North Falls Lake Area Study Project Prioritization

FINAL

Below is a description of the proposed approach for prioritization of the projects within the North Falls Lake Area Study. The overall approach is tied to many of the goals highlighted in Destination 2055, with specific metrics and supporting methodologies that are unique to NFLAS. These metrics and methodologies have been chosen to make it feasible for projects to be prioritized regardless of inclusion or exclusion in TRM outputs.

This methodology attempts to approximate the need served by each project across multiple metrics, as appropriate to the project type, and then to normalize that need by anticipated project cost. This is done using similar metrics for both roadway and bike/ped projects, but the two categories use slightly different metrics/methodologies in some areas, use different weightings of the metrics included, and scores will be normalized and compared within each of the categories, not between them.

Contents

Goal 1: Connect People and Places

Metric 1A: Future jobs and population near facility/project

Data sources: 2055 Preferred Scenario Socioeconomic Data and baseyear data from TAZ data for TRM area and Census data for unmodeled area.

Methodology (all projects):

In ArcGIS Pro:

1) Create Project Buffer
    - Buffer each project (intersection or roadway) by 1 mile.
    - Ensure the Project ID field is retained.
2) Prepare Jobs & Population Data
    - Use base year data and CommunityViz Preferred Scenario future year outputs (jobs + population).
    - Where TAZs or grid cells are split by the buffer, assume jobs and population are distributed proportionally by area.
3) Intersect Project Buffer with Grid Layer
    - Intersect the 1-mile project buffer with the jobs/population grid dataset.
4) Calculate Area-Based Proportions
    - For each intersected grid cell:
        - Calculate the acreage of the portion within the buffer.
        - Calculate the total acreage of the original grid cell.
        - Compute the proportion of the grid cell within the buffer:
            - Proportion = Intersected Acreage / Total Grid Cell Acreage
5) Allocate Jobs and Population
    - Multiply the total jobs and population in each grid cell by the calculated proportion to estimate values within the buffer.
6) Aggregate by Project
    - Summarize total jobs and population within each buffered project area using Project ID.
7) Normalize Scores
    - Normalize results to a 0–100 scale:
        - Score = (Project Value / Maximum Value) × 100
8) Join Results Back to Projects
    - Join the normalized score back to the master project layer using Project ID for all roadway projects.

Metric 4B: Areas with Network Connectivity

Data source: Roadway network (Composite roadway file for study area)

Methodology (all roadway projects)

1) Create Project Buffer
    - Buffer each project (intersection or roadway) by 500 feet.
    - Ensure the Project ID field is retained.
2) Generate Street Density Surface
    1. Create a line density raster representing roadway network density across the study area.
    2. Reclassify the raster to standardize density values.

3) Run the Zonal Statistics as Table Tool
   1. Zone field = Project ID
   2. Statistics type = Mean
4) Normalize Scores
   1. Normalize results to a 0–100 scale:
      - Score = ((value-min)/(max-min) X 100)
5) Join Results Back to Projects
   1. Join the normalized score back to the master project layer using Project ID for all roadway projects.

Goal 2: Manage Congestion and System Reliability

Metric 2A: Existing Daily Volume*Volume-to-Capacity Ratio

Data sources: 2025 base TRM outputs, 2024 NCDOT AADT Segments

Methodology (linear roadway projects in TRM):

- Use weighted average of max V/C (highest V/C for all four periods of the model day) for model segments, weighted based on segment daily volumes
- Divide by aggregate daily volume from all TRM segments
- Scores normalized to be between 0 and 100 (value/total X 100)
- Note: New location roadways will use calculation from a parallel route or route expected to be relieved by the new facility

Methodology (intersection roadway projects in TRM):

- Use weighted average of max V/C (highest V/C for all four periods of the model day) for model segments at intersection, weighted based on segment daily volumes
- Divide by aggregate daily volume from all TRM segments within intersection
- Process iterated for all segments per intersection project and calculates a weighted average.
- Scores normalized to be between 0 and 100 (value/total X 100)

Methodology (linear roadway projects outside of TRM):

