BICYCLE LEVEL OF TRAFFIC STRESS

Technical Documentation

DECEMBER 2020
VERSION 1.0

CITY of BOSTON

TOOLE DESIGN

CONTENTS

For further information and to view the interactive Bicycle Level of Traffic Stress map, please visit: ***boston.gov/blts***

CITY *of* BOSTON

1. INTRODUCTION

The Boston Transportation Department, with Toole Design Group, developed a Bicycle Level of Traffic Stress (LTS) score for each street in the city. Scores measure how much traffic stress bicyclists experience and range from 1, the least stressful, to 4, the most stressful. The project is part of a larger effort to streamline transportation development review for large developments (over 50,000 square feet) required to complete the Transportation Access Plan Agreement (TAPA). TAPA is a legal agreement with large developments and the Boston Transportation Department to mitigate impacts of development on traffic, congestion, and transportation infrastructure. The resulting map can be found on **boston.gov/blts**.

A development's goal in mitigating its impacts includes limiting and reducing its drive alone rates through a combination of infrastructure improvements and transportation demand management programs. Part of this will be to ensure that the roadways abutting and leading to developments are, at minimum, comfortable for most bicyclists, or an LTS score of two.

The LTS score for each road segment is based on traffic speed, average daily traffic volume, number of lanes in each direction, and conflict factors such as bus lanes and school zones. As each of these criteria increases so does the need for protective measures such as physically protected or separated bike lanes.

The resulting city-wide map of existing LTS streamlines mitigation and reduces any obscurity on how developers and the City will improve bicycle facilities. It also highlights gaps in the bicycle network and identifies segments with unacceptably high traffic stress, variables critical to increasing cycling commuters as laid out in *GoBoston 2030*[1], the City's long term transportation plan.

In a City of Boston survey[2] conducted fall 2020 on the impact of COVID-19 on the commuting choices of hospital, office, and university employees. The results show that of those who plan to change their commute post-pandemic, 12% chose cycling as the new mode they plan to try – the highest proportion among all sustainable options. For those unsure about cycling, there are three measures that respondents indicated would help them make the switch: (1) additional dedicated bike lanes, (2) more dedicated off-road paths, and (3) prioritized road space for bikes. This comes as no surprise - improvement of bicycle facilities is consistently selected as a top priority for both experienced and new cycling commuters.

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[1] Boston Transportation Department. *GoBoston 2030: Vision and Action Plan*. 2017. https://www.boston.gov/departments/transportation/go-boston-2030

[2] "Survey: Impact of COVID-19 on Commuting Choices." City of Boston, 9 Nov. 2020. www.boston.gov/departments/transportation/survey-impact-covid-19-commuting-choices

2. LEVEL OF TRAFFIC STRESS

I. DEFINING LTS

The methodology and analysis used have been adapted to fit Boston's context and the needs of the TAPA process from the Mineta Transportation Insititute's report *Low-Stress Bicycling and Network Connectivity*[3] and NACTO's *Urban Bikeway Design Guide*[4]. Traffic stress levels are defined in Table 1.

TABLE 1. DEFINITION OF EACH LEVEL OF TRAFFIC STRESS (LTS) SCORE

LTS	Description
1	Corridor is comfortable for all ages and abilities including children. LTS 1 roadways are characterized by protected bike lanes or greenways, and very little to no intermingling with vehicular traffic.
2	Tolerated by most adults. There may be some turning conflicts but cyclists are mostly separated from traffic through bike lanes. This type of corridor demands more attention from riders than an LTS 1 and is likely not suitable for children. Projects must improve bicycle facilities to meet an LTS 2 standard or better.
3	Roadways may have bike lanes next to multilane vehicular traffic with above average traffic volumes or vehicular speeds higher than Boston's default speed limit. An LTS 3 may also include shared lanes on streets that are not multilane and experience vehicular traffic at the City's default speed limit or lower.
4	Tolerated by only the most experienced and able bodied riders.

The methodology takes into consideration the limits and reliability of the available data. The analysis primarily uses a combination of city and state data sources to extract a street's vehicle volumes, speed limit, bicycle facilities, and on-street parking presence to determine the level of stress a bicycle rider is expected to experience on that street segment. In cases where vehicle volume data is unavailable, functional class and number of lanes are used as a temporary proxy until traffic counts are taken.

