Hillsborough County Florida

Hillsborough TPO
Transportation
Planning Organization

Bicycle Network Plan Location Screening and Ranking Methodology

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INTRODUCTION

To accomplish Hillsborough County's goals of Complete Streets, Vision Zero, and multimodal networks, which support alternatives to driving and travel by modes of choice to destinations people want to go, Hillsborough County and the Hillsborough Transportation Planning Organization (TPO) are working to identify, evaluate, and prioritize bicycle facility needs along County-owned roadways. To accomplish this, a methodology was developed to identify candidate locations for improvements to existing bicycle facilities and locations for new bicycle facilities to improve network connectivity. The methodology is driven by factors which capture both bicyclist risk to crashes, bicyclist exposure to traffic, and other prioritization factors. The bicycle risk score is based on traffic data on the segment which they travel on including crashes, posted speed limit, average daily traffic volume, number of lanes, and presence of roadway lighting. The exposure score is based on proximity to activity generators, activity centers, transit stops, and socio-economic and demographic inputs. The network score includes context classification, presence of existing bicycle facilities and sidewalks, and connectivity to existing facilities on intersecting and adjacent segments. The prioritized score will be calculated using the inputs from the risk, exposure, and network scores and will be used to prioritize locations for bicycle network improvements. The remainder of the technical memorandum provides details on the source data used and a summary of the scoring methodology used to develop the prioritized segments.

BICYCLE RISK FACTORS AND SCORING

The bicycle risk score includes a series of factors and indicators that reflect the potential crash risk for people on bikes traveling along a roadway segment. These factors also reflect the impact that the roadway segment may have on the level of stress and comfort for people riding along them. Therefore, where there may not be an inherent crash risk or safety issue, the factors in this category are often key indicators that determine an individual's perception of safety and risk. The risk score includes bicycle and pedestrian crash history, posted speed limit, average daily traffic volume, the number of through travel lanes, and the presence of roadway lighting.

The bicycle risk score is determined using the following formula that utilizes the factor inputs and scoring described in the following table.

$$Bicycle\ Risk\ Score = R_{Crash} + R_{Speed} + R_{AADT} + R_{Lanes} + R_{Lighting}$$

R Factors	Description	Measure	Score
Crash History (R_{crash})	Bicycle and pedestrian involved crashes along the segment during the analysis period.	0 Crashes	1
		1 Crashes	2
		2 – 3 Crashes	3
		4 – 5 Crashes	4
		>5 Crashes	5
Posted Speed Limit (R_{Speed})	Posted speed limit along the segment.	≤25 MPH	1
		30 MPH	2
		35 MPH	3
		40 MPH	4
		≥45 MPH	5
Average Annual Daily Traffic (AADT) (R_{AADT})	Average annual daily traffic along the segment.	≤5,000	1
		5,001 to 10,000	2
		10,001 to 20,000	3
		20,001 to 30,000	4
		>30,000	5
Total Lanes (R_{Lanes})	Number of travel lanes along the segment.	2 – 3	1
		4 – 5	3
		≥6	5
Lighting ($R_{Lighting}$)	The density (lighting poles per mile) of roadway lighting along the segment.	>35	1
		21 – 35	2
		10 – 20	3
		<10	4
		No Lighting	5
Max Potential Risk Score			***25***

Crash History (R_{Crash})

A demonstrated history of crashes involving people riding a bike or walking is indicative of both demand for, and a lack of, safe non-motorized facilities. Further, Hillsborough County has committed to Vision Zero, a framework that seeks to eliminate all crashes that result in a serious injury or death, reducing pedestrian and bicycle crashes will help in achieving this goal.

Prioritization Factor:

Crashes	Score
0	1
1	2
2 – 3	3
4 – 5	4
> 5	5

Data Source: Crash Data Management System (2017-2021)

Posted Speed Limit (R_{Speed})

Posted speed limit is a significant factor in determining the level of bicycle stress, and therefore the likelihood of use, and statistical level of risk for a person riding a bicycle.