- Utilized capacity methodology defined in HCM 6^{th} Edition, Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual, and FHWA Road Diet Info Guide. Determined by functional class, number of lanes, area type, cross-section.
- Calculate V/C for each point and average,
- (V/C of project / V/C of all projects) to a score between 0 and 100 (value/total X 100)

Methodology (intersection projects outside of TRM):

- Identify nearest NCDOT AADTs on each leg and estimate V/C, for both major and minor streets, using AADT and identified capacity of the major and minor streets.
- For major streets, (V/C * AADT of major street / AADT of major and minor streets). Process was iterated for minor streets.
- Weighted score for both streets was added to reflect contribution of all intersection legs.
- Scores normalized to be between 0 and 100 (value/total X 100)

Metric 2B: Future Volume-to-Capacity Ratio

Methodology (roadway projects in TRM): Identical to previous, but uses 2055 E+C model runs as data source

Methodology (roadway projects outside of TRM): Identical to previous but uses NCDOT AADTs increased by assigned growth rate.

- 2025 AADT was assumed to be similar to 2024 AADT.
- Anticipated jobs and household growth in the area outside of the TRM (10-15%). It is assumed that this growth encompasses for the 30-year period (2025 – 2055).
- Based on NCDOT data, historic AADT growth on roadways located along NFLAS projects in unmodeled areas range between 0.0% (inside Oxford) to 2.51%.
- External nodes of TRM were accounted for two projects: Grnv 102 (US 15 Widening) and Grnv 97 (US 158 Modernization from Oxford to Person Co). The former had negative 35-year growth (-10.15%). Therefore, a minimum annual growth of 0.50% was used. The latter had parts of the project running inside the TRM. The Tar River was located on an internal segment. Nevertheless, 35-year growth was calculated and from that, the annual growth was calculated to be 0.97% per year. This helps to assess TRM-related traffic traveling along US 158 to Oxford.
- Cumulative growth rate was calculated as the product of all these growth rates.
- Forecasted 2055 AADT = 2024 AADT * cumulative growth rate.
- The remaining steps are similar to Roadway Projects outside TRM (Existing).

Methodology (intersection roadway projects outside of TRM):

- Anticipated jobs and household growth in the area outside of the TRM (5-15%). It is assumed that this growth encompasses for the 30-year period (2025 – 2055). For areas within the core interior of Oxford, 15% was assumed. For areas along northern Oxford Loop, 10% was assumed. All other areas, 5% was utilized.
- Utilized capacity methodology defined in HCM 6th Edition, Planning and Preliminary Engineering Applications Guide to the Highway Capacity Manual, and FHWA Road Diet Info Guide. Determined by functional class, number of lanes, area type, cross-section.
- Identify nearest NCDOT AADTs on each leg and estimate V/C, for both major and minor streets, using AADT and identified capacity of the major and minor streets.
- Cumulative growth rate considered both historical AADT growth, compounded over 30 years, and factored with the assumed household/population growth. Future volume calculated by using AADT and factored with this growth rate.
- For major streets, (V/C * AADT of major street / AADT of major and minor streets). Process was iterated for minor streets.
- Weighted score for both streets was added to reflect contribution of all intersection legs.
- Scores normalized to be between 0 and 100 (value/total X 100)

Metric 2C: Proximity to Existing and Future Congested Roadway/Parallel Route

Methodology (bike/ped projects):

- Manually identify parallel routes and use same approach as prescribed for roadway projects to determine Volume*V/C
- 0 points if no proximate/parallel route within one mile

Goal 3: Promote Safety, Health, and Well-Being

Metric 3A: Fatal and Serious Injury Crash Cost

Data source: NCDOT fatal and serious injury crash history for the most recent 5-year period (2021-2025), 2024 Standardized Crash Cost Estimates for North Carolina

Methodology (all projects):

- 500' buffer applied for all projects – capture crashes within the buffer net.
- Costs were calculated per project using Tables 1b – 1i from the cost estimates documentation. For those crash types which do not fall under the guidelines of these tables, their area type, crash severity, and satellite imagery to assess the surrounding land use were utilized to calculate the cost from Table 2 – which uses severity type and area type.
- Total costs of all crashes per project were calculated.
- Score for roadway projects was weighted as total costs of each project against total costs of all roadway projects. Intersection projects implemented the same methodology.
- Normalize K/A crash costs to a score between 0 and 100 (value/total X 100).