Conflict factors are included because they make riding bicycles more stressful due to increased vehicle traffic at certain times of the day and greater potential for conflicts between modes due to vehicle maneuvering and unpredictability. For the purposes of this analysis, these factors include industrial, commercial, or hotel land uses; key bus routes; pick-up/drop-off zones

[3] Maaza C. Mekuria, Peter G. Furth, and Hilary Nixon. "Low-Stress Bicycling and Network Connectivity" Mineta Transportation Institute Publications (2012). https://scholarworks.sjsu.edu/cgi/viewcontent.cgi?article=1073&context=mti_publications

[4] National Association of City Transportation Officials. *Urban Bikeway Design Guide, Second Edition.* Island Press, 2014. https://nacto.org/publication/urban-bikeway-design-guide/

(including cab stands and valet zones); or proximity to schools. If one or more of these criteria are met, the LTS score is increased by one point; multiple criteria do not increase the score by more than the initial one point. Because land uses change along a street, this may cause the LTS scores to vary from block to block along an otherwise consistent street.

Only streets where bicycling is allowed are included in the analysis. Streets where bicycle access is restricted, such as highways, streets on private or restricted property, and street segments that are for walking access only, are given NULL values. Additionally, short dead-end streets that aren't used. Table 2 summarizes the methodology approach of the analysis.

TABLE 2. LEVEL OF TRAFFIC STRESS CRITERIA TABLE

			Posted Speed			**Conflict Factors[2]**	**All Ages & Abilities Treatments**		
Vehicle Volumes[1]			20	25	30+		**Protected Bike Lane**	**Shared Street[3]**	**Neighborhood Greenway[4]**
< 1,500	Bike lane	No Parking	LTS 1	LTS 1	LTS 2	Add 1 up to LTS 4	LTS 1	LTS 1	LTS 1
		Parking	LTS 1	LTS 1	LTS 3				
	No bike lane		LTS 1	LTS 2	LTS 3				
1,500 - 3k	Bike lane	No Parking	LTS 2	LTS 2	LTS 2		LTS 1	LTS 1	LTS 2
		Parking	LTS 2	LTS 2	LTS 3				
	No bike lane		LTS 2	LTS 2	LTS 3				
3k - 6k	Bike lane	No Parking	LTS 2	LTS 2	LTS 2		LTS 1	n/a	n/a
		Parking	LTS 2	LTS 2	LTS 3				
	No bike lane		LTS 3	LTS 3	LTS 4				
> 6k	Bike lane	No Parking	LTS 3	LTS 3	LTS 4		LTS 1	n/a	n/a
		Parking	LTS 3	LTS 4	LTS 4				
	No bike lane		LTS 3	LTS 4	LTS 4				

[1] If volumes are not available, a mix of functional class and volumes may be used to estimate AADT in the following way: Use the <1500 category for local streets in neighborhood slow zones. Use the 1500-3k category for local streets outside of neighborhood slow zones. Use the 3k - 6k category for any collector street and any 1-lane minor arterial street. Use the >6k category for any major arterial and 2+ lane/direction minor arterial.

