				
6 Lane				
8 Lane				
10 Lane				
12 Lane				

Directional Distribution Factor

- The percentage of the total, two-way peak hour traffic that occurs in the peak direction.

K Factor

- The proportion of AADT that occurs during the peak hour.

Adjustment Factors

Apply adjustment factors if applicable

Adjustment factors are included to account for a roadway characteristics that vary significantly from the averages used in the tables. **These adjustments should be applied to the service volumes on the tables.**

LIMITED ACCESS

Ramp Metering	Auxiliary Lanes
1.05	+20,000

Adjustment Factors

Apply adjustment factors if applicable

Adjustment factors are included to account for a roadway characteristics that vary significantly from the averages used in the tables. **These adjustments should be applied to the service volumes on the tables.**

ARTERIALS

Two lane undivided with no exclusive left turn	Two lane divided with Exclusive Left Turn Lane	Exclusive Right Turn Lane	Multilane Undivided With Exclusive Left Turn Lane	Multilane undivided No Exclusive Left Turn Lane	One Way Facility
0.8	1.05	1.05	0.95	0.75	0.60

FHWAhighways.gov

Adjustment Factors

Apply adjustment factors if applicable

Adjustment factors are included to account for a roadway characteristics that vary significantly from the averages used in the tables. **These adjustments should be applied to the service volumes on the tables.**

HIGHWAYS

2 Lane Divided Roadway with Exclusive Left Turn	Multilane Undivided with Exclusive Left Turn	Multilane Undivided without Exclusive Left Turn
1.05	0.95	0.75

Adjustment Factors

Apply adjustment factors if applicable

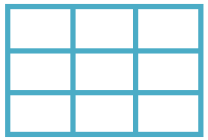
Adjustment factors are included to account for a roadway characteristics that vary significantly from the averages used in the tables. **These adjustments should be applied to the service volumes on the tables.**

NON-STATE

Non-State-Owned Facility

0.9

Type of problems you can solve for with the GSVTs



Determine LOS based on number of lanes and volume

Determine growth allowable before reaching a particular level of service

Determine number of lanes required for level of service given a volume

EXAMPLES USING TABLES

EXAMPLE 1
I-10/SR 8, D2

What is the LOS of a **4-lane** limited access roadway within a rural area? It has an AADT of **39,500**.

AADT: 39,500

Context class: N/A

Roadway type: LA

Area type: Rural

Number of lanes: 4 lanes

What is the Level of service?

a) LOS A

b) LOS B

c) LOS C

d) LOS D

Limited Access

Freeway Generalized Service Volume Tables

Peak Hour Directional

	B	C	D	E
2 Lane	2,400	3,170	3,970	4,150
3 Lane	3,390	4,600	5,810	6,130
4 Lane	4,340	6,060	7,700	8,170
5 Lane	5,480	7,450	9,680	10,390
6 Lane	6,630	9,220	11,520	12,760

Peak Hour Two-Way

	B	C	D	E
4 Lane	4,360	5,760	7,220	7,550
6 Lane	6,160	8,360	10,560	11,150
8 Lane	7,890	11,020	14,000	14,850
10 Lane	9,960	13,550	17,600	18,890
12 Lane	12,050	16,760	20,950	23,200

AADT

	B	C	D	E
4 Lane	51,300	67,800	84,900	88,800
6 Lane	72,500	98,400	124,200	131,200
8 Lane	92,800	129,600	164,700	174,700
10 Lane	117,200	159,400	207,100	222,200
12 Lane	141,800	197,200	246,500	272,900

(Core Urbanized)

	B	C	D	E
2 Lane	2,500	3,300	4,070	4,240
3 Lane	3,570	4,900	6,080	6,360
4 Lane	4,720	6,500	8,090	8,490
5 Lane	5,790	8,020	10,020	10,610

	B	C	D	E
4 Lane	4,550	6,000	7,400	7,710
6 Lane	6,490	8,910	11,050	11,560
8 Lane	8,580	11,820	14,710	15,440
10 Lane	10,530	14,580	18,220	19,290

	B	C	D	E
4 Lane	50,600	66,700	82,200	85,700
6 Lane	72,100	99,000	122,800	128,400
8 Lane	95,300	131,300	163,400	171,600
10 Lane	117,000	162,000	202,400	214,300

(Urbanized)

	B	C	D	E
2 Lane	2,430	3,180	3,790	3,910
3 Lane	3,520	4,670	5,610	5,870
4 Lane	4,630	6,170	7,440	7,830
5 Lane	5,690	7,640	9,220	9,800

	B	C	D	E
4 Lane	4,420	5,780	6,890	7,110
6 Lane	6,400	8,490	10,200	10,670
8 Lane	8,420	11,220	13,530	14,240
10 Lane	10,350	13,890	16,760	17,820

	B	C	D	E
4 Lane	45,100	59,000	70,300	72,600
6 Lane	65,300	86,600	104,100	108,900
8 Lane	85,900	114,500	138,100	145,300
10 Lane	105,600	141,700	171,000	181,800

(Transitioning)

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

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

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

(Rural)

Adjustment Factors

Auxiliary Lanes Present in Analysis Direction Adjustment: +1,000
Ramp Metering Present Adjustment: Multiply by 1.05

Auxiliary Lanes Present in Analysis Direction Adjustment: +1,800
Ramp Metering Present Adjustment: Multiply by 1.05

Auxiliary Lanes Present in Analysis Direction Adjustment: +20,000
Ramp Metering Present Adjustment: Multiply by 1.05

This table does not constitute a standard and should be used only for general planning applications. The table should not be used for corridor or intersection design, where more refined techniques exist.

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

LOS C

EXAMPLE 2
SR-820 / Pines Blvd, D4

What is the maximum AADT to **maintain LOS D** for this roadway? The **context classification is 3CR.** It is an **arterial** with **4 lanes**. There is an exclusive right turn lane.

AADT: ?

Context class: C3R

Roadway type: arterial

Number of lanes: 4

Level of service: D

Features right turn lanes

C3C & C3R

Motor Vehicle Arterial Generalized Service Volume Tables

(C3C-Suburban Commercial)

Peak Hour Directional

	B	C	D	E
1 Lane	*	760	1,070	**
2 Lane	*	1,520	1,810	**
3 Lane	*	2,360	2,680	**
4 Lane	*	3,170	3,180	**

Peak Hour Two-Way

	B	C	D	E
2 Lane	*	1,380	1,950	**
4 Lane	*	2,760	3,290	**
6 Lane	*	4,290	4,870	**
8 Lane	*	5,760	5,780	**

AADT

	B	C	D	E
2 Lane	*	15,300	21,700	**
4 Lane	*	30,700	36,600	**
6 Lane	*	47,700	54,100	**
8 Lane	*	64,000	64,200	**

(C3R-Suburban Residential)

	B	C	D	E
1 Lane	*	970	1,110	**
2 Lane	*	1,700	1,850	**
3 Lane	*	2,620	2,730	**

	B	C	D	E
2 Lane	*	1,760	2,020	**
4 Lane	*	3,090	3,360	**
6 Lane	*	4,760	4,960	**

	B	C	D	E
2 Lane	*	19,600	22,400	**
4 Lane	*	34,300	37,300	**
6 Lane	*	52,900	55,100	**

Adjustment Factors

The peak hour directional service volumes should be adjust by multiplying by 1.2 for one-way facilities
The AADT service volumes should be adjusted by multiplying 0.6 for one way facilities 2 Lane Divided Roadway with an Exclusive Left Turn Lane(s): Multiply by 1.05
2 lane Undivided Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.80
Exclusive right turn lane(s): Multiply by 1.05
Multilane Undivided Roadway with an Exclusive Left Turn Lane(s): Multiply by 0.95
Multilane Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.75
Non-State Signalized Roadway: Multiply by 0.90

This table does not constitute a standard and should be used only for general planning applications. The table should not be used for corridor or intersection design, where more refined techniques exist.
* 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.

What is the adjustment factor we are using?

a) 1.05

b) 0.80

c) 0.90

d) 0.75

	B	C	D	E
2 Lane	*	19,600	22,400	**
4 Lane	*	34,300	37,300	**
6 Lane	*	52,900	55,100	**

MSV for level of service D on a 4-lane facility with exclusive right turn lanes?

$$37300 \times 1.05 = \mathbf{39,165}$$

Example 3
Colonial Dr from SR 527 to Summerlin Av, D5

What is the LOS of a **4-lane** arterial with a **context classification C4** and an AADT of **41,000**?

AADT: 41,000

Context class: C4

Roadway type: arterial

Number of lanes: 4 lanes

C2T, C4, C5, & C6

Motor Vehicle Arterial Generalized Service Volume Tables

(C2T-Rural Town)

Peak Hour Directional

	B	C	D	E
1 Lane	*	720	940	**
2 Lane	*	1,140	1,640	**
3 Lane	*	2,120	2,510	**

Peak Hour Two-Way

	B	C	D	E
2 Lane	*	1,310	1,710	**
4 Lane	*	2,070	2,980	**
6 Lane	*	3,850	4,560	**

AADT

	B	C	D	E
2 Lane	*	13,800	18,000	**
4 Lane	*	21,800	31,400	**
6 Lane	*	40,500	48,000	**

(C4-Urban General)

	B	C	D	E
1 Lane	*	*	870	1,190
2 Lane	*	1,210	1,790	2,020
3 Lane	*	2,210	2,810	2,990
4 Lane	*	2,590	3,310	3,510

	B	C	D	E
2 Lane	*	*	1,580	2,160
4 Lane	*	2,200	3,250	3,670
6 Lane	*	4,020	5,110	5,440
8 Lane	*	4,710	6,020	6,380

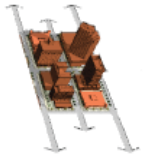
	B	C	D	E
2 Lane	*	*	17,600	24,000
4 Lane	*	24,400	36,100	40,800
6 Lane	*	44,700	56,800	60,400
8 Lane	*	52,300	66,900	70,900

(C5-Urban Center)

	B	C	D	E
1 Lane	*	*	690	1,080
2 Lane	*	1,290	1,900	2,130
3 Lane	*	1,410	2,670	3,110
4 Lane	*	2,910	3,560	3,640