Running the Script Tools for Congestion and Crash Cost Scores

Metrics 2A, 2B, 2C, and 3A utilize a set of automated script tools that needs to be run in order from 1 – 12. These tools follow the methodology adopted for each metric. Roadways projects consist of steps 1 – 5. Intersection projects consist of steps 6 – 8. Bicycle and pedestrian projects consist of steps 9 – 12. The steps are itemized by criteria.

- *1 – Non-TRM Roadway Projects Congestion Scoring Tool (Metrics 2A + 2B)*
    - *Non-normalized scores were calculated externally. The tool transfers the scores over to GIS.*
    - *Tool focuses on roadway projects outside TRM.*
- *2 – New Location Roadway Projects Congestion Scoring Tool (Metrics 2A + 2B)*
    - *Non-normalized scores were calculated externally. The tool transfers the scores over to GIS.*
    - *Tool focuses on roadway projects at new locations.*
- *3 – New Location Project Grnv49a Congestion Scoring Tool (Metrics 2A + 2B)*
    - *Non-normalized scores were calculated using a tool within GIS.*
    - *Tool focuses on roadway project Grnv49a using a parallel route.*
    - *Grnv49b was listed as part of the input dataset. However, it was commented that the project was not scored.*
- *4 – Existing TRM Roadway Projects Congesting Scoring Tool (Metrics 2A + 2B)*
    - *Non-normalized scores were calculated using a tool within GIS.*
    - *All scores from steps 1 – 4 were normalized as a final step.*
    - *Tool focuses on roadway projects in TRM.*
- *5 – Roadway Projects Crash Scoring Tool (Metric 3A)*
    - *Tool calculates normalized crash scores within GIS.*
- *6 – Non-TRM Intersection Projects Congestion Scoring Tool (Metrics 2A + 2B)*
    - *Non-normalized scores were calculated externally. The tool transfers the scores over to GIS.*
    - *Tool focuses on intersection projects outside TRM.*
- *7 – Existing TRM Intersection Projects Congesting Scoring Tool (Metrics 2A + 2B)*

- *Non-normalized scores were calculated using a tool within GIS.*
  - *All scores from steps 6 – 7 were normalized as a final step.*
  - *Tool focuses on intersection projects in TRM.*
- *8 – Intersection Projects Crash Scoring Tool (Metrics 3A)*
  - *Tool calculates normalized crash scores within GIS.*
- *9 – Non-TRM Bicycle & Pedestrian Projects Congestion Scoring Tool (Metric 2C)*
  - *Non-normalized scores were calculated externally. The tool transfers the scores over to GIS.*
  - *Tool focuses on bicycle & pedestrian projects outside TRM.*
- *10 – New Location Bicycle & Pedestrian Projects Congestion Scoring Tool (Metric 2C)*
  - *Non-normalized scores were calculated using a tool within GIS.*
  - *Tool focuses on bicycle & pedestrian projects at new locations.*
- *11 – Existing TRM Bicycle & Pedestrian Projects Congesting Scoring Tool (Metric 2C)*
  - *Non-normalized scores were calculated using a tool within GIS.*
  - *All scores from steps 9 – 11 were normalized as a final step.*
  - *Tool focuses on bicycle & pedestrian projects in TRM.*
- *12 – Bicycle and Pedestrian Projects Crash Scoring Tool (Metric 3A)*
  - *Tool calculates normalized crash scores within GIS.*

For the listed tools above, instructions are provided when ArcGIS Pro is opened.

1. From the catalog pane, once a connection is established for the **Transportation Data.gdb**, bring in all datasets listed from each table below. Each table represents the input parameters found in each tool and the corresponding dataset which shall be used for the run.
2. From the geoprocessing pane, find the toolbox and expand it.
3. Double-click the pertaining tool, i.e. 1 – Non-TRM Roadway Projects Congestion Scoring Tool.
4. Load the relevant dataset for each parameter which is provided from the tables.
5. Click Run.

