Appendix F:

ROADWAY SEGMENT LOS CAPACITY THRESHOLDS & BICYCLE AND PEDESTRIAN LEVEL OF TRAFFIC STRESS

F

The following LOS capacity thresholds are based on HCM 2000 methodology and are generally appropriate for suburban and rural areas.

Table of Functional Class and Peak Hour LOS Thresholds					
Facility Type	**A**	**B**	**C**	**D**	**E**
Minor 2-Lane Highway	90	200	680	1,410	1,740
Major 2-Lane Highway	120	290	790	1,600	2,050
4-Lane, Multilane Highway [1]	1,070	1,760	2,530	3,280	3,650
2-Lane Arterial	-	-	970	1,760	1,870
4-Lane Arterial, Undivided	-	-	1,750	2,740	2,890
4-Lane Arterial, Divided	-	-	1,920	3,540	3,740
6-Lane Arterial, Divided	-	-	2,710	5,320	5,600
8-Lane Arterial, Divided	-	-	3,720	7,110	7,470
2-Lane Freeway [1]	1,110	2,010	2,880	3,570	4,010
2-Lane Freeway + Auxiliary Lane [1]	1,410	2,550	3,640	4,490	5,035
3-Lane Freeway [1]	1,700	3,080	4,400	5,410	6,060
3-Lane Freeway + Auxiliary Lane [1]	2,010	3,640	5,180	6,350	7,100
4-Lane Freeway [1]	2,320	4,200	5,950	7,280	8,140
Notes: [1] LOS capacity threshold is for one direction. - LOS is not achievable due to type of facility.					

Table of Functional Class and Daily LOS Thresholds					
Minor 2-Lane Highway	900	2,000	6,800	14,100	17,400
Major 2-Lane Highway	1,200	2,900	7,900	16,000	20,500
4-Lane, Multilane Highway [1]	10,700	17,600	25,300	32,800	36,500
2-Lane Arterial	-	-	9,700	17,600	18,700
4-Lane Arterial, Undivided	-	-	17,500	27,400	28,900
4-Lane Arterial, Divided	-	-	19,200	35,400	37,400
6-Lane Arterial, Divided	-	-	27,100	53,200	56,000
8-Lane Arterial, Divided	-	-	37,200	71,100	74,700
2-Lane Freeway [1]	11,100	20,100	28,800	35,700	40,100
2-Lane Freeway + Auxiliary Lane [1]	14,100	25,500	36,400	44,900	50,350
3-Lane Freeway [1]	17,000	30,800	44,000	54,100	60,600
3-Lane Freeway + Auxiliary Lane [1]	20,100	36,400	51,800	63,500	71,000
4-Lane Freeway [1]	23,200	42,000	59,500	72,800	81,400
Notes: [1] LOS capacity threshold is for one direction. - LOS is not achievable due to type of facility.					

Bicycle and Pedestrian Level of Traffic Stress Methodology

Pedestrian LTS Table

Pedestrian Streetscore+ link criteria are presented in **Table 1** and discussed in the section below.

TABLE 1 STREETSCORE+ CRITERIA
SIDEWALKS IN URBANIZED AREAS

Criteria	Streetscore+ 1	Streetscore+ 2	Streetscore+ 3	Streetscore+ 4
Usable Sidewalk	>=8 feet	7 to 6 feet	<6 feet	No Sidewalk
Sidewalk Quality	Even, Smooth Surface	(no effect)	(no effect)	Cracks, Failing Pavement
Sidewalk Accessibility	Driveway Curb Cuts Out of the Sidewalk Zone	(no effect)	(no effect)	Frequent Driveway Curb Cuts into the Sidewalk Zone
Landscape Buffer and Street Trees	Yes, Continuous	Yes, Discontinuous[1] or parking or bike lane buffer	No Landscaping	(no effect)
# of General Purpose Lanes	2-3	4-5	(no effect)	6+
Prevailing Speed	<=30 MPH	31-45 MPH	(no effect)	>45 MPH
Lighting	Pedestrian-Scale	Roadway Lighting	(no effect)	No Lighting[2]
Heavy Vehicle[3]	<=5%	5-8% with no buffer OR >8% with buffer	(no effect)	>8% with no buffer
Crosswalk Frequency[4]	Crosswalks Spaced 400 feet or Less	(no effect)	Crosswalks Spaced > 400 feet	(no effect)

1. Discontinuous is defined as not having a consistent effect on street life. Regularly spaced street trees may still feel like a "continuous" buffer and should receive a score of 1.
2. No lighting also includes ineffective roadway lighting.
3. Consider the percentage of heavy vehicles operating in the curbside travel lane as data is available.
4. In urbanized areas where pedestrians are expected, crosswalk frequency should be taken into consideration where there is demand based on land use and densities. As a general rule of thumb, consider marking a crosswalk if 20 pedestrians in a given hour may cross at that location.

Note: Same as the Mekuria, Furth, and Nixon (2012) methodology, "no effect" signifies that there is no further decrease in comfort for that variable.