	B	C	D	E
2 Lane	*	*	1,250	1,960
4 Lane	*	2,350	3,450	3,870
6 Lane	*	2,560	4,850	5,650
8 Lane	*	5,290	6,470	6,620

	B	C	D	E
2 Lane	*	*	13,900	21,800
4 Lane	*	26,100	38,300	43,000
6 Lane	*	28,400	53,900	62,800
8 Lane	*	58,800	71,900	73,600



(C6-Urban Core)

	B	C	D	E
1 Lane	*	***	790	1,030
2 Lane	*	***	1,490	1,920
3 Lane	*	***	2,730	2,940
4 Lane	*	***	3,250	3,490

	B	C	D	E
2 Lane	*	***	1,440	1,870
4 Lane	*	***	2,710	3,490
6 Lane	*	***	4,960	5,350
8 Lane	*	***	5,910	6,350

	B	C	D	E
2 Lane	*	***	16,000	20,800
4 Lane	*	***	30,100	38,800
6 Lane	*	***	55,100	59,400
8 Lane	*	***	65,700	70,600

Adjustment Factors

The peak hour directional service volumes should be adjust by multiplying by 1.2 for one-way facilities
The AADT service volumes should be adjusted by multiplying 0.6 for one way facilities 2 Lane Divided Roadway with an Exclusive Left Turn Lane(s): Multiply by 1.05
2 lane Undivided Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.80
Exclusive right turn lane(s): Multiply by 1.05
Multilane Undivided Roadway with an Exclusive Left Turn Lane(s): Multiply by 0.95
Multilane Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.75
Non-State Signalized Roadway: Multiply by 0.90

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* 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.

	B	C	D	E
2 Lane	*	*	17,600	24,000
4 Lane	*	24,400	36,100	40,800
6 Lane	*	44,700	56,800	60,400
8 Lane	*	52,300	66,900	70,900

How can we achieve LOS D or better on this facility?

a) Add exclusive left turn

b) Add exclusive right turn

c) Add a lane on both sides

d) Both a and b

The peak hour directional service volumes should be adjust by multiplying by 1.2 for one-way facilities
The AADT service volumes should be adjusted by multiplying 0.6 for one way facilities 2 Lane Divided Roadway with an Exclusive Left Turn Lane(s): Multiply by 1.05
2 lane Undivided Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.80

Exclusive right turn lane(s): Multiply by 1.05
Multilane Undivided Roadway with an Exclusive Left Turn Lane(s): Multiply by 0.95
Multilane Roadway with No Exclusive Left Turn Lane(s): Multiply by 0.75
Non-State Signalized Roadway: Multiply by 0.90

LOS F

AADT: 41,000

Context class: C4

Number of lanes: 4 lanes

Example 4
Ingraham Highway, D4

What is the growth allowable of **2-lane** highway with a **context classification C2** and AADT of **2,600,** before reaching LOS C?

AADT: 2,600

Context class: C2

Roadway type: highway

Number of lanes: 2 lanes

What is the growth allowable before reaching LOS C?

a) 2,600

b) 11,400

c) 5,600

C1 & C2

Motor Vehicle Highway Generalized Service Volume Tables

(C1-Natural & C2-Rural)

Peak Hour Directional

	B	C	D	E
1 Lane	240	430	730	1,490
2 Lane	1,670	2,390	2,910	3,340
3 Lane	2,510	3,570	4,370	5,010

Peak Hour Two-Way

	B	C	D	E
2 Lane	440	780	1,330	2,710
4 Lane	3,040	4,350	5,290	6,070
6 Lane	4,560	6,490	7,950	9,110

AADT

	B	C	D	E
2 Lane	4,600	8,200	14,000	28,500
4 Lane	32,000	45,800	55,700	63,900
6 Lane	48,000	68,300	83,700	95,900

Adjustment Factors

2 Lane Divided Roadway with Exclusive Left Turn Adjustment: Multiply by 1.05
Multilane Undivided Highway with Exclusive Left Turn Adjustment: Multiply by 0.95
Multilane Undivided Highway without Exclusive Left Turn Adjustment:: Multiply by 0.75

This table does not constitute a standard and should be used only for general planning applications. The table should not be used for corridor or intersection design, where more refined techniques exist.

AADT

	B	C	D	E
2 Lane	4,600	8,200	14,000	28,500
4 Lane	32,000	45,800	55,700	63,900
6 Lane	48,000	68,300	83,700	95,900

8200-2600=5600

Bicycle and Pedestrian Level of Traffic Stress

As outlined in the Multimodal Quality/Level of Service Handbook 2023

POLL

How familiar are you with Level of Traffic Stress?

Not Familiar

Somewhat Familiar

Very Familiar

Overview/Background


Source: Miami Herald

Bike and Ped quality of service is not based on level of service but instead on **Level of Traffic Stress (LTS)**

LTS provides a simple methodology that works with **easily obtainable** inputs

Based on methodology developed in 2012 by the **Minneta Transportation Institute at San Jose State University**

What is level of traffic stress?

- Level of traffic stress or LTS, measures the quality of service for pedestrians and bicyclists (BLTS, PLTS).
- The scale is defined by the type of user that find the facility comfortable. Levels 1 being the most comfortable for most users and 4 being the most uncomfortable for most user.
- LTS applies to context classifications C2T, C3C, C3R, C4, C5, C6.

Level of Traffic Stress as a Measure of Quality of Service

A traveler-based/user's perception of how well a transportation service or facility operates.

What it is not

- A measure of safety
- A measure of ADA accessibility

How may it be used in FDOT

- For QLOS handbook, to evaluate a facility and the performance of the system at a high level
- Assist in determining needs
- Compare alternatives

LTS Levels

BLTS 1

Most children can use confidently.

BLTS 2

Will be tolerated by most adults.

BLTS 3

Tolerated by confident cyclists who still prefer having their own dedicated space for riding.

BLTS 4

Tolerated only by those with limited route or mode choice or cycling enthusiasts that choose to ride under stressful conditions.

LTS Levels

PLTS 1

Suitable for all users including teenagers traveling alone, the elderly, and people using a wheeled mobility device. People feel safe and comfortable on the pedestrian facility and all users are willing to use the facility.

PLTS 2

All users can use the facility and most users are willing to use the facility.

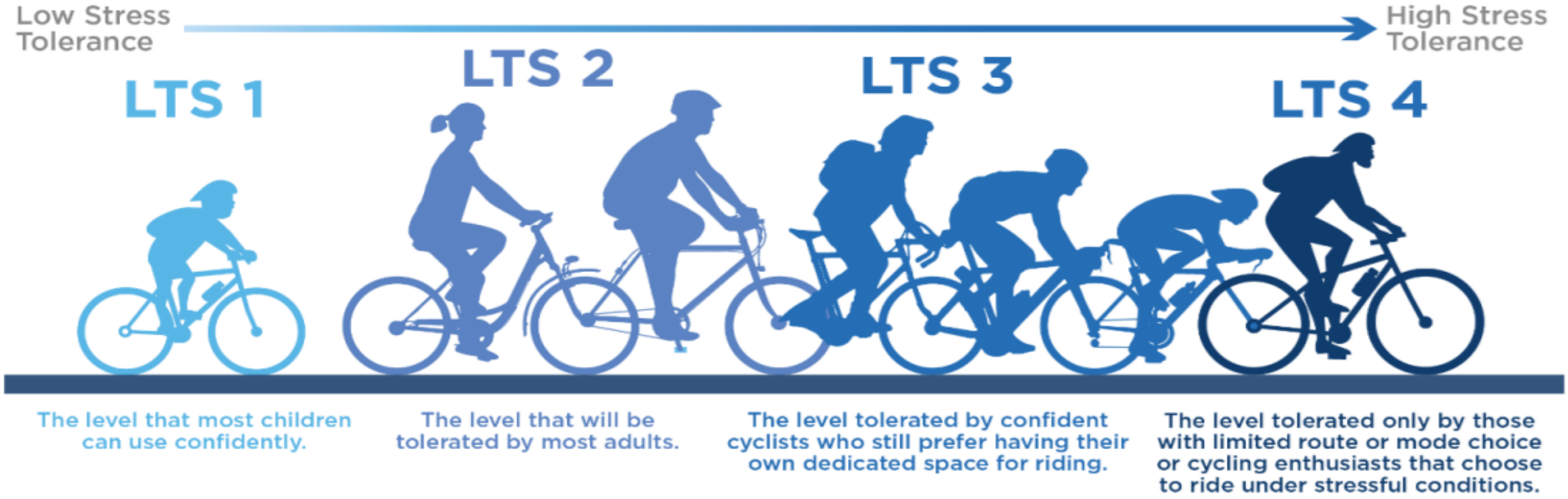
PLTS 3

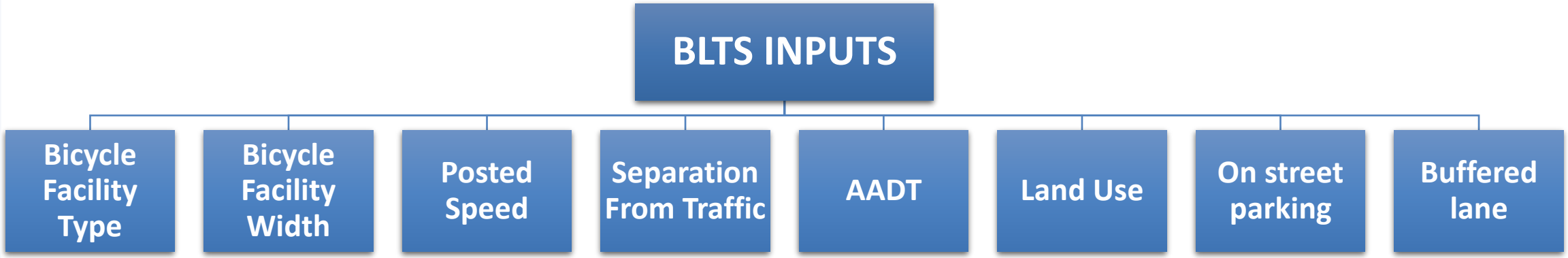
Some users are willing to use this facility, but others may only use the facility when there are limited route and mode choices available.