1 – Non-TRM Roadway Projects Congestion Scoring Tool	
Parameter	**Dataset**
Roadway Projects	Roadway_Project_Recommendations_Template
Non-TRM Data	RoadwayProjectRecommendations_NonTRM_Area

2 – New Location Roadway Projects Congestion Scoring Tool	
Parameter	**Dataset**
Roadway Projects	Roadway_Project_Recommendations_Template
Non-Normalized 2020 Score	RoadwayProjectRecommendations_TRM_NewLocations_2020_CongestionScoring
Non-Normalized 2055 Score	RoadwayProjectRecommendations_TRM_NewLocations_2055_CongestionScoring

3 – New Location Project Grnv49a Congestion Scoring Tool	
Parameter	**Dataset**
Roadway Projects	Roadway_Project_Recommendations_Template
Non-Normalized 2020 Score	Grnv49a_Grnv49b_2020_CongestionScoring
Non-Normalized 2055 Score	Grnv49a_Grnv49b_2055_CongestionScoring

4 – Existing TRM Roadway Projects Congesting Scoring Tool	
Parameter	**Dataset**
Roadway Projects Buffer	RoadwayProjects_100ft_Buffer
Non-Normalized 2020 Score	TRM_Segments_Inside_RoadwayProjects_2020_v3
Non-Normalized 2055 Score	TRM_Segments_Inside_RoadwayProjects_2055_v3

5 – Roadway Projects Crash Scoring Tool	
Parameter	**Dataset**
KA Crashes	KA_Crashes_RoadwayProjects
Roadway Crash Buffer	RoadwayProjects_Crash_500ft_Buffer

6 – Non-TRM Intersection Projects Congestion Scoring Tool	
Parameter	**Dataset**
Intersection Projects	Intersection_Project_Recommendations_Template
Non-TRM Data	IntersectionProjectRecommendations_NonTRM_Area

7 – Existing TRM Intersection Projects Congesting Scoring Tool	
Parameter	**Dataset**
Intersection Projects Buffer	IntersectionProjectRecommendations_Final_100ft_Buffer
Non-Normalized 2020 Score	TRM_Segments_Inside_IntersectionProjects_2020
Non-Normalized 2055 Score	TRM_Segments_Inside_IntersectionProjects_2055

8 – Intersection Projects Crash Scoring Tool	
Parameter	**Dataset**
KA Crashes	KA_Crashes_IntersectionProjects
Intersection Crash Buffer	IntersectionProjects_Crash_500ft_Buffer

9 – Non-TRM Bicycle & Pedestrian Projects Congestion Scoring Tool	
Parameter	**Dataset**
BikePed Projects	Bicycle_and_Pedestrian_Project_Recommendations_Template
Non-TRM Data	BikePedProjectRecommendations_NonTRM_Area

10 – New Location Bicycle & Pedestrian Projects Congestion Scoring Tool	
Parameter	**Dataset**
New Location BikePed Projects	BikePed_Projects_NewLocations
New Location TRM Parallel Route	EC_PS_2055_BikePed_NewLocations

11 – Existing TRM Bicycle & Pedestrian Projects Congesting Scoring Tool	
Parameter	**Dataset**
BikePed Projects Buffer	BikePeds_Projects_Buffer_100ft_AlongTRM
Existing Location TRM 2055	EC_PS_2055_BikePed_ExistingLocations

12 – Bicycle and Pedestrian Projects Crash Scoring Tool	
Parameter	**Dataset**
KA Crashes	KA_Crashes_BikePedProjects
BikePed Crash Buffer	BikePedProjects_Crash_500ft_Buffer

Goal 4: Promote and Expand Multimodal and Affordable Transportation

Metric 4A: Roadway projects with a Bike/Ped Element

Data source: Road Project GIS File

Methodology (all roadway projects)

1) Identify Roads with Bike/Ped Element
   - Open project attribute table
   - Identify fields that indicate presence of bicycle and pedestrian facilities
     - Proj_Sidewalk, Proj_Bicycle_Lane, Proj_Multiuse_Path
2) Assign Scores
   - Where these fields = 1, row is determined to have a bicycle or pedestrian element, and therefore a score of 100.
   - Those where fields = 0, row is determined to NOT have a bicycle or pedestrian element, and therefore a score of 0.