Bicycle LTS Table

Bike Lanes

Table 2. Criteria for Bike Lanes Alongside a Parking Lane

	LTS ≥ 1	LTS ≥ 2	LTS ≥ 3	LTS ≥ 4
Street width (through lanes per direction)	1	(no effect)	2 or more	(no effect)
Sum of bike lane and parking lane width (includes marked buffer and paved gutter)	15 ft. or more	14 or 14.5 ft.[a]	13.5 ft. or less	(no effect)
Speed limit or prevailing speed	25 mph or less	30 mph	35 mph	40 mph or more
Bike lane blockage (typically applies in commercial areas)	rare	(no effect)	frequent	(no effect)

Note: (no effect) = factor does not trigger an increase to this level of traffic stress.
[a] *If speed limit < 25 mph or Class = residential, then any width is acceptable for LTS 2.*

Table 3. Criteria for Bike Lanes Not Alongside a Parking Lane

	LTS ≥ 1	LTS ≥ 2	LTS ≥ 3	LTS ≥ 4
Street width (through lanes per direction)	1	2, if directions are separated by a raised median	more than 2, or 2 without a separating median	(no effect)
Bike lane width (includes marked buffer and paved gutter)	6 ft. or more	5.5 ft. or less	(no effect)	(no effect)
Speed limit or prevailing speed	30 mph or less	(no effect)	35 mph	40 mph or more
Bike lane blockage (may apply in commercial areas)	rare	(no effect)	frequent	(no effect)

Note: (no effect) = factor does not trigger an increase to this level of traffic stress.

In-Roadway Cycle Tracks with Parking

Parking-protected in-roadway cycle tracks have similar Streetscore+ criteria to raised cycle tracks, but include additional details on the operable cycle track lane width as well as the type and width of buffer.

Per NACTO, the desired width of the operable cycle track area is 7 feet in uphill portions or where bicycle volumes are higher and is otherwise 6 feet, allowing for a Streetscore+ of 1. A minimum width of 5 feet is required, resulting in a Streetscore+ of 2.

While parking is assumed in this scenario, buffer type offers an additional level of protection for the cycle track. If the buffer is solid or raised, the maximum Streetscore+ of 1 is received. If the buffer is painted and has some vertical elements, such as soft-hit posts or rubber curb, a Streetscore+ of 2 is calculated. While the highest score a paint-only cycle track can receive is 3. Likewise, the desired minimum dimension for parking and the parking-side buffer is 11 feet with a minimum 3 foot buffer. Parking widths of 7 feet that

still provide the 3 foot buffer receive a score of 3 to account for added friction and more constrained cross-section. **Table 6** presents the methodology.

TABLE 10: STREETSCORE+ CRITERIA
IN-ROADWAY CYCLE TRACK WITH PARKING

Criteria		Streetscore+ 1	Streetscore+ 2	Streetscore+ 3	Streetscore+ 4
Bicycle Lane Width	***Uphill or High Volume***	>=7 feet	<=6 feet	(no effect)	(no effect)
	Otherwise	>=6 feet	<=5 feet	(no effect)	(no effect)
Buffer Type		Solid/Raised	Painted + Some Vertical Elements[1]	Painted Only	(no effect)
Parking + Buffer Width		>=11 feet, with >3 feet buffer	(no effect)	10 feet total, with minimum 3 feet buffer	<10 feet total or buffer <3 feet
Visibility at Minor Streets		Parking prohibited 30 feet from intersections	(no effect)	Sight triangles <30 feet	(no effect)
Cycle Track Blockage		Vehicle loading is accommodated through design	(no effect)	Vehicle loading is not accommodated through design and blockages are Expected	(no effect)

1. Such as soft-hit posts, landscape planters, and other vertical elements that provided additional protection but do not provide a continuous raised barrier.

Note: Same as the Mekuria, Furth, and Nixon (2012) methodology, "no effect" signifies that there is no further decrease in comfort for that variable.

In-Roadway Cycle Tracks without Parking

In-roadway cycle tracks without parking includes the same criteria as in-roadway cycle tracks with parking, but also includes the speed criteria to account for the lack of parking buffer. Visibility at minor streets focuses on sight triangles since parking is prohibited in this condition. **Table 7** presents the methodology.

TABLE 11 STREETSCORE+ CRITERIA
IN-ROADWAY CYCLE TRACK WITHOUT PARKING

Criteria		Streetscore+ 1	Streetscore+ 2	Streetscore+ 3	Streetscore+ 4
Bicycle Lane Width	***Uphill or High Volume***	>=7 feet	<=6 feet	(no effect)	(no effect)

	Otherwise	>=6 feet	<=5 feet	(no effect)	(no effect)
Buffer Type		Solid/Raised	Painted + Some Vertical Elements[1]	(no effect)	(no effect)
Buffer Width		>=4 feet	3 feet	<3 feet	(no effect)
Visibility at Minor Streets		Design accommodates sight triangle of 20 feet to the cycle track from minor street crossings and 10 feet from driveway crossings	(no effect)	Sight triangles less than 20 feet and 10 feet	(no effect)
Speed Limit or Prevailing Speed		<=30 MPH or less	31 MPH – 35 MPH	36 MPH – 45 MPH	>45 MPH
Cycle Track Blockage		Vehicle loading is accommodated through design	(no effect)	Vehicle loading is not accommodated through design and blockages are Expected	(no effect)

1. Such as soft-hit posts, landscape planters, and other vertical elements that provided additional protection but do not provide a continuous raised barrier.

Same as the Mekuria, Furth, and Nixon (2012) methodology, "no effect" signifies that there is no further decrease in comfort for that variable.

Shared Roadway

BICYCLE BOULEVARD LINKS

Criteria	Streetscore+ 1	Streetscore+ 2	Streetscore+ 3	Streetscore+ 4
ADT on Link	<1,500	1,500-3,000	3,000-6,000	>6,000
Speed	<=20 MPH	Up to 25 MPH	(no effect)	>25 MPH
Number of Stop Signs per Mile	2	4	6	>6

Same as the Mekuria, Furth, and Nixon (2012) methodology, "no effect" signifies that there is no further decrease in comfort for tha variable.

Sidepaths

All sidepaths (8 feet or wider) have a bike LTS of 1