Bike Level of Service Data Sheet

6/22/2020

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Overview

In 2012, Alta Planning + Design conducted a review of the North Carolina Statewide Bicycle Route System. Part of this review included calculating a quantitative Bicycle Level of Service using an equation from the National Cooperative Highway Research Program's (NCHRP) Report 616. The purpose of this task is to run this equation statewide, using updated data sources.

Data Sources

To perform the calculations, data from four different feature classes are required. These data are combined using spatial operations in ArcMap.

Road Characteristics

The first quarter 2019 road characteristics data were used. This is the version of road characteristics that the AADT data are referenced to, so this facilitates the incorporation of the AADT values.

AADT

These values were incorporated using an event table from Traffic Safety (Stacy Culpepper). This event table was rendered using the 2019 Q1 Road Characteristics line work, and then the ArcMap Identity tool was used to transfer attributes.

Pavement Data

These data were obtained from the P6 version of SPOT Online. The event data was rendered using the 2019 Q1 road characteristics data, and then the ArcMap Identity tool was used to transfer attributes.

PBIN

The September 2019 PBIN data were used. The data for existing bike facilities was incorporated using ArcMap snap and transfer attributes. This still requires some manual QC to transfer data where the linework does not line up well with road characteristics. Note that PBIN data are not available for all counties and an update to the geodatabase is in progress. PBIN updates will be incorporated into the BLOS analysis when updates are complete.

Calculations

The NCHRP Equations is:

$$BLOS = 0.507\ln(Vol_{15}/L_n) + 0.188\ SP_t(1+10.38HV)^2 + 7.066(1/PR_5)^2 - 0.005(W_e)^2 + 0.760$$

These calculations use similar assumptions to the ones used in the 2012 report. The main difference is that in the 2012 report, median values were used for missing values. In this iteration, default values were obtained using an average weighted by distance by functional class.

Road characteristics does not have an attribute that specifies Urban/Suburban vs Rural. These values were derived using the logic from the CTP 2.0 process.

Urban – if a road segment is within a smoothed urban boundary polygon

Suburban – if a road segment Is not in an urban boundary polygon, but is within an MPO polygon or town limit (municipal boundary)

Rural – all other road segments

The equation is calculated in sections to facilitate QC. Each heading below corresponds to a field name in the file geodatabase.

Vol_{15}

$Vol_{15} = (ADT \times D \times K_d)/(4 \times PHF)$

Values from Underlying Data

ADT – from [AADT_2018]
Urban Classification = from [UrbClass]

Default Values (from 2012 study)

	Urban/Suburban	Rural
D	0.55	0.6
K_d	0.09	0.1
PHF	0.92	0.88

Default Values for Missing AADT (from weighted average)

Functional Class	Default AADT
Interstate (1)	39,765
Principal Arterial – Other Freeways and Expressways (2)	19,885
Principal Arterial - Other (3)	16,589
Minor Arterial (4)	8,551
Major Collector (5)	3,673
Minor Collector (6)	1,534
Local (7)	768

BLOSPART1

BLOSPART1 = $0.507\ln(Vol15/L_n)$

Values from Underlying Data

L_n – from [ThruLaneCount]. If direction is not Bidirectional, then this value is doubled.

Default Values for Missing ThruLaneCount (based on weighted average)

Functional Class	Default ThruLaneCount
Interstate (1)	4
Principal Arterial – Other Freeways and Expressways (2)	4
Principal Arterial - Other (3)	3
All Others	2

SP_t

$SP_t = 1.1199\ln(SP_P-20)+0.8103$

Values from Underlying Data

SP_P – from [SpeedLimit] Note that if Speed Limit <= 20, 21 is used.