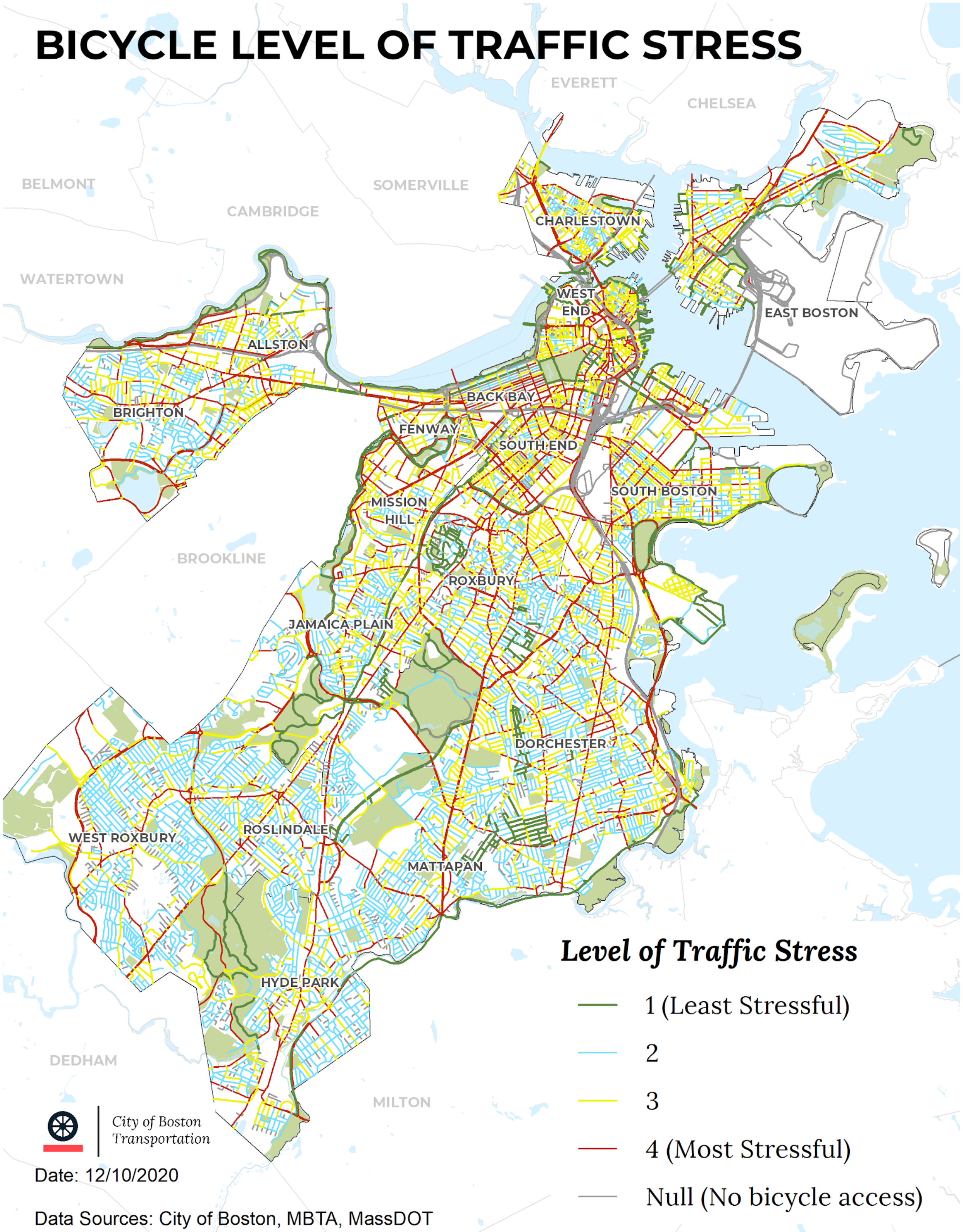
[2] If any of the following conflict factors are present, add 1 to the LTS score: industrial, commercial, or hotel uses; key bus route; valet zone; pick-up/drop-off zone; cab stand; or school.

[3] For shared streets to meet all ages and abilities criteria, prevailing vehicle speeds should not exceed 10 mph.

[4] For neighborhood greenways to meet all ages and abilities criteria, horizontal and/or vertical deflection measures should be used to keep prevailing vehicle speeds under 20 mph.

FIGURE 1: MAP OF BICYCLE LEVEL OF TRAFFIC STRESS

An interactive version of the map below is available online at boston.gov/blts.



II. WHAT DOES THE LTS MEAN FOR YOUR PROJECT OR DEVELOPMENT?

The map allows developers, consultants, or project managers to identify the level of traffic stress and network gaps in the study area or project corridor. At a minimum, the corridors should be upgraded to at least a LTS 2 or better. This means resolving turning conflicts with vehicles, implementing safety measures such as road dieting, or installing bike lanes. The goal is to make biking safe and comfortable for, at least, most adults. Depending on the volume, traffic speeds, and presence of parked vehicles as outlined in Table 2 proper mitigation may require the installation of protected bicycle lanes.

3. DATA ANALYSIS

I. DATA PREPARATION

The four primary attributes – vehicle volumes, speed limits, bicycle facilities, and parking – are chosen because of their direct impacts on the level of traffic stress people riding bikes experience and because these are factors that the City and developers can impact. Data for this analysis was retrieved from multiple sources, and include:

- City of Boston:
  - Boston Streets Segments
  - Existing Bike Network
  - Public Schools Data
  - Non-Public Schools Data
  - Parcels Data
- Massachusetts Department of Transportation (MassDOT):
  - MassDOT Roads for streets centerline data
  - MBTA Bus Routes for key bus routes

Further information and details on the sources and field columns used in the creation of the shapefile are detailed in **Appendix 1: LTS Shapefile Data Dictionary**.