PLTS 4

Difficult or impassible by a wheeled mobility device or users with other limitations in their movement and most likely used by users with limited route and mode choice.

Bicyclist Level of Traffic Stress



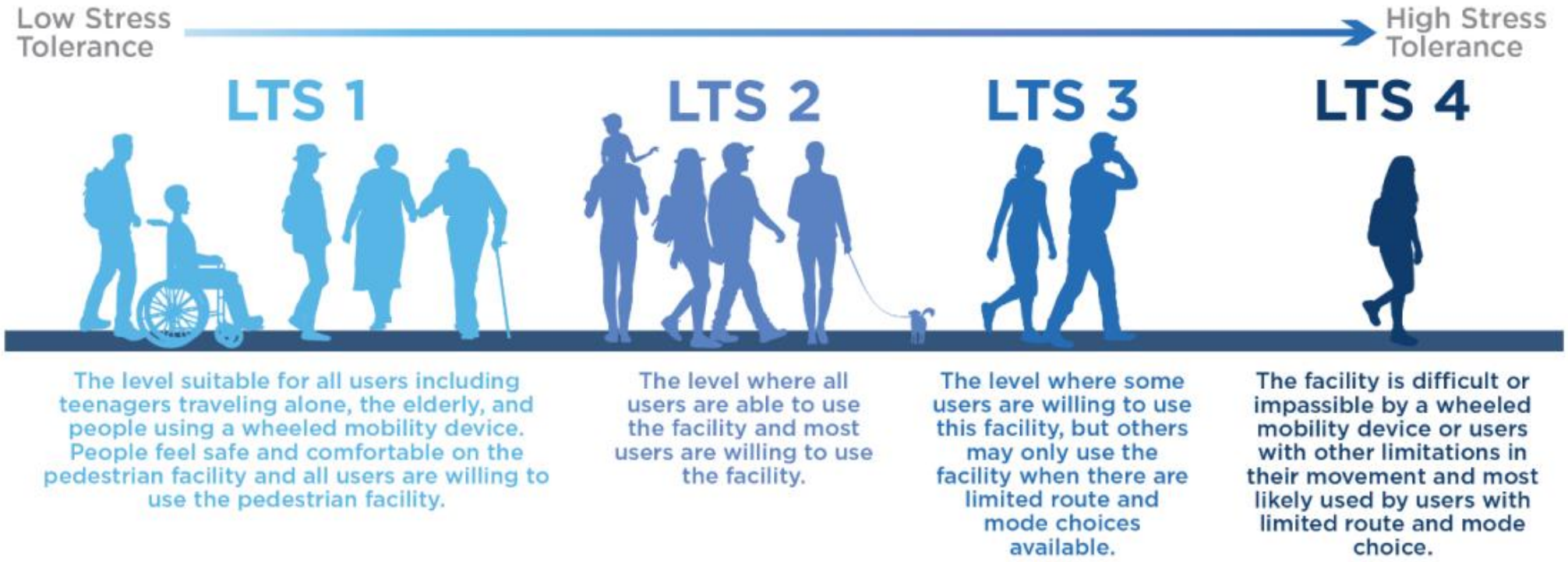


Sharrow

Marked Shoulder/Paved shoulder

Separated Bike Lane

Pedestrian Level of Traffic Stress



PLTS Inputs

- Existence of a Sidewalk
- Sidewalk Continuity
- Sidewalk Width
- Posted Speed
- Lateral Separation
- Vertical Separation

Types of Separation

Level of Traffic Stress Considerations

LTS considers a few important factors that allow a quick simple analysis, it does not include some other important factors such as:

- **Delay at intersections**
- **Network connectivity**
- **Pavement condition**
- **Driveway density**
- **Lighting**

Note: This is the first iteration of the Level of Traffic Stress Flowcharts by FDOT.

Through user experience and data availability over time, the flowcharts will continue to be improved

Bicycle Level of Traffic Stress Flow Chart to use When Bicycle Facility is Present

C2T, C3C, C3R, C4, C5, & C6

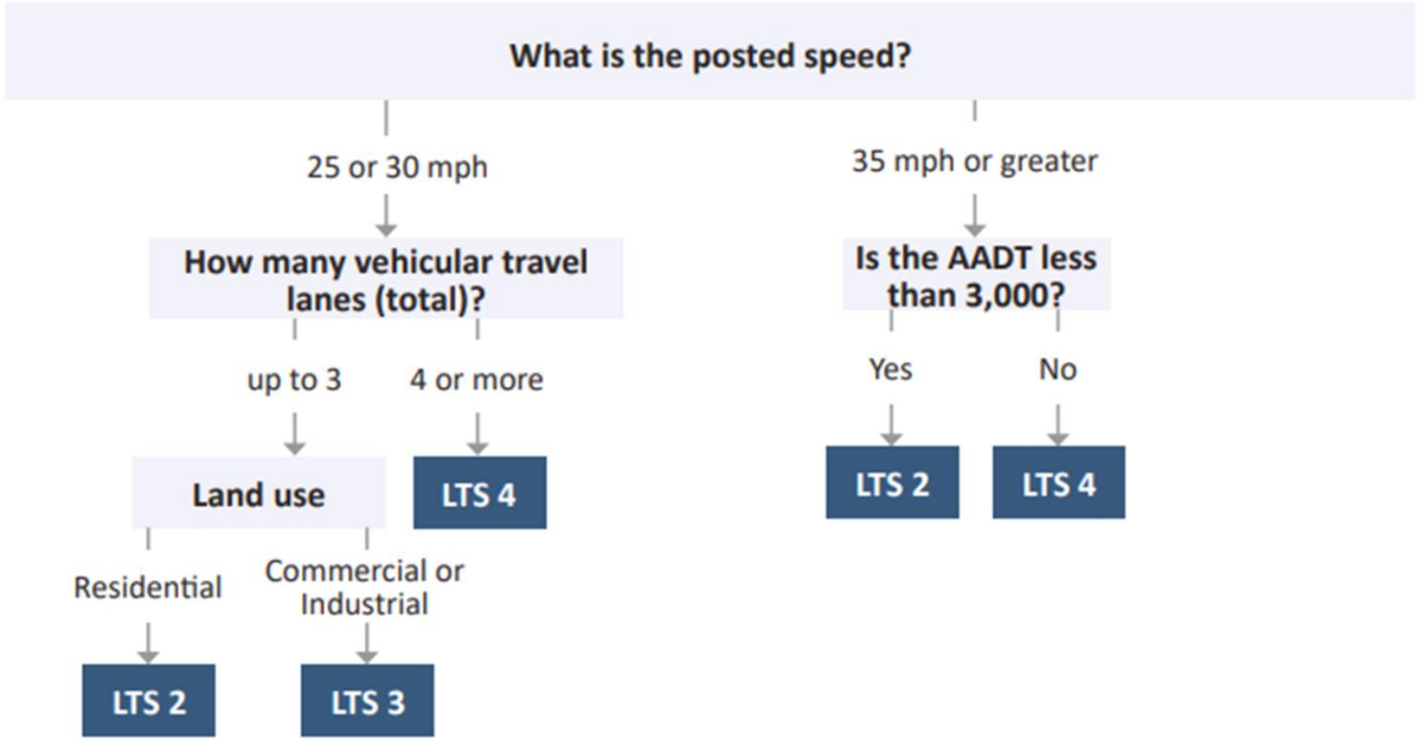
What kind of bicycle facility is present?

- Separated Bicycle Lane, Shared Use Path, or Urban Side Path → **LTS 1**
- Bicycle Lane, Marked Shoulder, or Paved Shoulder → **Is the posted speed 40 mph or more?**
  - Yes → **LTS 4**
  - No → **Is the AADT less than or equal to 7,000?**
    - Yes → **LTS 1**
    - No → **Is the posted speed 35 mph?**
      - Yes → **Is there a buffered bicycle lane?**
        - Yes → **LTS 2**
        - No → **LTS 3**
      - No → **Is the bicycle facility next to on-street parking?**
        - Yes → **Width of the bicycle lane and separation**
          - Greater than or equal to 7′ → **LTS 1**
          - 5′ or 6′ → **LTS 2**
          - 4′ → **LTS 3**
        - No → **Width of the bicycle lane**
          - Greater than or equal to 6′ → **LTS 1**
          - 5′ → **LTS 2**
          - 4′ → **LTS 3**
- Sharrow or None → **Use bicycle level of traffic stress assessment for when bicycle facility is not present**

Notes:
1) This chart does not constitute a standard and should be used only for general planning applications. The chart should not be used for corridor or intersection design, where more refined techniques exist.
2) If there is both a separated bicycle lane, shared use path or urban side path and a bicycle lane, marked shoulder, or paved shoulder, evaluate the facility as having a shared use path