Prioritization Factor:

Speed	Score
≤25 MPH	1
30 MPH	2
35 MPH	3
40 MPH	4
≥45 MPH	5

Data Source: Hillsborough County AADT 2019 shapefile

Traffic Volume (R_{AADT})

Traffic volume, measured as Average Annual Daily Traffic (AADT), is another important determinant of the level of stress and statistical level of risk for a person riding a bicycle.

Prioritization Factor:

Volume	Score
≤ 5,000	1
5,001 to 10,000	2
10,001 to 20,000	3
20,001 to 30,000	4
> 30,000	5

Data Source: Hillsborough County AADT 2019 shapefile

Total Lanes (R_{Lanes})

The total number of travel lanes is another determinant of the level of stress and statistical risk for a person riding a bicycle, with the level of separation required being closely related to the total number of travel lanes.

Prioritization Factor:

Lanes	Score
2 to 3	1
4 to 5	3
≥6	5

Data Source: Hillsborough County AADT 2019 shapefile

Roadway Lighting ($R_{Lighting}$)

The presence of roadway lighting and density of that light is an indicator of the safety of comfort of using a facility in dark conditions. The density, number of light poles per mile along a segment, was used to determine lighting conditions along each segment.

Prioritization Factor:

Volume	Score
>35	1
21 – 35	2
10 – 20	3
<10	4
No Lighting	5

Data Source: Hillsborough County Street Light shapefile

BICYCLE EXPOSURE FACTORS AND SCORING

The bicycle exposure score includes factors and indicators that reflect one's likelihood, desire, or need to ride a bicycle. The bicycle exposure score includes a segments proximity to activity generators like schools, libraries, parks, community centers, and government services; proximity to areas with a higher density of population; whether a segment has transit stops located along it, and the segments proximity to areas that contain people who have been historically underserved.

The bicycle exposure score is determined using the following formula that utilizes the factor inputs and scoring described in the following table.

$$Bicycle\ Exposure\ Score = E_{Generators} + E_{Residential\ Density} + E_{Transit} + E_{Equity}$$

Factor	Description	Measure	Score
Activity Generators ($E_{Generators}$)	Segment's proximity, in miles, to an activity generator such as a park, school, government services, cultural facility, identified activity center, or zoning category of commercial general or intensive.	>0.75	1
		0.75 – 0.51	2
		0.50 – 0.26	3
		0.25 – 0.10	4
		<0.10	5
Residential Density ($E_{ResidentialDensity}$)	The existing residential density (population per acre) of the traffic analysis zones (TAZ) adjacent to the segment.	0 – 2	1
		2 – 4	2
		4 – 8	3
		8 – 12	4
		>12	5
Proximity to Bus Stops ($E_{Transit}$)	Segment's proximity, in miles, to a public transit stop.	<0.10	5
		0.10 - 0.25	4
		0.26 – 0.75	3
		0.76 – 1.50	2
		>1.50	1
Equity & Social Justice (E_{Equity})	Segment is within or directly adjacent an Underserved Community. Scoring based on the equity factor scoring for each Census block group.	<4	1
		4 – 5	2
		6	3
		7	4
		8 – 9	5
Max Potential Exposure Score			***20***

Proximity to Activity Generators ($E_{Generators}$)

For this task, an Activity Generator refers to an individual facility or land use that a person riding a bicycle may desire to visit and would therefore generate individual bicycle trips. Activity Generators include parks, schools, universities and colleges, public cultural facilities such as museums and libraries, identified land use activity centers, and commercial general and intensive zoning categories.

Prioritization Factor: A segment's proximity, in miles, to an activity generator was used to determine scoring.

Proximity	Score
>0.75	1
0.75 – 0.51	2
0.50 – 0.26	3
0.25 – 0.10	4
<0.10	5

Data Source: County Parks, Schools, Libraries, Museums, and Zoning shapefiles

Residential Density ($E_{ResidentialDensity}$)

Higher residential densities are often associated with being more supportive of non-motorized trips, including bicycle trips.

Prioritization Factor: A segment that directly abuts, runs through, or connects a traffic analysis zone (TAZ) with an existing (2015 base year) population density will be scored based on the information in the following table.