Vehicle Volumes

A higher number of vehicles on a street, measured by the annual average daily traffic (AADT), increases the potential for conflicts between motorists and bicyclists, creating a more stressful riding experience for cyclists of all ages and abilities.

Vehicle volumes are broken up into four categories:

- Fewer than 1,500 vehicles per day
- Between 1,500 and 2,999 vehicles per day
- Between 3,000 and 5,999 vehicles per day
- Over 6,000 vehicles per day

The AADT data used in the analysis came from the most recent MassDOT's roads layer which is a centerline shapefile and includes volumes counted within the prior three years. The shapefile can be found on the MassGIS website cited above.

BTD, BPDA, or developers may supplement this data by additional traffic counts in key areas to increase the accuracy of the LTS scores.

More information on how cases where volume data was unavailable or out of date were treated can be found below.

Streets Without Vehicle Volume Counts

Traffic volume data that was collected between 2014 and 2016 (the most recent three available years) are compiled into the MassDOT roads layer dataset. The "AADT" field in the streets centerline file was used to retrieve the annual average daily traffic counts. Of these, some reflect direct counts, but many more reflect estimated volumes. To ensure the data that is used to calculate the LTS scores is accurate, only vehicle volumes collected in the last three years were included in the analysis, and volumes that are out of date or were estimated are not included.

To supplement the street segments where accurate and recent volume data is unavailable, functional class, the number of travel lanes, and neighborhood slow zone designation are instead used as a proxy.

Street segments are grouped into one of the four-volume categories:

- Under 1,500 vehicles per day: streets in the neighborhood slow zone designation. These streets include volume-control design measures, making this lowest category fitting.
- Between 1,500 and 2,999 vehicles per day: all other local streets. These streets are used primarily for access to adjacent properties and minimally for cut-through traffic.
- Between 3,000 and 5,999 vehicles per day: collector streets and 1-lane minor arterial streets. These streets are used for both local access and cut-through traffic and see higher traffic volumes than local streets.
- Over 6,000 vehicles per day: any principal arterial and minor arterials with two or more lanes per direction. These streets are primarily used to travel between areas and carry the highest traffic volumes.

Data for functional classification and number of lanes come from the MassDOT street centerline shapefile using the field "F_Class".

These categories are designed to err on the side of higher vehicle volumes resulting in a higher LTS score to ensure street segments are not showing as lower stress than they actually are. When these values can be supplemented with actual data, it is designed to be more likely for the LTS score to decrease than increase.

Speed Limits

Higher vehicle speeds increase the risk of injury in the event of a crash with a person riding a bicycle and makes biking feel more stressful.

- Boston has a statutory citywide speed limit of 25 mph. This is the default value for all streets unless otherwise posted.
- In order to confirm posted speed limits greater than 25mph, the analysis team used Google Street View on targeted street categories, as they are likely to have higher posted speed limits:
  - On streets where speed studies were previously conducted
  - On state-owned streets
- Streets in Neighborhood Slow Zones as well as others noted in the Streetview review were marked as 20mph in order to match the intended design speeds for streets in those project areas.

As with volume data, BTD, BPDA, or developers can supplement speed limit data by additional review in key areas.

Bicycle Facilities and Parking

Bicycle facilities that offer dedicated space or priority for bicyclists can decrease the LTS score for a street. In this analysi, the Boston Transportation Department shapefile for bicycle facilities was used. The file and the accompanying data dictionary can be found on Analyze Boston[5]. Further explanation of the abbreviations of the bicycle facility codes used below can be found in **Appendix 2: Bike Facilities Description**.