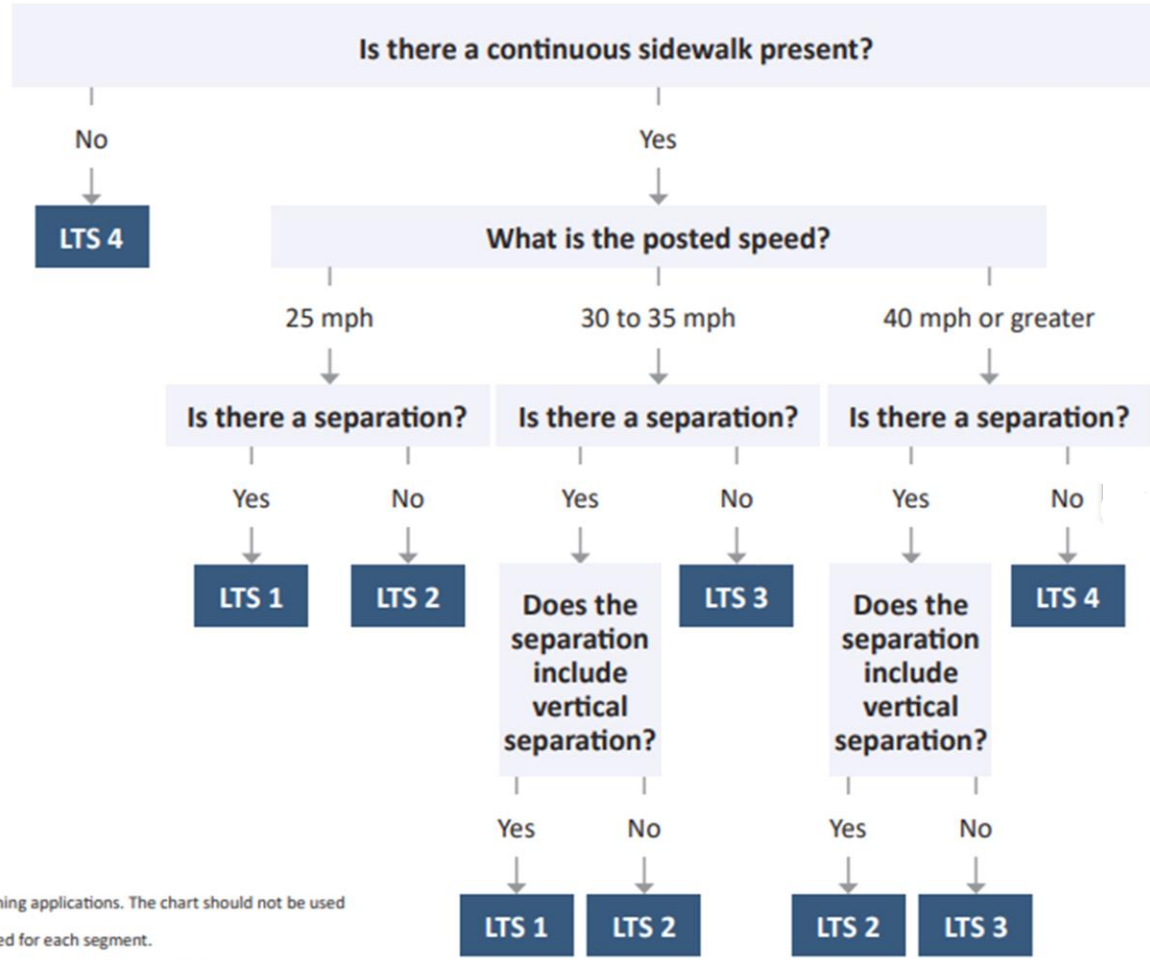
Bicycle Level of Traffic Stress Flow Chart to use When No Bicycle Facility is Present or When There are Sharrows Present

C2T, C3C, C3R, C4, C5, & C6



Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



Notes:
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2) This analysis is conducted for each side of the road and the worst side PLTS is applied for each segment.
3) If the sidewalk width is less than or equal to 5 feet, reduce the PLTS by 1.
4) Separation is defined by space between the outside vehicular travel lane and sidewalk and can include bicycle lanes, unmarked shoulders, street furniture, vertical separation, landscaping, or utility strips. Vertical separation in the separation includes tubular markers, islands, on-street parking, rigid barriers, and landscaping.
5) Sidewalk space over 6 feet can be evaluated as part of the separation.

LTS Notes:

- ***This chart does not constitute a standard and should be used only for general planning applications.***

- ***For both BLTS and PLTS, scores are calculated separately for each side of the road, and the higher (more stressful) value is assigned as the overall score for the segment.***

Pedestrian LTS Notes:

If the sidewalk width is less than or equal to 5 feet, **increase the PLTS** by 1.

Separation is defined by space between the outside vehicular travel lane and sidewalk

Vertical separation includes tubular markers, islands, on-street parking, rigid barriers, and landscaping.

Sidewalk space **over 6 feet** can be evaluated as part of the separation.

Bicycle LTS Notes:

Jacksonville, E City

If there is both a separated bicycle lane, shared use path or urban side path and a bicycle lane, marked shoulder, or paved shoulder, **evaluate the facility as having a shared use path**.

POLL

What is the minimum width of the sidewalk before it experiences a traffic stress increase of one LTS point?

A) 6

B) 5

C) 4

D) 7

EXAMPLES USING FLOWCHARTS

EXAMPLE 1

SR 441, VOLUSIA COUNTY

Bicycle Facility: None

Sidewalk: One side

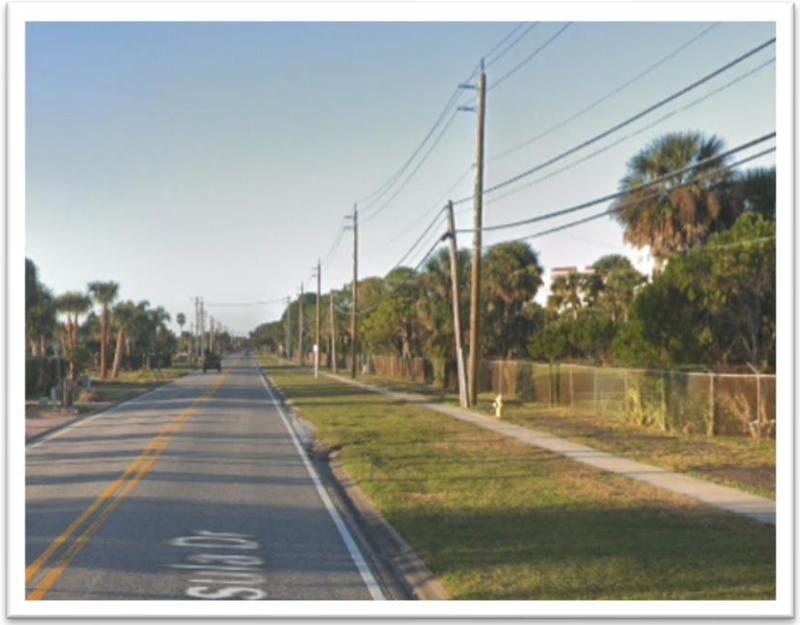
Sidewalk Width: 4 ft

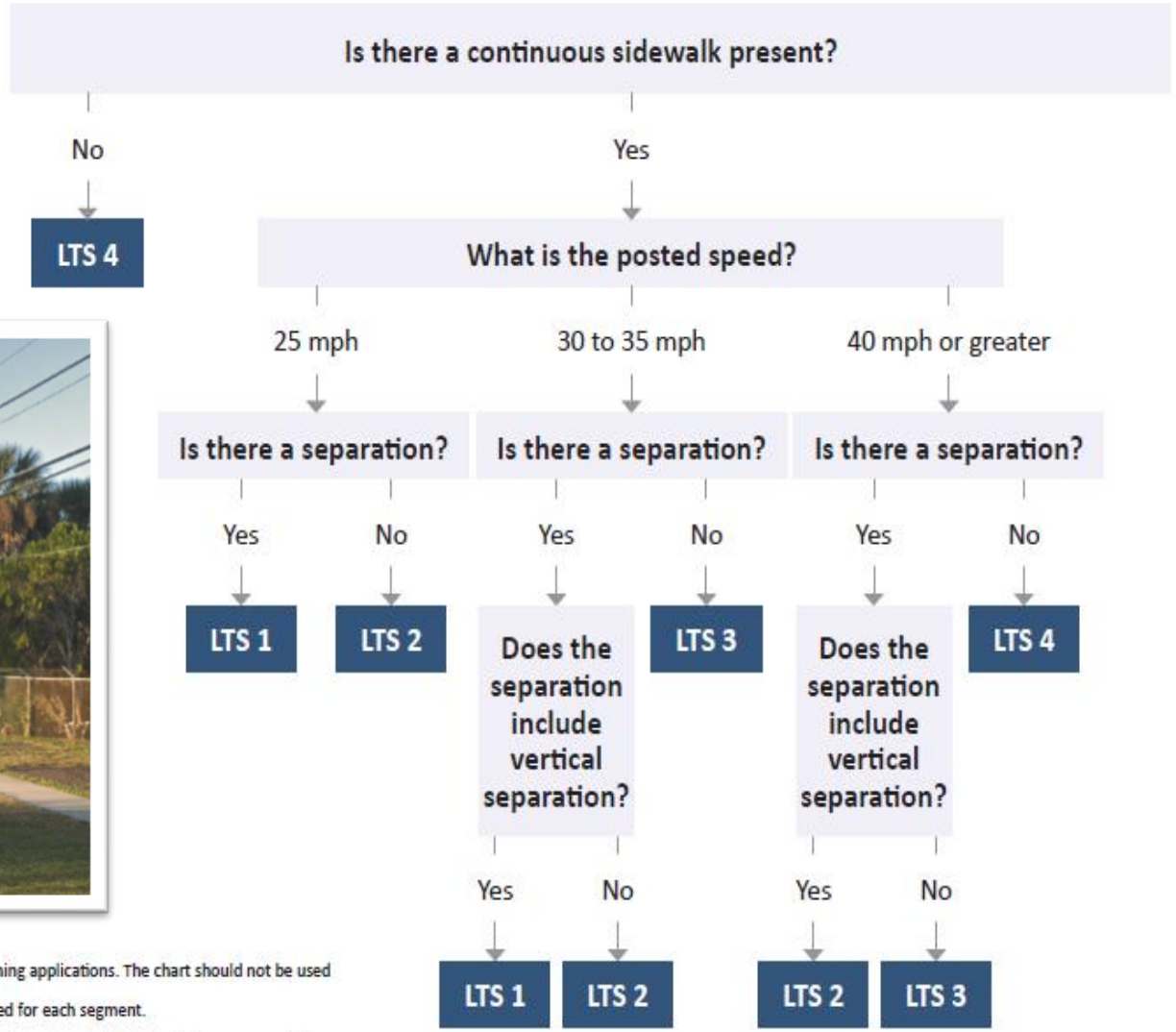
Posted Speed: 40 mph

AADT: 5.8 K

Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6





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5) Sidewalk space over 6 feet can be evaluated as part of the separation.

