Appendix B: Current MPO LTS Methodology

The methodology used by the MPO to calculate level of traffic-stress (LTS) scores is based on that developed by Maaza C. Mekuria, Peter G. Furth, and Hilary Nixon in their 2012 research report, Low-Stress Bicycling and Network Connectivity. The methodology used to calculate road segment scores was revised in 2023 to better align it with guidance from NACTO[1] and to incorporate traffic volumes into segment scores.

The LTS score for each street segment is determined by combining the segment score, based on the characteristics of the segment itself, with the intersection score, based on characteristics of the intersecting roadway and the intersection configuration (specifically the presence and design of bike and right turn lanes). Each segment receives the higher (greater stress level) of the two scores as its final LTS.

Bike facilities with LTS scores of 1 and 2 are generally considered low stress and are suitable for less confident riders. LTS 3 facilities are considered moderately stressful. Facilities rated LTS 4 are where bicyclists are expected to feel the highest levels of traffic-related stress and are generally only comfortable for the most confident riders.

See Assessing Urban Bicycle Facilities for more information.

LTS Calculation Notes

1. Number of lanes: The number of lanes is based on the number of through traffic lanes. Turn lanes that disappear at the next intersection are not counted. Bus lanes are counted. Lane counts should reflect off-peak lanes only (i.e. peak period lanes used for parking during off-peak hours are not counted as travel lanes).
2. Bus-bike lanes are equivalent to through traffic lanes.
3. Roundabouts with 2 lanes for any portion of the roundabout are classified as LTS 4, roundabouts that are no more than 1 lane at any location are LTS 3.
4. Protected lanes are classified as LTS 2.
5. Off-street facilities, such as shared-use paths, are classified as LTS 1.

Road Segments

To calculate a road segment's LTS score, select the appropriate table below based on whether the road segment is equipped with a bike lane without on-street parking (Table 17), a bike lane with on-street parking (Table 18), or does not have a bike lane (Table 19). The LTS segment score is based on average daily traffic (ADT), the number of travel lanes, posted speed limit, and bike lane width (if applicable).

[1] https://nacto.org/publication/urban-bikeway-design-guide/designing-bikeways-for-all-ages-and-abilities/

Table 1 Criteria for Bike Lanes Not Alongside Parking

# of Through Lanes per Direction	Effective ADT*	Bike Lane Width	Speed Limit (mph)			
			≤ 25	30	35	≥ 40
1	≤ 1500	< 6 ft	LTS 1	LTS 2	LTS 3	LTS 4
		6-7 ft	LTS 1	LTS 2	LTS 3	LTS 4
		> 7 ft	LTS 1	LTS 2	LTS 3	LTS 4
	1501 - 3000	< 6 ft	LTS 2	LTS 2	LTS 3	LTS 4
		6-7 ft	LTS 1	LTS 2	LTS 3	LTS 4
		> 7 ft	LTS 1	LTS 2	LTS 3	LTS 4
	3001-6000	< 6 ft	LTS 3	LTS 3	LTS 4	LTS 4
		6-7 ft	LTS 2	LTS 2	LTS 3	LTS 4
		> 7 ft	LTS 1	LTS 2	LTS 3	LTS 4
	> 6000	< 6 ft	LTS 3	LTS 3	LTS 4	LTS 4
		6-7 ft	LTS 3	LTS 3	LTS 3	LTS 4
		> 7 ft	LTS 2	LTS 3	LTS 3	LTS 4
2	≤ 6000	< 6 ft	LTS 3	LTS 3	LTS 4	LTS 4
		6-7 ft	LTS 3	LTS 3	LTS 3	LTS 4
		> 7 ft	LTS 3	LTS 3	LTS 3	LTS 4
	> 6000	< 6 ft	LTS 4	LTS 4	LTS 4	LTS 4
		6-7 ft	LTS 3	LTS 3	LTS 4	LTS 4
		> 7 ft	LTS 3	LTS 3	LTS 3	LTS 4
3+	Any ADT	< 6 ft	LTS 4	LTS 4	LTS 4	LTS 4
		6-7 ft	LTS 3	LTS 4	LTS 4	LTS 4
		> 7 ft	LTS 3	LTS 4	LTS 4	LTS 4