- On undivided streets where the bicycle facility is different on either side of the street, the facility with the least separation between motor vehicles and bicycles is selected for analysis.
- Bicycle facilities reflect the city's existing bike network dataset last updated in February 2020. Further coordination prior to the annual update in December took place in anticipation of release of this dataset.
- Streets with separated bike lanes default to LTS 1, regardless of traffic volumes, vehicle speeds, or conflict factors.
  - For the purposes of this analysis, separated bike lanes include streets where the existing facility type is "SBL," "SUB," "SUP," "SUC," or "NSUP".
- Shared streets (ie. streets such as Winter Street, designed and constructed as public open space shared by vehicles, bicyclists, and pedestrians) default to LTS 1 regardless of

[5] Existing Bike Network dataset: https://data.boston.gov/dataset/existing-bike-network

conflict factors where vehicle volumes are below 3,000 vehicles per day and speeds are below 10mph.
    - For the purposes of this analysis, shared streets include streets where the existing facility type is “SRd”
- Neighborhood greenways (also known as bike boulevards) are considered LTS 1 if volumes are below 1,5000 vehicles per day and LTS 2 if volumes are below 3,000 vehicles per day if vehicle speeds are below 20mph.
    - For the purposes of this analysis, neighborhood greenways include streets where the existing facility type is “NW”
- Bike lanes include standard bike lanes and buffered bike lanes, but do not include shared lane markings.
    - For the purposes of this analysis, bike lanes include streets where the existing facility type is “BL,” “CL,” “BFBL,” or “CFBL”
- Bike lanes adjacent to on-street parking are generally more stressful than those not adjacent to on-street parking due to the added stress people biking feel due to the risk of “dooring,” or when people in cars open their doors into the path of someone riding a bike.
    - The existence of on-street parking was confirmed using Google Streetview only for streets with bike lanes.
- Walking paths, those categorized as “WALK,” are not included as bicycle facilities.

III. CONFLICT FACTORS

Land Uses

Streets that are within commercial, industrial, and hotel land use areas have an LTS score one point higher than a street with the same base factors (vehicle volume, speed limit, and bicycle facility type) would have. These streets have higher likelihood of conflict between vehicles and people riding bikes, increasing the expected stress of people riding bikes. Parcel data is based on the City of Boston Parcels.

Commercial

- Increased curbside activity, including parking, standing, and loading increase potential conflicts in commercial land uses.
    - Other land use types like universities, government buildings, hospitals, and religious institutions, are also included for the same reason.
- The conflict factor is applied to street segments along a commercial parcel.
- The parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way.

- Only streets where a significant portion of the length – at least 25% of the segment – are within that buffer are included.

Included parcels:

- Land use codes of “Commercial,” “Commercial Land,” “Commercial Condominium,” and “Mixed Residential Commercial.”
- State class codes of “Office Condo: exempt,” “Retail Condo: exempt,” “College (Academic),” “Hospital,” “Government Office Building,” and “Church, Synagogue”

Industrial

- Increased loading activities and heavy vehicle traffic, which have decreased visibility compared to passenger vehicles and a higher likelihood for high crash severity, increase potential conflicts.
- The conflict factor is applied to street segments along an industrial parcel.
    - The parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way.
    - Only streets where a significant portion of the length – at least 25% of the segment – are within that buffer are included.

Included parcels:

- Land use codes of “Industrial”
- State class codes of “Incineration Plant” or “Water Treatment Plant”

Hotel

- Increased curbside activity, including parking, standing, and loading increase potential conflicts.
- The conflict factor is applied to street segments along a hotel parcel.
    - The parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way.
    - Only streets where a significant portion of the length – at least 25% of the segment – are within that buffer are included.
- 25% of a street segment must be within the buffer to be considered in the conflict zone.
- Hotel parcels are included in various commercial land use designations.

Key Bus Routes

Frequent bus traffic and operation can increase the stress of bicyclists. Buses driving near bicyclists, maneuvering to and from bus stops, and blocking bike lanes all contribute to increased stress for a vulnerable bicyclist.

- Street segments that carry a Massachusetts Bay Transit Authority (MBTA) Key Bus Route are considered to have this conflict.
- Key bus routes include Routes 1, 15, 22, 23, 28, 32, 39, 57, 66, 71, 73, 77, 111, 116, and 117.
- Bus route data is published by the MBTA.

Pick-up/Drop-off Zones

Designated pick-up/drop-off zones have high vehicle turnover, increasing curbside conflicts with bicyclists as motorists and rideshare drivers pull over to board and alight passengers.

- Street segments with at least one city-designated pick-up/drop-off space on it are designated for this conflict factor.
- Currently, the pilot pick-up/drop-off zones in Fenway and the Seaport are included.

Schools

Streets that are on the same block face as a school see heavy curbside activities during pick up and drop off times, increasing potential conflicts with people biking through these areas.