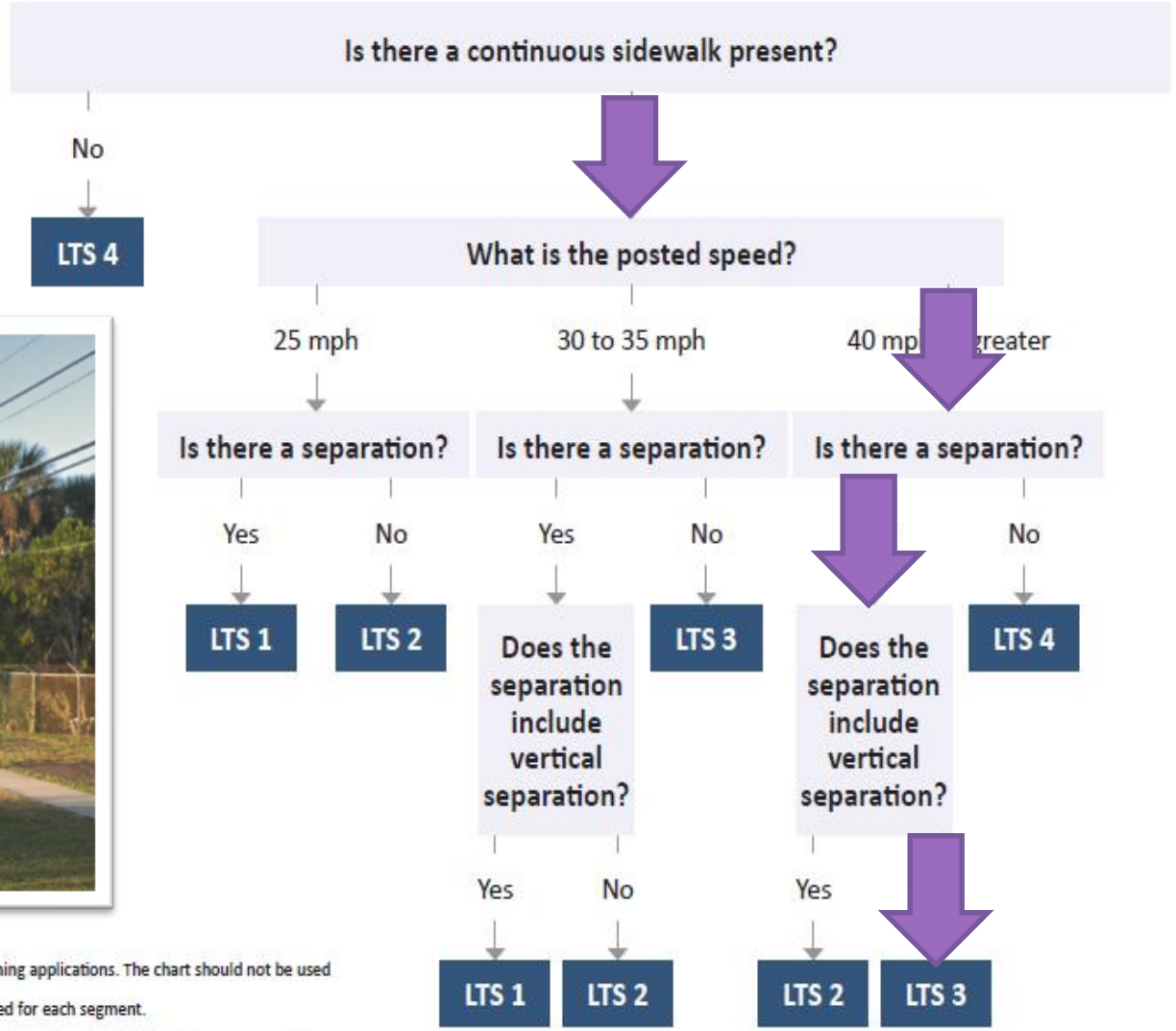
Sidewalk: One side

Sidewalk Width: 4 ft

Posted Speed: 40 mph

Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



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5) Sidewalk space over 6 feet can be evaluated as part of the separation.

Sidewalk: One side

Sidewalk Width: 4 ft

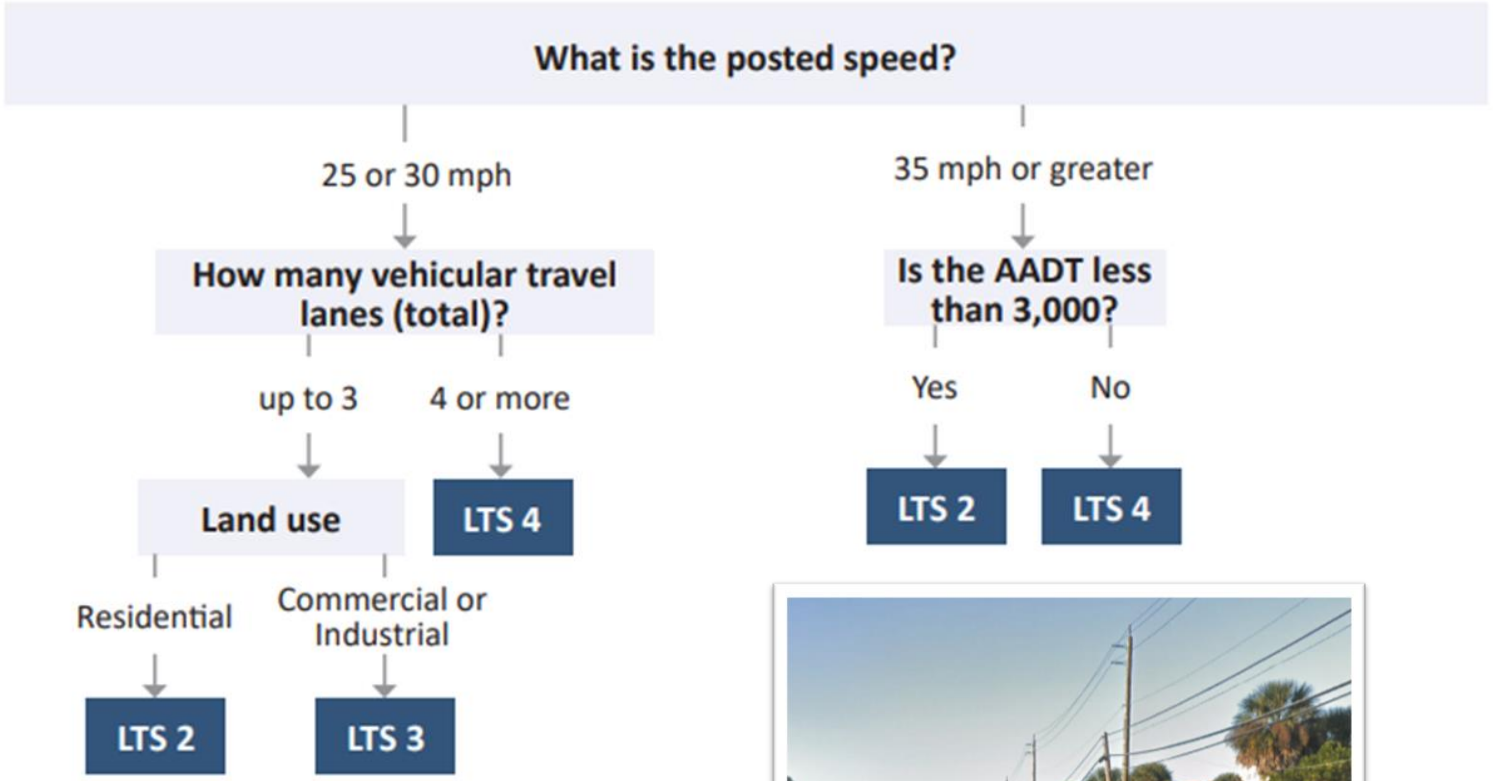
Posted Speed: 40 mph

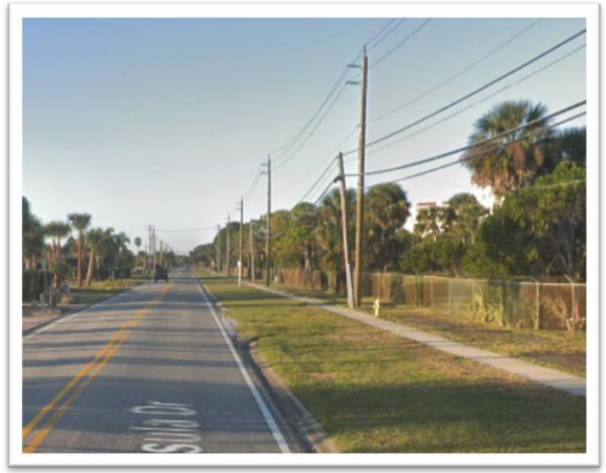
Plus 1 LTS due to 5 ft or less sidewalk width

PLTS = 4

Bicycle Level of Traffic Stress Flow Chart to use When No Bicycle Facility is Present or When There are Sharrows Present