* Effective ADT = ADT for two-way roads; Effective ADT = 1.5 * ADT for one-way roads

Table 2 Criteria for Bike Lanes Alongside Parking

# of Through Lanes per Direction	Effective ADT*	Bike Lane Width	Speed Limit (mph)			
			≤ 25	30	35	≥ 40
1	≤ 1500	< 13 ft	LTS 2	LTS 2	LTS 3	LTS 4
		13-14 ft	LTS 1	LTS 2	LTS 3	LTS 4
		> 14 ft	LTS 1	LTS 2	LTS 3	LTS 4
	1501 - 3000	< 13 ft	LTS 2	LTS 2	LTS 3	LTS 4
		13-14 ft	LTS 1	LTS 2	LTS 3	LTS 4
		> 14 ft	LTS 1	LTS 2	LTS 3	LTS 4
	3001-6000	< 13 ft	LTS 3	LTS 3	LTS 4	LTS 4
		13-14 ft	LTS 2	LTS 2	LTS 3	LTS 4
		> 14 ft	LTS 1	LTS 2	LTS 3	LTS 4
	> 6000	< 13 ft	LTS 3	LTS 3	LTS 4	LTS 4
		13-14 ft	LTS 3	LTS 3	LTS 3	LTS 4
		> 14 ft	LTS 2	LTS 3	LTS 3	LTS 4
2	≤ 6000	< 13 ft	LTS 3	LTS 3	LTS 4	LTS 4
		13-14 ft	LTS 3	LTS 3	LTS 3	LTS 4
		> 14 ft	LTS 3	LTS 3	LTS 3	LTS 4
	> 6000	< 13 ft	LTS 4	LTS 4	LTS 4	LTS 4
		13-14 ft	LTS 3	LTS 3	LTS 4	LTS 4
		> 14 ft	LTS 3	LTS 3	LTS 3	LTS 4
3+	Any ADT	< 13 ft	LTS 4	LTS 4	LTS 4	LTS 4
		13-14 ft	LTS 3	LTS 4	LTS 4	LTS 4
		> 14 ft	LTS 3	LTS 4	LTS 4	LTS 4

* Effective ADT = ADT for two-way roads; Effective ADT = 1.5 * ADT for one-way roads

Table 3 Criteria for Mixed Traffic Streets

Number of Through Lanes per direction	Effective ADT*	Speed Limit (mph)				
		≤ 20	25	30	35	≥ 40
1	0 – 1500	LTS 1	LTS 2	LTS 2	LTS 3	LTS 4
	1501 - 3000	LTS 2	LTS 2	LTS 2	LTS 3	LTS 4
	3000 +	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4
2	0 - 6000	LTS 3	LTS 3	LTS 3	LTS 4	LTS 4
	6000 +	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4
3+	Any ADT	LTS 4	LTS 4	LTS 4	LTS 4	LTS 4
* Effective ADT = ADT for two-way roads; Effective ADT = 1.5 * ADT for one-way roads.						

Intersections

The LTS criteria used to evaluate intersections varies based on whether the intersection is governed by traffic signals, whether the road is divided, and whether there are right turn lanes. It is important to note that, due to technical limitations, intersection LTS was not used to calculate the LTS scores of off-street paths in this analysis. However, excluding rural areas, where paths may cross high-speed roads at unsignalized intersections, most path intersections are low stress (LTS 1 or 2). LTS scores for unsignalized crossings are calculated using either Table 20 or Table 21, depending on whether the road being crossed has a median at least 6 feet wide that can provide a refuge for bicyclists or is a one-way street.