- The conflict factor is applied to street segments along a school parcel.
    - The parcel data was buffered by 75 feet so the data could be joined to the adjacent street centerline spatial data, since parcels do not include street rights-of-way.
    - Only streets where most of the length – at least 50% of the segment – are within that buffer included. A higher threshold is used for schools that other land use categories.
- Parcels are considered to have a school on it if a public or non-public school point is within a parcel of any type or if the state class code of the parcel is “School” or “Private School.”

School location data is published by Massachusetts Department of Education and can be found on the City of Boston Analyze Boston website.

IV. LTS ANALYSIS

The LTS analysis was executed by Toole Design staff in PostGIS database tables. The functions were primarily coded using PostgreSQL, a free and open-source database language. Some other functions used proprietary tools built by Toole Design staff in Python, another coding language. The geometry was based on the Boston Street Segments shapefile, and the output includes the original segment IDs, street name, and street type.

Attributes in the analysis that are based on other line features were joined using a Toole Design proprietary tool that conflated features from the base file into the LTS data based on how well the lines matched up spatially. These attributes include vehicle volumes, vehicle volume collection method, functional class, jurisdiction, number of lanes, type of access control, and one- or two-way operations from the MassDOT Street Centerlines file; bicycle facility type from the Boston Existing Bike Network file; and bus routes from the MBTA bus routes file.

Attributes in the analysis that are based on point or polygon features are joined to the dataset with more simple spatial join functions in PostGIS. These attributes include all parcel and land use data, school locations, pick-up/drop-off zones, and Neighborhood Slow Zones.

Off-street bicycle facility geometry was added to the LTS shapefile. Any segment in the Existing Bike Network file with facilities "NSUP," "SUB," "SUC," or "SUP" was added to the geometry with a segment ID (segid) equal to 50,000 + the FID field to ensure no segment ID overlap.

Additional attributes were added manually, as described above. These attributes include parking next to bike facilities and speed limits.

Following reviews by BTD, BPDA, and Toole Design staff of the results, individual segments were corrected as needed using PostGIS script when the attribute in the data didn't line up with the conditions on the ground.

V. UPDATES TO THE DATA IN GIS SOFTWARE

BTD staff will conduct updates to the LTS scores and bike facilities annually in December in coordination with updates to existing bike network dataset.

Attributes can be updated as needed by BTD staff using the "Edit" function in any GIS program. Refer to the table "LTS Shapefile Fields" for a complete list of the fields, what attributes they refer to, the data type, and any notes on how to interpret the meaning or value range.

Once the attribute is updated to reflect changes in the city, BTD staff can then use the LTS table to find the speed limit ("speedlimit"), traffic volume ("adt"), bicycle facility ("bike_fac"), and parking ("parking") values to select the appropriate base LTS score. Then, staff can add 1 to the

LTS value if there is a conflict factor ("conflict" is TRUE) to find the final LTS value and update the LTS field.

If there is no traffic volume data, BTD staff can use the fields "slowzone," "class," "num_lanes," and "operation" to categorize streets into volume categories. These values are used in the following ways:

```
(class IN (0,-1) AND slowzone IS TRUE) THEN adt < 1500

(class IN (0,-1) AND slowzone IS FALSE) THEN adt >= 1500 AND adt < 3000

class IN (6) OR class IN (5) AND ((num_lanes = 1 AND operation IN (0,1))
OR (num_lanes = 2 AND operation = 2)) THEN adt >= 3000 AND adt < 6000

class IN (2,3,4) OR class IN (5) AND ((num_lanes > 1 AND operation IN
(0,1)) OR (num_lanes > 2 AND operation = 2)) THEN adt >= 6000
```

If the bicycle facility is coded as "SBL," "SUB," "SUP," "SUC," "NSUP," or "SRd," then the LTS value is 1. If the bicycle facility is coded as "NW" and volumes are below 1,500 vehicles per day, then the LTS value is 1, and if volumes are between 1,500 and 2,999 (inclusive) then the LTS value is 2.

APPENDIX 1: BICYCLE LEVEL OF TRAFFIC STRESS DATA DICTIONARY

This data dictionary describes the field names used in the Bicycle Level of Traffic Stress shapefile.