Metric 4B: Proximity to Existing Bike/Ped Facilities

Data source: Existing Bike/Ped Facilities (create composite based on edited PBIN/Atlas linework)

Methodology (all roadway projects with bike/ped facility, all bike/ped projects):

1) Create Project Buffer
   - Buffer each project (intersection or roadway) by 2 miles.
   - Ensure the Project ID field is retained.
2) Intersect Project Buffer with Grid Layer
   - Intersect the 2-mile project buffer with the bicycle and pedestrian linear dataset.
3) Calculate Area-Based Proportions
   - Calculate the total linear feet of all bicycle and pedestrian features in new intersected dataset.
4) Aggregate by Project
   - Summarize total linear feet of bicycle and pedestrian features within each buffered project area using Project ID.
5) Normalize Scores
   - Normalize results to a 0–100 scale:
     - Score = (Project Value / Maximum Value) × 100
6) Join Results Back to Projects
   - Join the normalized score back to the master project layer using Project ID for all roadway projects with a bicycle or pedestrian facility and all bicycle and pedestrian projects.

Metric 4C: Connectivity to Regional Land Use Destinations

Data source: Schools and Local Parks GIS Points

Methodology (all bike/ped projects and roadway projects):

1) Create Project Buffer **All project buffers needed were created in previous metrics.*
   - Buffer each project (intersection or roadway) by 1 mile.
   - Ensure the Project ID field is retained.
2) Join Project Buffer with Schools and Parks Point Layer
   - Use a spatial join using the 1-mile project buffer with the schools and parks dataset.
3) Calculate All Destinations
   - Add all schools and parks into one field using the join count field.
4) Aggregate by Project
   - Summarize total sum of parks and school features within each buffered project area using Project ID.
5) Normalize Scores
   - Normalize results to a 0–100 scale:
     - Score = (Project Value / Maximum Value) × 100
6) Join Results Back to Projects
   - Join the normalized score back to the master project layer using Project ID for all roadway projects and all bicycle and pedestrian projects.
7) Create Project Buffer **All project buffers needed were created in previous metrics.*
   - Buffer each project (intersection or roadway) by 1 mile.
   - Ensure the Project ID field is retained.
8) Join Project Buffer with Schools and Parks Point Layer
   - Use a spatial join using the 1-mile project buffer with the schools and parks dataset.
9) Calculate All Destinations
   - Add all schools and parks into one field using the join count field.
10) Aggregate by Project
    - Summarize total sum of parks and school features within each buffered project area using Project ID.
11) Normalize Scores
    - Normalize results to a 0–100 scale:
      - Score = (Project Value / Maximum Value) × 100
12) Join Results Back to Projects
    - Join the normalized score back to the master project layer using Project ID for all roadway projects and all bicycle and pedestrian projects.

Metric 4D: Regional Trail Connections

Data Source: Regional Trail connections (updated from ECG and GTS)

Methodology (all roadway projects with bike/ped facility, all bike/ped projects)

1) Pull All Regional Trail Connections and Bicycle and Pedestrian Facilities.
   - Symbolize based on regional trails, bicycle and pedestrian facilities touching regional trails, touching municipal boundaries, or crossing the county line.
2) Assign Scores – *Only roadway projects with bicycle and pedestrian facilities or bicycle and pedestrian projects.*
   - 100 points to Great Trails State and East Coast Greenway trails
   - 50 points to facilities that connect directly to one of these regional trails
   - 25 points to other connections that travel between municipalities or counties

Recall the "Future Jobs and Population metric" from Connect People and Places not replicated here to avoid double-counting

Goal 5: Stimulate Economic Vitality and Opportunity

Metric 5A: Connections to economic development centers

Data source: 2055 Preferred Scenario Placetypes

Methodology (all projects):