C2T, C3C, C3R, C4, C5, & C6





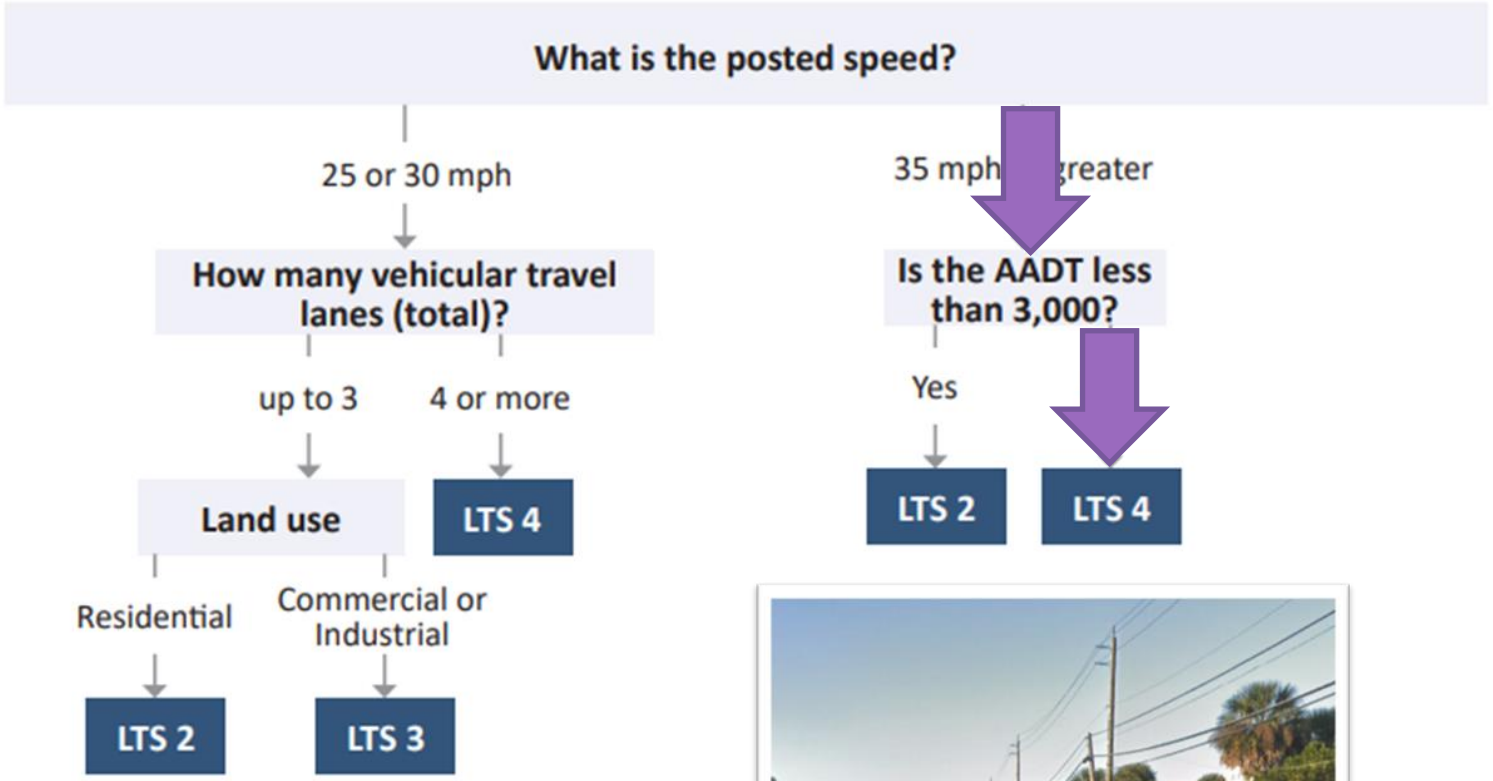
Bicycle Facility: None

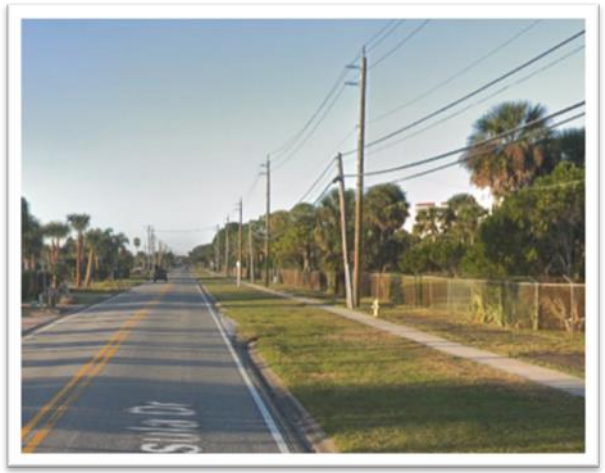
Posted Speed: 40 mph

AADT: 5.8 k

Bicycle Level of Traffic Stress Flow Chart to use When No Bicycle Facility is Present or When There are Sharrows Present

C2T, C3C, C3R, C4, C5, & C6





Bicycle Facility: None

Posted Speed: 40 mph

AADT: 5.8 k

BLTS = 4

EXAMPLE 2

US 1, BROWARD COUNTY

Bicycle Facility: Marked shoulder

Sidewalk: Both sides

Sidewalk Width: 7 ft

Posted Speed: 35 mph

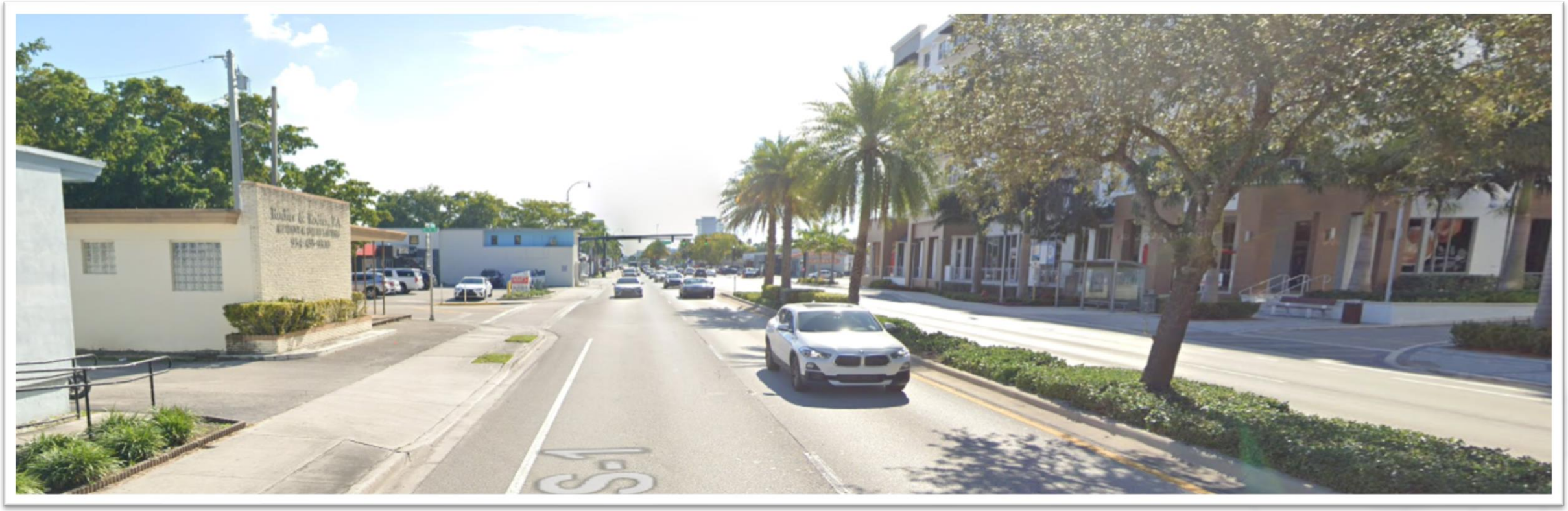
AADT: 33 K

POLL

Is there separation present (lateral) for the sidewalk on this facility?

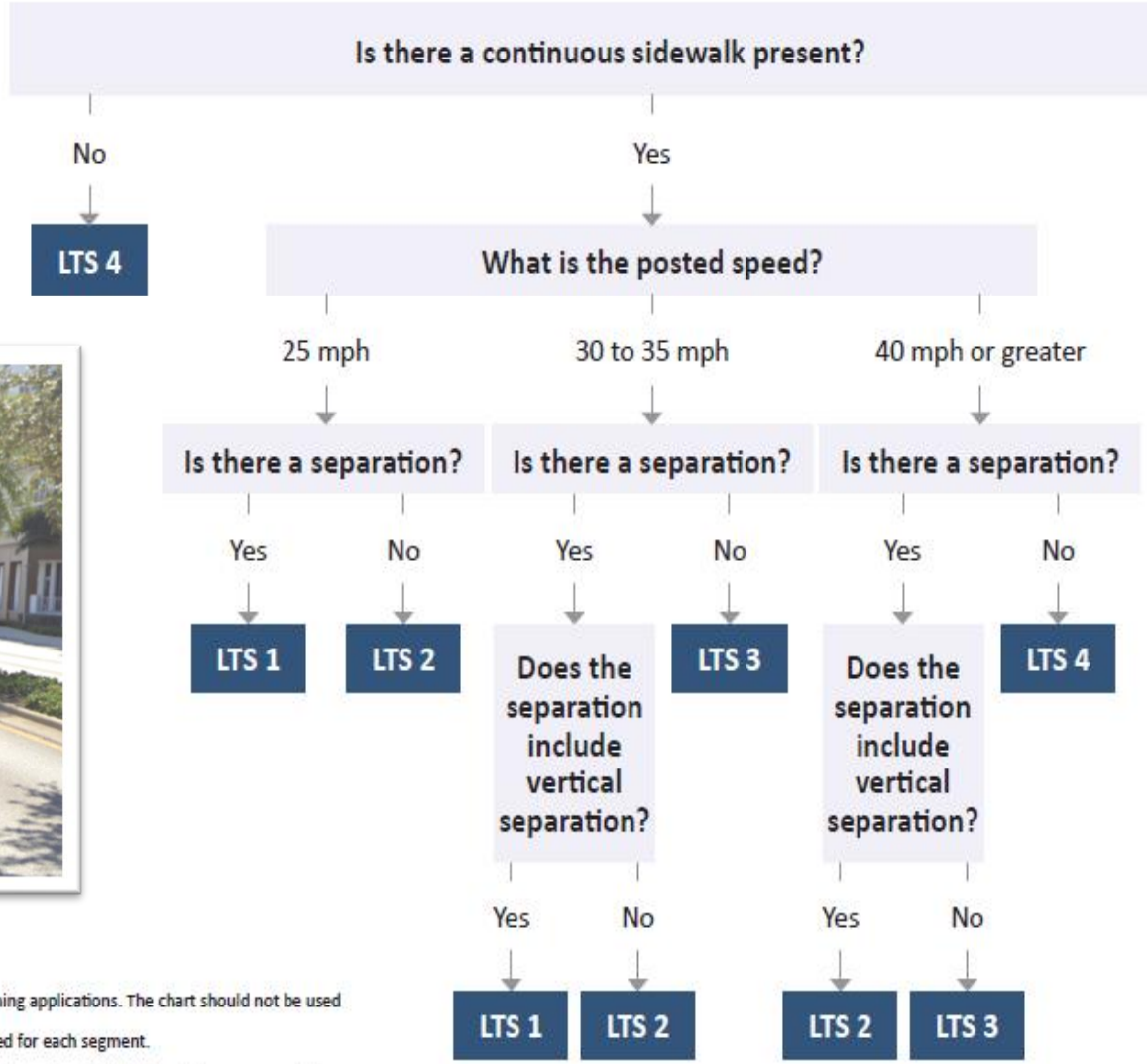
A) Yes

B) No



Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



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3) If the sidewalk width is less than or equal to 5 feet, reduce the PLTS by 1.
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5) Sidewalk space over 6 feet can be evaluated as part of the separation.