FIELD NAME	FULL NAME	TYPE	DESCRIPTION/VALUES	SOURCE
pri_k	Primary key	Integer	ID generated for analysis purposes.	
geom	Geometry	Line	From Boston Streets Segments dataset.	City of Boston Boston Street Segments
segid	Segment ID	Numeric	From "segment_id" in the Boston Street Segments.	City of Boston Boston Street Segments
name	Street name	Varchar	From "st_name" in the Boston Street Segments.	City of Boston Boston Street Segments
type	Street type	Varchar	From "st_type" in Boston Street Segments.	City of Boston Boston Street Segments
class	Functional classification	Integer	From "F_Class" in MassDOT Road Centerline data. A road classification system used by Massachusetts that incorporates urban/rural census designation and the federal classification system. The value 4 is no longer used in this field. 0 = Local 1 = Interstate 2= Urban or Rural Principal Arterial 3 = Urban Principal or Rural Minor Arterial 5 = Urban Minor Arterial or Rural Major Collector 6 = Urban Collector or Rural Minor Collector	MassDOT Roads
jurisdiction	Jurisdiction	Varchar	From "Jurisdictn" in MassDOT Road Centerline data. The owner of a road, usually responsible for maintenance activities and project initiation.	MassDOT Roads

			0 = Unaccepted by city or town 1 = MassDOT 2 = City or Town accepted road 3 = Dept. of Conservation and Recreation 5 = Massachusetts Port Authority 6 = State Park or Forest 7 = State Institutional 8 = Federal Park or Forest 9 = County Institutional	
control	Access control	Integer	From “Control” in MassDOT Road Centerline data. Describes the ease of access for traffic to enter and exit the facility. A road with no control would be an undivided, local road with mixed-use driveways on it. A road with full control would be an interstate highway, and partial control would represent a divided state highway with select local or commercial road connections. 0 = No control 1 = Full control 2 = Partial control	MassDOT Roads
operation	Street Operation	Integer	From “Operation” in MassDOT Road Centerline data. The number of directions traffic flow is allowed along a route. 1 = One-way traffic 2 = Two-way traffic	MassDOT Roads
slowzone	Neighborhood Slow Zone	Boolean	Generated from spatial join with Neighborhood Slow Streets dataset. TRUE = Segment is in a neighborhood slow zone FALSE = Segment is not in a neighborhood slow zone	City of Boston
speedlimit	Speed limit	Numeric	Value of the posted or default speed limit.	
adt	Vehicle volumes	Integer	From “AADT” in MassDOT Road Centerline data.	MassDOT Roads

			Average annual daily traffic, measured by counting the total number of vehicles in a year and dividing by 365. Only derivation methods ("adt_deriv") 1, 2, 6, 7, and 8 where the count year is greater than 2013 are included.	
adt_deriv	Traffic count method	Integer	From "AADT_Deriv" in MassDOT Roads Centerline data. Traffic counts are not collected on every road, every day of the year. Due to this limitation, different models are used to assign road traffic numbers to areas that have not had a recent count. 1 = Derived from counts collected on or adjacent to the section during the current year 2 = Derived from factoring counts from the previous year count-based AADT that is less than three years old 6 = MassDOT Highway Special Count 7 = RPA Count 8 = Other Count	MassDOT Roads
bike_fac	Bicycle facility	Varchar	From"ExisFacil" in the Existing Bike Network dataset. Identifies the current bike facility type. BFBL = Buffered bike lane BL = Bike lane BLSL = Bike lane on one side, shared lane on the opposite side BSBL = Bus/bike lane CFBL = Contra-flow bike street NSUP = Shared use path, natural surface NW = Neighborway, marked NW-U = Neighborway, unmarked SBL = Separated bike lane SBLBL = Separated bike lane on one side, bike lane on the opposite side SLM = Shared lane markings SRd = Shared road SUB = Shared use path bridge SUC = Shared use connector SUP = Shared use path TC = Traffic calmed street	City of Boston Existing Bike Network