Default Values for Missing Speed Limit (values provided by Kathryn Zeringue, 6/8/2020)

Functional Class	Default Speed Limit
Interstate (1)	60
Principal Arterial – Other Freeways and Expressways (2)	55
Principal Arterial - Other (3)	50
Minor Arterial (4)	50
Major Collector (5)	45
Minor Collector (6)	50
Local (7)	25

BLOSPART2

BLOSPART2 = $0.199SP_t(1+10.38HV)^2$

Values from Underlying Data

HV – from HV

HV is according to Functional Class (from 2012 study)

Functional Class	HV
Interstate (1)	.05
Principal Arterial – Other Freeways and Expressways (2)	.035
Principal Arterial - Other (3)	.035
Minor Arterial (4)	.02
Major Collector (5)	.015

Minor Collector (6)	.015
Local (7)	0
No Data	.01

BLOSPART3

$7.066(1/PR_5)^2$

Values from Underlying Data

PR_5 – from [RTG_NBR]. This number was divided by 20 to scale the values to the 5-point pavement surface condition rating.

Default Values for Missing RTG_NBR (based on a weighted average, 0 is treated as a missing value)

Functional Class	Default PR_5
Interstate (1)	4.79
Principal Arterial – Other Freeways and Expressways (2)	4.41
Principal Arterial - Other (3)	4.37
Minor Arterial (4)	4.29
Major Collector (5)	4.26
Minor Collector (6)	4.07
Local (7)	4.03

BLOSPART4

BLOSPART4 = $0.005(W_e)^2$

Values from Underlying Data

W_E – from [LaneWidth], [LftPvdShldrWidth], [RtPvdShldrWidth] – This value is the sum of LaneWidth and whichever shoulder width value is less.

Default Values for missing lane width (based on a weighted average)

Functional Class	Lane Width
Interstate (1)	17
Principal Arterial – Other Freeways and Expressways (2)	16
Principal Arterial - Other (3)	15
Minor Arterial (4)	13
Major Collector (5)	12
Minor Collector (6)	11
Local (7)	11

BLOSRESULT

BLOSRESULT = BLOSPART1 + BLOSPART2 + BLOSPART3 - BLOSPART4 + 0.760

BLOSPART4PBIN

BLOSPART4 = $0.005(W_e)^2$

Values from Underlying Data

W_E – from [LaneWidth], [LftPvdShldrWidth], [RtPvdShldrWidth] – This value is the sum of LaneWidth and whichever shoulder width value is less.

This value incorporated with the PBIN data assigns default shoulder widths when the shoulder width value from Road Characteristics is null, or the value from road characteristics is less. Shoulder width defaults are assigned as follows:

PBIN Existing Facility Type	Default Shoulder Width (ft)
Bike Lane	5
Buffered Bike Lane or Separated Bike Lane	7
Paved Shoulder	4

Default Values for missing lane width

Functional Class	Lane Width
Interstate (1)	17
Principal Arterial – Other Freeways and Expressways (2)	16
Principal Arterial - Other (3)	15
Minor Arterial (4)	13
Major Collector (5)	12
Minor Collector (6)	11
Local (7)	11

BLOSRESULTPBIN

BLOSRESULT = BLOSPART1 + BLOSPART2 + BLOSPART3 - BLOSPART4PBIN + 0.760

BLOSGrade and BLOSGradePBIN

The BLOSGrade is assigned by rounding the BLOSResult to the nearest 10th. Routes with a route class of Interstate (1), Ramp (80) or Projected Route (9) are excluded from analysis and assigned a value of "NA". Routes with full access control are also excluded, except when the route class is Federal Route (7) which included roads like the Blue Ridge Parkway. The Road Characteristics linework also contains the Cape Fear River Trail in Cumberland County. This trail is not open to traffic and is also assigned a BLOSGrade of "NA".

BLOS Grade	BLOS Score	Description
A	<=1.5	Excellent bicycle environment
B	> 1.5 and <=2.5	Good bicycle environment
C	> 2.5 and <=3.5	Fair bicycle environment (acceptable to experienced and novice bicyclists)
D	> 3.5 and <=4.5	Poor environment (acceptable to experienced bicyclists)
E	> 4.5 and <=5.5	Deficient environment (unacceptable to experienced and novice bicyclists)
F	> 5.5	Unsafe environment (unsuitable for any bicycle travel)