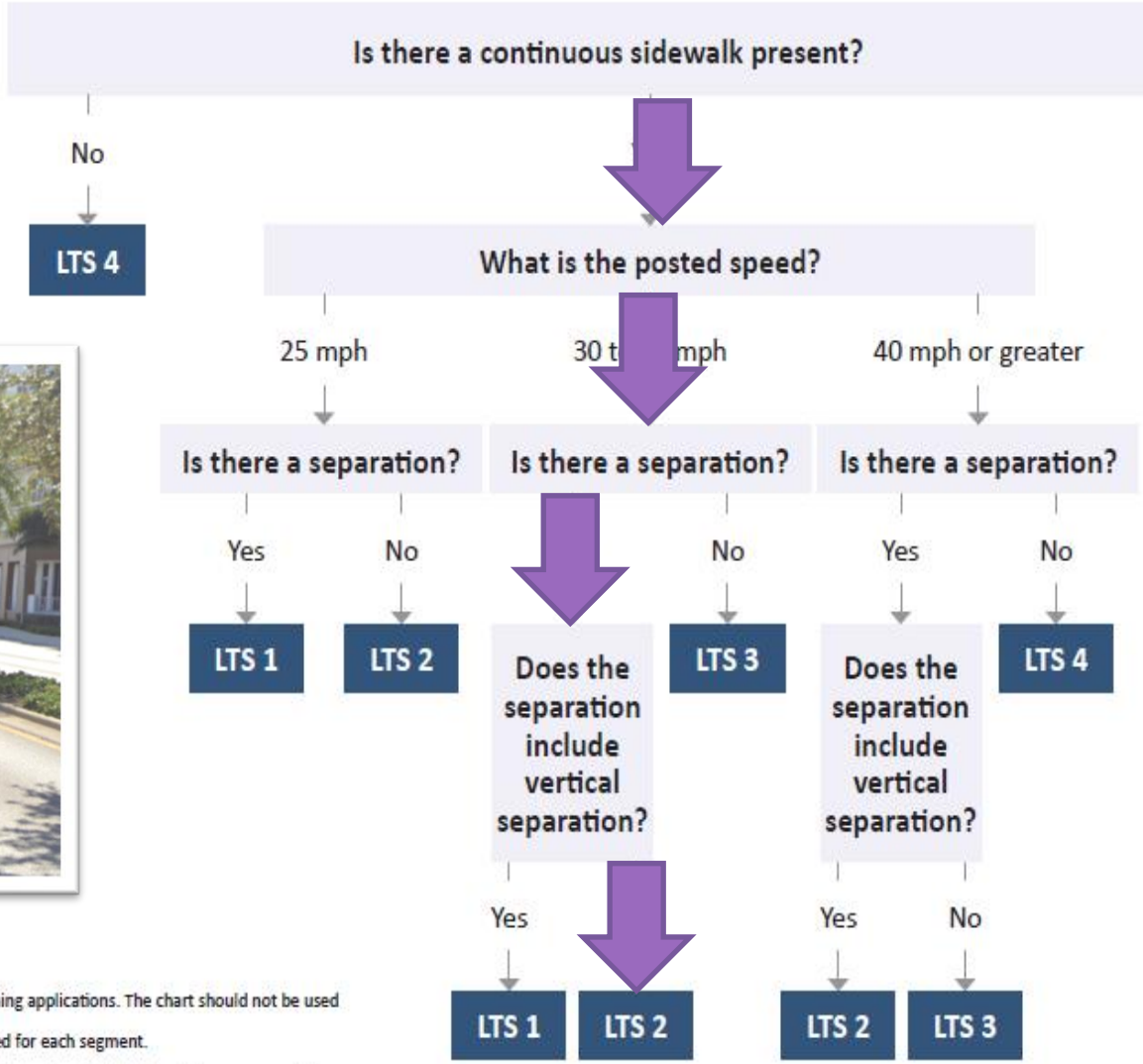
Sidewalk: Both sides

Sidewalk Width: 7 ft

Posted Speed: 35 mph

Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



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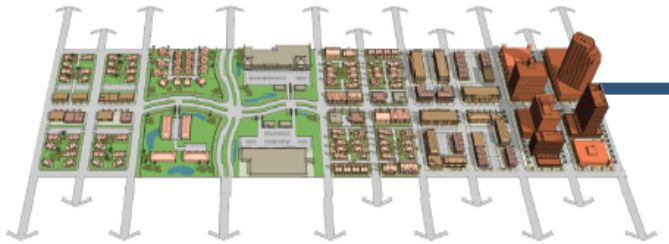
5) Sidewalk space over 6 feet can be evaluated as part of the separation.

Sidewalk: Both Sides

Sidewalk Width: 7 ft

Posted Speed: 35 mph

PLTS=2



Bicycle Level of Traffic Stress Flow Chart to use When Bicycle Facility is Present

C2T, C3C, C3R, C4, C5, & C6

What kind of bicycle facility is present?

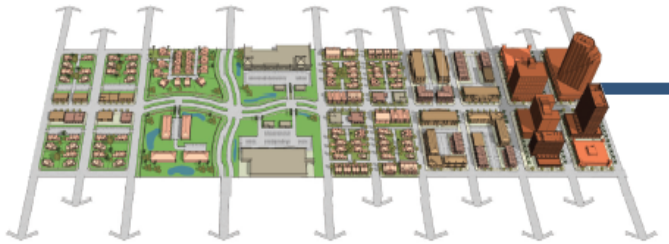
- Separated Bicycle Lane, Shared Use Path, or Urban Side Path → **LTS 1**
- Bicycle Lane, Marked Shoulder, or Paved Shoulder → **Is the posted speed 40 mph or more?**
  - Yes → **LTS 4**
  - No → **Is the AADT less than or equal to 7,000?**
    - Yes → **LTS 1**
    - No → **Is the posted speed 35 mph?**
      - Yes → **Is there a buffered bicycle lane?**
        - Yes → **LTS 2**
        - No → **LTS 3**
      - No → **Is the bicycle facility next to on-street parking?**
        - Yes → **Width of the bicycle lane and separation**
          - Greater than or equal to 7′ → **LTS 1**
          - 5′ or 6′ → **LTS 2**
          - 4′ → **LTS 3**
        - No → **Width of the bicycle lane**
          - Greater than or equal to 6′ → **LTS 1**
          - 5′ → **LTS 2**
          - 4′ → **LTS 3**
- Sharrow or None → **Use bicycle level of traffic stress assessment for when bicycle facility is not present**

Notes:
1) This chart does not constitute a standard and should be used only for general planning applications. The chart should not be used for corridor or intersection design, where more refined techniques exist.
2) If there is both a separated bicycle lane, shared use path or urban side path and a bicycle lane, marked shoulder, or paved shoulder, evaluate the facility as having a shared use path

Bicycle Facility:
Marked shoulder

Posted Speed:
35 mph

AADT:
33 k



Bicycle Level of Traffic Stress Flow Chart to use When Bicycle Facility is Present

C2T, C3C, C3R, C4, C5, & C6

What kind of bicycle facility is present?

- Separated Bicycle Lane, Shared Use Path, or Urban Side Path → **LTS 1**
- Bicycle Lane, ...ed Shoulder, or Pa... ...ulder → **Is the posted speed 40 mph or more?**
  - Yes → **LTS 4**
  - **Is the AADT less than or equal to 7,000?**
    - Yes → **LTS 1**
    - **Is the posted speed 35 mph?**
      - **Is there a buffered bicycle lane?**
        - Yes → **LTS 2**
        - **LTS 3**
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          - 4′ → **LTS 3**
        - No → **Width of the bicycle lane**
          - Greater than or equal to 6′ → **LTS 1**
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          - 4′ → **LTS 3**
- Sharrow or None → **Use bicycle level of traffic stress assessment for when bicycle facility is not present**

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2) If there is both a separated bicycle lane, shared use path or urban side path and a bicycle lane, marked shoulder, or paved shoulder, evaluate the facility as having a shared use path