			WALK = Walkway Further description of each bicycle facility code can be found in Appendix 2: Bike Facilities Description.	
tot_lanes	Total travel lanes	Integer	Calculated from “num_lanes” + “opp_lanes”. Includes travel lanes on the opposite side of a divider or median.	
num_lanes	Travel lanes	Integer	From “Num_Lanes” in MassDOT Road Centerline data. Number of travel lanes in any direction of travel on an undivided road. Divided roadways note the number of lanes on the given segment only.	MassDOT Roads
opp_lanes	Opposite-side travel lanes	Integer	From “Opp_Lanes” in MassDOT Road Centerline data. Number of lanes in opposing traffic on the given segment only.	MassDOT Roads
deadend	Dead end street	Boolean	Calculated based on geometry features. “TRUE” if a dead end.	
busroute	Bus route number	Varchar	Only includes key bus routes: 1, 15, 22, 23, 28, 32, 39, 57, 66, 71, 73, 77, 111, 116, 117. Key bus routes are defined by the MBTA Service Delivery Policy as routes that operate longer hours and at higher frequencies to meet high levels of passenger demand in high-density travel corridors.	MassDOT MBTA Bus Routes
parking	Parking	Integer	“1” if there is parking adjacent to the bicycle facility.	
czoning	Zoning conflict	Integer	“1” if there is a zoning conflict.	
chotel	Hotel conflict	Integer	“1” if there is a hotel land use conflict.	
cbus	Key bus route conflict	Integer	“1” if there is a key bus route conflict.	
cschool	School conflict	Integer	“1” if there is an adjacent school conflict.	
cpudo	Pick-up/Drop-off Zone Conflict	Integer	“1” if there is a pick-up/drop-off zone conflict.	

conflict	Conflict Factor	Boolean	“TRUE” if any of the above conflict factors have a value of “1”
lts	Level of Traffic Stress	Integer	The LTS score, on a scale from 1 (lowest stress) to 4 (highest stress). “NULL” if it is not a bicycle access street.

APPENDIX 2: BIKE FACILITIES DESCRIPTION

This table comes from the City of Boston's Existing Bike Network dataset[6] found on the Analyze Boston website. It describes the bicycle facility codes used in both the LTS and Existing Bike Network datasets. We included it here for convenience.

CODE	FACILITY TYPE	FACILITY DESCRIPTION	EXAMPLE
BFBL	Buffered bike lane	A lane for exclusive use by people biking. A striped buffer zone separates the lane from adjacent the vehicle travel lane or parking lane.	Seaver St, Roxbury
BL	Bike lane	A lane for exclusive use by people biking.	Norfolk St, Mattapan & Dorchester
BLSL	Bike lane on one side, shared lane on the other side	A two-way street with a bike lane in one direction and a shared lane in the opposite direction. The shared lane may be marked with shared lane markings.	Meridian St, East Boston
CFBL	Contraflow bike street	A street where people biking are allowed to travel in both directions and vehicles are allowed only in one direction. This condition is indicated with signage and a bike lane to separate bicyclists from motor vehicles traveling in the opposite direction. A bike lane or shared lane markings may be present in the direction of motor vehicle travel.	Bay State Road, Fenway

[6] Existing Bike Network dataset: https://data.boston.gov/dataset/existing-bike-network

SBL	Separated bike lane	An exclusive lane for bicycle travel that is physically separated from motor vehicle traffic via flexposts, on-street parking, and/or raised curbs. Segments may have one-way separated bike lanes on both sides of the street, a two-way separated bike lane on one side of the street, two-way separated bike lanes on both sides of the street, or a combination thereof.	Columbus Ave, Roxbury
NW, NW-U	Neighborway, unmarked neighborway	A quiet street that forms a link in the bicycle network. Bicycle priority is indicated with signage and shared lane markings. Traffic calming devices may be installed to reduce vehicle speeds. Unmarked neighborways are links in the bicycle network that have not been designated with shared lane markings, signage, or physical modifications to the roadway.	Franklin Street, Allston Commonwealth Ave carriage roads, Allston
SLM	Shared lane markings	A lane with shared lane markings indicating that bicycles and motor vehicles must share a travel lane.	Huntington Ave, Fenway
SRd	Shared street	A street designed for slow speeds with a single surface shared by all users. Motor vehicle access may be restricted entirely or during certain times of day.	Washington St, Downton Crossing
SUC	Shared Use Connector	Minor segments which connect to mainline pathways shared by bicyclists and pedestrians and other shared use paths	

SUP, NSUP, SUB	Shared Use Path	A pathway shared by bicyclists and pedestrians. The pathway may be a paved or natural surface.	Neponset Trail, Dorchester
TC	Traffic Calming	A quiet street with raised traffic calming devices that provides neighborhood connections for bicyclists.	Southern Ave, Dorchester
WALK	Walkway	A walkway or footbridge that comprises a link in the bicycle network, usually by providing access to a shared use path. Signs instruct people to walk their bicycles.	Arthur Fiedler Footbridge, Back Bay