The rationale for using one set of criteria for two-way streets without medians and another set of criteria for one-way streets and streets with medians is that medians and one-way traffic both make it easier to cross at unsignalized intersections. Medians of at least 6 feet in width provide a refuge for bicyclists, where they can wait for an opening in traffic on the far side of the street. Similarly, there are usually more gaps in traffic on one-way than on two-way streets. An unsignalized intersection's LTS score is applied to the approaching segment(s) if it exceeds the segment's original LTS score. For example, a road segment with a base LTS of 2 crossing a 30-mph street with one lane in each direction (LTS 1) would maintain its rating of LTS 2. However, the same road segment crossing a 35-mph street with 2 lanes in each direction (LTS 3) would have its rating increased to LTS 3.

Table 4 LTS Criteria for Unsignalized Intersections without a Median Refuge

Speed Limit of Street Being Crossed	Width of Street Being Crossed (travel lanes per direction)		
	1	2	3+
Up to 25 mph	LTS 1	LTS 2	LTS 4
30 mph	LTS 1	LTS 2	LTS 4
35 mph	LTS 2	LTS 3	LTS 4
40+	LTS 3	LTS 4	LTS 4

Table 5 Criteria for Unsignalized Intersections with a Median Refuge and One-Way Streets

Speed Limit of Street Being Crossed	Width of Street Being Crossed (travel lanes per direction)		
	1	2	3+
Up to 25 mph	LTS 1	LTS 1	LTS 2
30 mph	LTS 1	LTS 2	LTS 3
35 mph	LTS 2	LTS 3	LTS 4
40+	LTS 3	LTS 4	LTS 4

Signalized intersections do not generally present a barrier to cycling and do not normally affect the LTS scores of approaching segments. However, right-turn lanes can increase traffic stress for bicyclists approaching these intersections. The factors related to right-turn lanes that impact bicyclists include the length of the right-turn lane (which indicates the volume of right-turning traffic) and the speed of right-turning traffic. Two separate scoring tables are used to determine LTS at signalized intersections with right-turn lanes depending on whether there is a pocket bike lane (Table 22) or not (Table 23). Pocket lanes are those that lie between the rightmost through lane (for motor vehicles) and the right-turn lane. For pocket bike lanes, whether the bike lane continues straight or shifts to the left, and whether the turn lane starts abruptly—reducing the overlap between the bike lane and right-turning vehicles—also affect intersection LTS.

Table 6 Criteria for Right Turn Lanes with Pocket Bike Lanes

Configuration	Level of Traffic Stress
Single right-turn lane up to 150 ft. long, starting abruptly while the bike lane continues straight, and having an intersection angle and curb radius, such that turning speed is ≤ 15 mph.	**LTS 2**
Single right-turn lane longer than 150 ft. starting abruptly while the bike lane continues straight, and having an intersection angle and curb radius such that turning speed is ≤ 20 mph.	**LTS 3**
Single right-turn lane in which the bike lane shifts to the left but the intersection angle and curb radius are such that turning speed is ≤ 15 mph.	**LTS 3**
Single right-turn lane with any other configuration: dual right-turn lanes: or right-turn lane along with an option (through-right) lane.	**LTS 4**

Table 7 Criteria for Right Turn Lanes with Mixed Traffic

Configuration	Level of Traffic Stress
Single right-turn lane with length ≤ 75 ft. and intersection angle and curb radius such that turning speed is ≤ 15 mph.	No effect on LTS
Single right-turn lane with length between 75 and 150 ft., and intersection angle and curb radius such that turning speed is ≤ 15 mph.	**LTS 3**
Otherwise.	**LTS 4**

Limitations

It should be noted that the LTS methodology excludes from consideration a number of factors that can affect the comfort of bicyclists. These would need to be considered at a project level rather than the network level that the LTS methodology is designed for. These include:

- Left turn lanes.
- Topography (steep hills).
- Pavement condition.
- High driveway density.
- Rough or skewed railroad crossings.
- Neighborhood crime and safety concerns.