1) Create Project Buffer **All project buffers needed were created in previous metrics.*
   - Buffer each project (intersection or roadway) by 1 mile.
   - Ensure the Project ID field is retained.
2) Prepare Economic Development Center Dataset
   - Filter to the following placetypes: Community Commercial, Light Industrial Center, Heavy Industrial Center, Civic and Institutional, Town Center, Mixed Use Center, TOD
3) Intersect Project Buffer with Economic Development Centers Layer
   - Intersect the 1-mile project buffer with the economic development center dataset.
4) Calculate Area-Based Proportions
   - Calculate acreage of all economic development facility centers in the new intersected dataset.
5) Aggregate by Project
   - Summarize total sum of economic development center acres within each buffered project area using Project ID.
6) Normalize Scores
   - Normalize results to a 0–100 scale:
     - Score = (Project Value / Maximum Value) × 100
7) Join Results Back to Projects
   - Join the normalized score back to the master project layer using Project ID for all projects.

Goals 6: Ensure Equity and Participation

Metric 6A: Proximity to Communities of Concern

Data source: CAMPO Communities of Concern

8) Create Project Buffer **All project buffers needed were created in previous metrics.*
   - Buffer each project (intersection or roadway) by 1 mile.
   - Ensure the Project ID field is retained.
9) Intersect Project Buffer with Communities of Concern Layer
   - Intersect the 1-mile project buffer with the communities of concern dataset.
10) Calculate Area-Based Proportions
    - Calculate total number of communities of concern in the new intersected dataset.
11) Aggregate by Project
    - Summarize sum of communities of concern within each buffered project area using Project ID.
12) Normalize Scores
    - Normalize results to a 0–100 scale:
      - Score = (Project Value / Maximum Value) × 100
13) Join Results Back to Projects

- Join the normalized score back to the master project layer using Project ID for all projects.

Weighted Score

The above metrics will be aggregated into a combined needs score based on the following factors. For roadway projects, these factors were identified to be as similar to the RPT as is reasonable given the limited consistent datasets available for the study area. Adjustments were made to Roadway Weighting to total 100% instead of 85% as in RPT due to the addition of a secondary Cost Effectiveness measure (see below).

MTP Goal	Metric	RPT Category Equiv.	Roadway Weighting	Intersection Weighting	Bike/Ped Weighting
Connect People and Places	Future Jobs and Population Near Project	Connectivity	5%	10%	10%
	Areas with Network Connectivity	Connectivity	5%	0%	0%
Manage Congestion and System Reliability	Existing Daily Volume x V/C Ratio	Congestion	30%	25%	0%
	Future Daily Volume x V/C Ratio	Congestion	20%	15%	0%
	Proximity to Existing and Future Congested Routes	Congestion	0%	0%	10%
Promote Safety, Health, and Well-being	Aggregate Fatal and Severe Crash Cost	Safety	20%	25%	20%
Promote and Expand Multimodal and Affordable Transportation	Roadway Projects with a Bike/Ped Element	Multimodal	5%	0%	0%
	Proximity to Existing Bike/Ped Facilities	Multimodal	5%	10%	15%
	Connectivity to Regional Land Use Destinations	Multimodal	5%	5%	20%
	Regional Trail Connections	Multimodal	0%	0%	15%
Stimulate Economic Vitality and Opportunity	Connections to Economic Development Centers	Economic	5%	10%	10%
Ensure Equity and Participation	Proximity to Communities of Concern	Equity	0%	0%	0%

Cost Effectiveness

Cost Effectiveness will be calculated by dividing the Weighted Score of projects by estimate project cost in millions. This will be normalized to 100 and combined with the Weighted Score to get to a Final Composite Score.

Methodology:

- Divide weighted score by estimate project cost in millions
- Normalize to 100

Final Composite Score

Composite score calculated to factor in Weighted Score (a measure of need) and Cost Effectiveness Score (a measure of cost effectiveness). This final score is calculate by adding Weighted Score (x 0.5) and the Cost Effectiveness Score (x 0.5).

Prioritization by Project Type

Projects are ranked within the Roadway universe of projects, Intersection projects and within the Bike/Ped universe of projects, but generally not between groups due to different funding sources/limitations.