Bicycle Facility:
Marked shoulder

Posted Speed:
35 mph

AADT:
33 k

BLTS = 3

EXAMPLE 3

N BLAIRE STONE RD, LEON COUNTY

Bicycle Facility: Marked bicycle lane

Sidewalk: Both sides

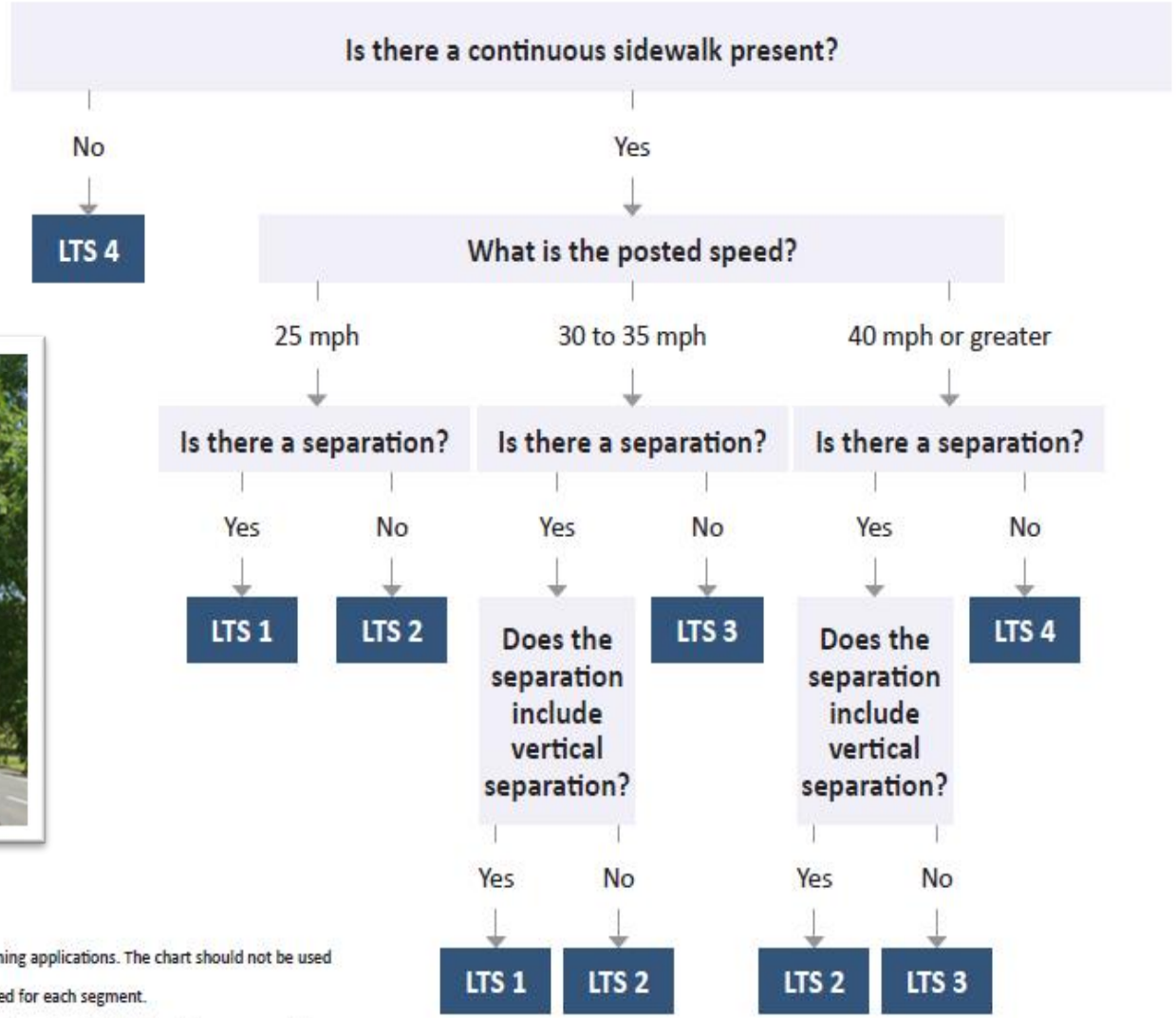
Sidewalk Width: 5 ft

Posted Speed: 35 mph

AADT: 12 k

Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



Notes:
1) This chart does not constitute a standard and should be used only for general planning applications. The chart should not be used for corridor or intersection design, where more refined techniques exist.
2) This analysis is conducted for each side of the road and the worst side PLTS is applied for each segment.
3) If the sidewalk width is less than or equal to 5 feet, reduce the PLTS by 1.
4) Separation is defined by space between the outside vehicular travel lane and sidewalk and can include bicycle lanes, unmarked shoulders, street furniture, vertical separation, landscaping, or utility strips. Vertical separation in the separation includes tubular markers, islands, on-street parking, rigid barriers, and landscaping.
5) Sidewalk space over 6 feet can be evaluated as part of the separation.

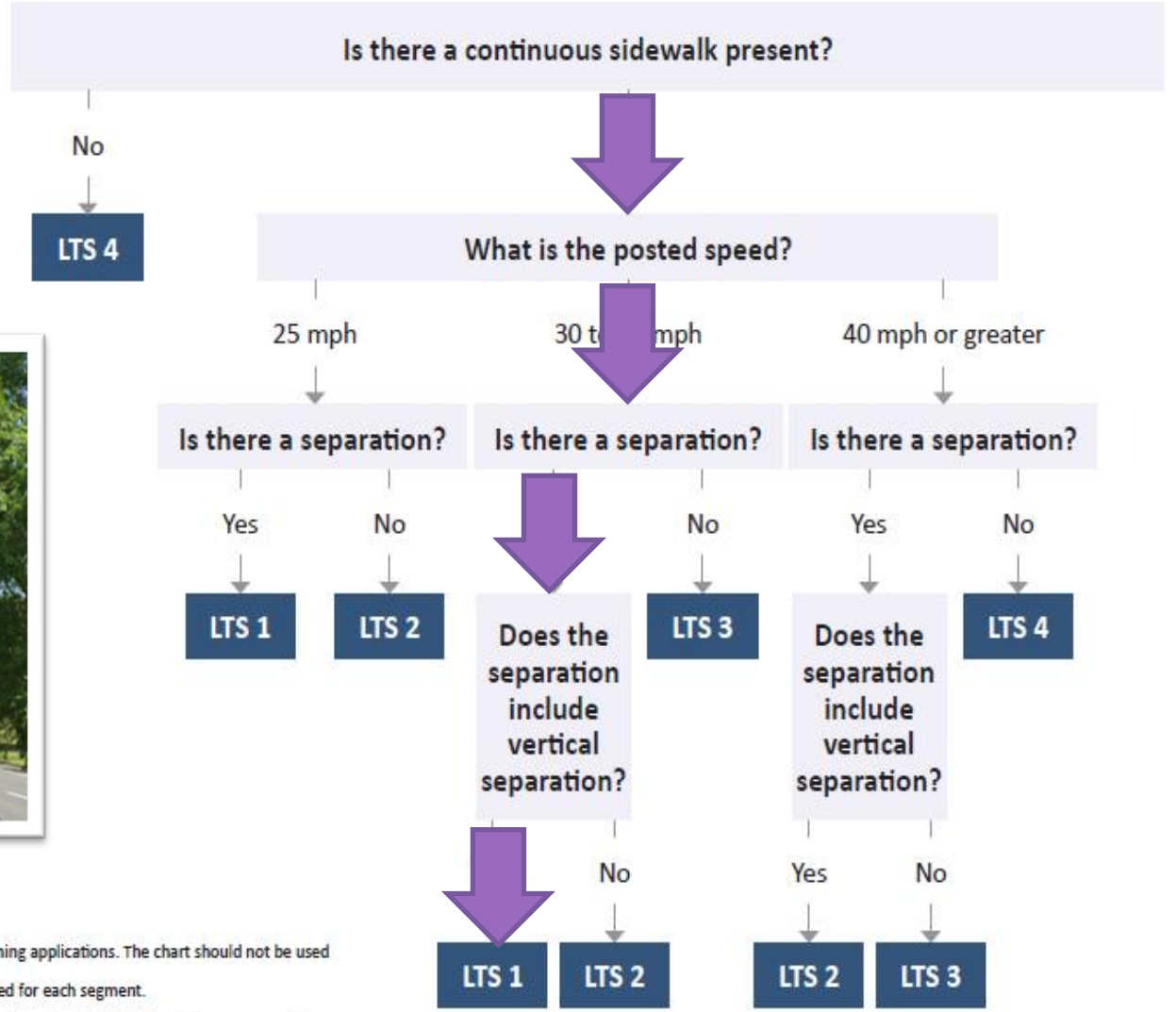
Sidewalk: Both sides

Sidewalk Width: 5 ft

Posted Speed: 35 mph

Pedestrian Level of Traffic Stress Flow Chart

C2T, C3C, C3R, C4, C5, & C6



Notes:
1) This chart does not constitute a standard and should be used only for general planning applications. The chart should not be used for corridor or intersection design, where more refined techniques exist.
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5) Sidewalk space over 6 feet can be evaluated as part of the separation.

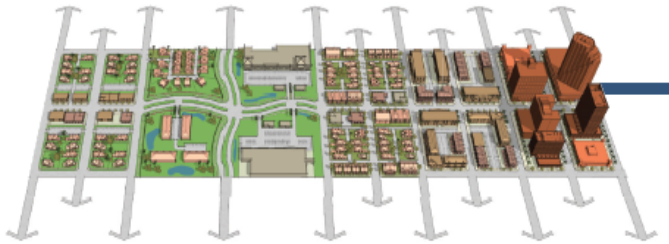
Sidewalk: Both sides

Sidewalk Width: 5 ft

Posted Speed: 35 mph

Minus 1 LTS due to 5 ft or less sidewalk width

PLTS =2



Bicycle Level of Traffic Stress Flow Chart to use When Bicycle Facility is Present

C2T, C3C, C3R, C4, C5, & C6

What kind of bicycle facility is present?

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- Bicycle Lane, Marked Shoulder, or Paved Shoulder → **Is the posted speed 40 mph or more?**
  - Yes → **LTS 4**
  - No → **Is the AADT less than or equal to 7,000?**
    - Yes → **LTS 1**
    - No → **Is the posted speed 35 mph?**
      - Yes → **Is there a buffered bicycle lane?**
        - Yes → **LTS 2**
        - No → **LTS 3**
      - No → **Is the bicycle facility next to on-street parking?**
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          - Greater than or equal to 7′ → **LTS 1**
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          - 4′ → **LTS 3**
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          - Greater than or equal to 6′ → **LTS 1**
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          - 4′ → **LTS 3**
- Sharrow or None → **Use bicycle level of traffic stress assessment for when bicycle facility is not present**

Notes:
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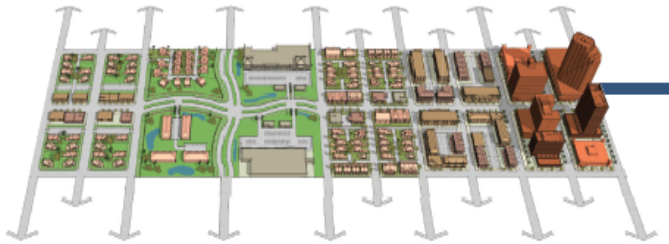
2) If there is both a separated bicycle lane, shared use path or urban side path and a bicycle lane, marked shoulder, or paved shoulder, evaluate the facility as having a shared use path

Bicycle Facility:
Marked bicycle lane

Posted Speed:
35 mph

AADT:
12 k



Bicycle Level of Traffic Stress Flow Chart to use When Bicycle Facility is Present

C2T, C3C, C3R, C4, C5, & C6

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Bicycle Facility:
Marked bicycle lane

Posted Speed:
35 mph

AADT:
12 k

BLTS = 3

CONTACT INFO

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THANK YOU!