Pop/Acre	Score
0 – 2	1
2 – 4	2
4 – 8	3
8 – 12	4
>12	5

Data Source: TPO 2045 LRTP Existing SE Data shapefile(s)

Proximity to Transit ($E_{Transit}$)

Transit service and access can help extend the range in which a person on a bike can travel and is often associated with non-motorized demand, given that the first and last mile of most transit stops involve a journey on a bicycle or by foot.

Prioritization Factor: A segments proximity, in miles, to an existing transit stop.

Proximity	Score
<0.10	1
0.10 - 0.25	2
0.26 – 0.75	3
0.76 – 1.50	4
>1.50	5

Data Source: Hillsborough Area Regional Transit (HART) stops shapefile

Equity & Social Justice (E_{Equity})

Enhancing access to a comfortable, well-connected bicycle network is one way to work towards achieving equity. Considering this aim, and in compliance with USDOT requirements, the TPO's 2021 Nondiscrimination and Equity Plan included the development of a methodology to identify Underserved Communities. The methodology is inclusive of the following data as described by the plan:

- Racial Minorities: Non-white residents who are non-Hispanic/Latinx, including African American or Black, Asian, Pacific Islander, American Indian, Alaskan Native, and members of two or more races
- Ethnic Minorities: Hispanic or Latino(a/x)
- Low-Income Households: Households that earn at or below the poverty line; for this effort the census definition of poverty is used which varies based on total household size
- Persons with Disabilities: Households with at least one person with a disability
- Limited English Proficiency Households: Households in which English is not the primary language and who do not speak English well
- Zero Vehicle Households: Households who do not own a car
- Low Educational Attainment: Persons without a high school degree
- Female Head of Households: Households with a female listed as head of household, with no husband present
- Youth: Residents who are between the ages of 10 and 17
- Older Adults: Residents who are 65 years old or older

Prioritization Factor: A segment that runs through or directly abuts a designated Undeserved Community will be awarded points based on the number of equity factors as described in the following table.

Equity Factors	Score
<4	1
4 – 5	2
6	3
7	4
8 – 9	5

Data Source: Most Underserved Area Shapefile

BICYCLE NETWORK FACTORS AND SCORING

The bicycle network score includes factors and indicators that reflect the existing conditions that impact the ability and opportunities to ride a bicycle. Having existing bicycle facilities, connectivity to other facilities, and land use that is generally more supportive of multiple travel modes impact people's decisions one where and how to ride a bicycle. The bicycle network score includes whether a

segment currently has an existing bicycle facility and what type of facility; whether a segment has existing sidewalks that can help support bicycle mobility; proximity to other existing bicycle facilities, if a segment intersects or connects to a segment that has a facility it can potentially help support longer trips; and the context classification of the segment, which reflects the expected users along a segment based on that segment's location, surrounding land use, and the surrounding street network.

The bicycle network score is determined using the following formula that utilizes the factor inputs and scoring described in the following table.

$$Bicycle\ Network\ Score = N_{Bike} + N_{Sidewalk} + N_{Connectivity} + N_{Context}$$

Factor	Description	Measure	Score
Existing Bicycle Facility (N_{Bike})	Existing bicycle facility that accommodates bicyclists along the segment.	Separated Facility	1
		Buffered Lane	2
		Standard Lane	3
		Paved Shoulder	4
		None	5
Existing Sidewalk ($N_{Sidewalk}$)	Existing sidewalk along the segment.	Sidewalk (Both Sides)	1
		Sidewalk with Gaps	3
		No Sidewalk	5
Connectivity ($N_{Connectivity}$)	Segment's distance (miles) from an existing or planned bicycle facility.	>0.75	1
		0.75 – 0.51	2
		0.50 – 0.26	3
		0.25 – 0.10	4
		<0.10	5
Context Classification ($N_{Context}$)	Context classification along the segment.	C1 & C2	1
		C3T	2
		C4	3
		C3R	4
		C3C	5
Max Potential Network Score			***20***

Existing Bicycle Facility (N_{Bike})

Existing bicycle facilities, or the way bicyclists are separated from motorists, has an impact on the safety and experience of biking along a roadway. Generally, the higher the degree of separation between bicyclists and motorists, the higher the level of comfort and feeling of safety.

Prioritization Factor:

Bicycle Facility	Score
Separated Facility	1
Buffered Lane	2
Standard Lane	3
Paved Shoulder	4
None	5

Data Source: Hillsborough County Bicycle Facilities, Sidewalk, and 2019 AADT shapefiles

Existing Sidewalk ($N_{Sidewalk}$)

Sidewalks, in many instances, especially in situations where bicycle facilities are not present or are not an attractive option to users, are utilized as the de facto bicycle facility. While sidewalks are not specifically designed to accommodate people riding bicycles, they can and often do provide people with a more comfortable riding experience.

Prioritization Factor:

Sidewalk	Score
No Sidewalk	1
Partial Sidewalk	3
Complete Sidewalk (Both Sides)	5

Data Source: 2019 AADT and Hillsborough County Sidewalk shapefiles

Connectivity ($N_{Connectivity}$)

A crucial aspect of achieving a highly useful, efficient, effective, and comfortable bicycle network is connectivity. Although the process of building out system-wide connectivity is typically a slow one, it is critically important to making bicycling a reasonable modal choice. Closing a gap between existing facilities or provide a direct connection to intersecting facilities will create a more connected and effective network of bicycle facilities.

Prioritization Factor: A segment that continues or is perpendicular to/intersects with an existing or planned bicycle facility will be awarded a score based on the following table.

Proximity	Score
>0.75	1
0.75 – 0.51	2
0.50 – 0.26	3
0.25 – 0.10	4
<0.10	5

Data Source: County Bicycle Facilities Shapefile

Context Classification ($N_{Context}$)

According to Hillsborough County's 2022 Complete Streets Guide, context-based roadway classification communicates the overall development pattern and form for a street. The Complete Streets plan asserts that, by considering the local context, design decisions can be focused to address user needs, connectivity, walkability, placemaking, livability, and community values. The number of typologies reflect the variety of ways in which streets serve the community and reflect the need for the design to be more closely aligned with the environment it serves. Different roadway classifications demand different bicycle treatments and as built today, lend a certain level of comfort for people riding bikes.

Prioritization Factor:

Context Classification	Weight
Rural (C1 & C2)	1
Suburban Town (C3T)	2
Urban (C4)	3
Suburban Residential (C3R)	4
Suburban Commercial (C3C)	5

Data Source: Hillsborough County Context Classification and FDOT District 7 Initial Context Classification shapefile

SEGMENT PRIORITIZATION SCORE

The segment prioritization score is the overall score for each location considering the risk, exposure, and network factors described in this memorandum. The segment prioritization score can be used to prioritize and inform the planning and development of bicycle network improvements. The segment prioritization scores are a product of the risk, exposure, and network scores, with the higher scores indicating locations with a higher priority, based on the data-driven process outlined in this document.

Since the risk, exposure, and network scores are naturally unbalanced, in that the potential sum of the factors for each group has a different scoring range, a normalization factor was applied to the groups to create a balanced score for each of the factor groups. The following formula shows how the normalization factors were applied.

$$Segment\ Normalization = (\sum Risk \times 0.4) + (\sum Exposure \times 0.5) + (\sum Network \times 0.5)$$

The result of the normalization is that the potential maximum score for each factor group is 10, with a maximum total score of 30.

It was determined that the prioritization scoring should be slightly weighted to reflect a priority towards the network factor scoring. It was determined that the factor groups would be weighted with the network factors receiving 40% of the total score and the risk and exposure factors each receiving 30% of the total score. This weighting was achieved using the following formula:

$$Segment\ Prioritization = (\sum Risk \times 0.4 \times 0.9) + (\sum Exposure \times 0.5 \times 0.9) + (\sum Network \times 0.5 \times 1.2)$$

The segment prioritization scores with the Network focused weighting applied are characterized by the following scoring scale:

Prioritization Score Value	Prioritization Score Category
9.9600 – 17.1600	Low
17.1601 – 19.2600	Moderate
19.2601 – 21.2700	High
> 21.2700 (max. 27.0000)	Very High