

MEMORANDUM

Date: January 19, 2021 Project #: 23031.006
To: Kenneth Shonkwiler and Jessica Horning, Oregon Department of Transportation
From: Matt Bell, Camilla Dartnell, and Grace Carsky, Kittelson & Associates, Inc.
Project: Statewide Active Transportation Needs Inventory
Subject: Draft Prioritization Memo

INTRODUCTION

The Oregon Department of Transportation (ODOT) is working to create safer, more walkable and bikeable networks in and between communities across the state, in alignment with the direction set out in the *Oregon Bicycle and Pedestrian Plan*. ODOT has completed an inventory of the existing bicycle, pedestrian, and shoulder facilities on all state highways and identified areas where additional facilities may be needed. ODOT has also evaluated the existing facilities with respect to ODOT's current design standards and identified gaps and deficiencies in the system. ODOT is currently using a range of evaluation criteria to help classify and prioritize the bicycle and pedestrian needs on the system. This evaluation is aimed at understanding the highest areas of need; however, it will not answer the question of what type of facility or design should be used to address the identified need. This memorandum, *Prioritization and Scaling*, (Task 7.1) builds on the *Final Evaluation Criteria* memorandum, and consists of the following sections:

- Background
 - A Framework for Applying the Criteria: summarizes the NCHRP Report 803 ActiveTrans Priority Tool prioritization framework
 - Evaluation Criteria: summarizes the evaluation criteria selected for the analysis (from the *Final Evaluation Criteria* memorandum)
- Recommendations for Scaling: summarizes the scaling approach for each evaluation criteria and the results of the scaling effort.

Note: Further background on applying the evaluation criteria and the relationship to the *Oregon Bicycle and Pedestrian Plan* are included in the *Final Evaluation Criteria* memorandum. The primary focus of this memorandum is on the scaling step of the prioritization process.

BACKGROUND

A Framework for Applying the Criteria

The evaluation process will roughly follow the framework from NCHRP 803: ActiveTrans Priority Tool¹ (APT). The Active Transportation Needs Inventory (ATNI) is following the methodology developed through this research and is leveraging the accompanying spreadsheet tool. The APT methodology is based on an extensive review of existing prioritization processes being used by agencies across the country at the state, regional, and local level. It uses a standard set of terms and definitions to describe the different steps in the process. The following definitions apply within the APT:

- **Factors** are the categories used to express community or agency values considered in the prioritization process and contain groups of variables with similar characteristics. The APT identifies nine factors commonly used by agencies across the country that are particularly suited for prioritization of active transportation needs. *Several of these factors align closely with the goals in the Oregon Bicycle and Pedestrian Plan.*
- **Variables** are characteristics of roadways, households, neighborhood areas, and other features that can be measured, organized under each factor. *“Variables” in the APT are synonymous with “evaluation criteria” in the terminology for the ATNI.*
- **Weights** are the numbers used to indicate the relative importance of different factors based on community or agency values. *In order to increase transparency and legibility in the weighting step, weights are done on factors, NOT variables, which are often much more technical in nature.*
- **Scaling** is the process of making two variables comparable to one another (e.g., number of crashes vs. population density.)

The APT outlines the 10-step process in two phases: **Scoping**, (steps 1-6) in which the prioritization purpose is established, factors and variables are selected, and data resources are assessed; and **Prioritization**, (steps 7-10) in which data is organized, scaling is applied, and prioritization scores are calculated. The Scoping phase is often iterative, as agencies may find a need to substitute variables if they find a lack of data availability. The primary focus of this memorandum is Step 9: Scaling, with the proposed methodology outlined in **Evaluation Criteria Scaling**.

Evaluation Criteria and Weighting

To select prioritization factors and evaluation criteria, the project team reviewed NCHRP Report 803 (referenced above), the *Oregon Bicycle and Pedestrian Plan*, and the Active Transportation Needs Inventories for Region 1, 4, and 5. The project team also sought input from internal stakeholders around

¹ Lagerwey, Peter A., et al. *Pedestrian and Bicycle Transportation Along Existing Roads—ActiveTrans Priority Tool Guidebook*. NCHRP Report 803. Project No. 07-17. 2015. Available online at http://onlinepubs.trb.org/onlinepubs/nchrp/nchrp_rpt_803.pdf

the Regions and used this input to assess the relative importance of each criteria in the prioritization process, described in more detail in the *Final Evaluation Criteria* memorandum. Table 1 presents the factors, weights, and evaluation criteria for the prioritization process.

Table 1: Proposed Factor Weighting

Factor	Weighting Factors R1	Weighting Factors R4&5	Weights for Statewide ATNI	Evaluation Criterion
Safety	8	9	8	Bicycle or pedestrian crash frequency
				Bicycle or pedestrian risk factors
Connectivity	4	6	6	Bicycle Level of Traffic Stress
				Fills a gap in an area surrounded by existing facilities
Demand	7	7	4	Access to essential destinations
				Access to transit
				Bicycle tourism routes
Equity	3	4	7	Transportation disadvantaged communities
				Health
Stakeholder Input	2	3	2	Local plan/TSP priorities
Existing Conditions	-	4	4	Presence of existing facility

The weights shown in Table 1 will be applied to the average evaluation scores for each factor in the spreadsheet tool developed for the ATNI process. The weights can be changed in the future to reflect a distinct prioritization purpose. For instance, if ODOT wanted to use the spreadsheet tool to assist with decision-making for allocating safety-related funding, the weights of the other factors could each be decreased to further emphasize safety.

RECOMMENDATIONS FOR SCALING

NCHRP Report 803 provides guidance on adjusting raw values for a given variable (criterion) to fit a common scale. There are multiple ways to adjust the values to fit the scale, depending on the distribution of the data and relative importance of the values. NCHRP Report 803 distinguishes the adjustment methods based on their appropriateness for addressing outliers. Two primary methods will be used in this project to adjust raw values to fit the selected common scale of 0 to 10. Each is described below. The following sections present a summary of the data for each criterion and the recommended adjustment methodology.

Proportionate Scaling

- Appropriate for data without outliers.
- Raw values are adjusted proportionately to fit the common scale.
- The highest value in the common scale is assigned to the highest raw value and the lowest value in the common scale is assigned to the lowest raw value. The raw values in between are scaled proportionately based on their relationship to the highest and lowest raw values.
- $Y = (X - \text{MIN}) / (\text{MAX} - \text{MIN}) \times S$, where Y is the scaled value, X is the raw value, MIN is the minimum raw value, MAX is the maximum raw value, and S is the scale.
- Zero values may be excluded and assigned a value of zero or included in the calculation and scaled.

Rank Order Scaling

- Appropriate for data with outliers.
- Raw values are ranked and then scaled proportionately to fit the selected scale.
- Zero values may be excluded and assigned a value of zero or included in the calculation and scaled.

Table 2 summarizes recommendations for scaling for each of the evaluation criteria.

Table 2: Proposed Scaling

Factor	Evaluation Criterion	Proposed Scaling
Safety	Bicycle or pedestrian crash frequency	Proportionate Scaling
	Bicycle or pedestrian risk factors	Proportionate Scaling
Connectivity	Bicycle Level of Traffic Stress	Proportionate Scaling with adjustments
	Fills a gap in an area surrounded by existing facilities	Proportionate Scaling
Demand	Access to essential destinations	Rank Order Scaling with adjustments
	Access to transit	Rank Order Scaling with adjustments
	Bicycle tourism routes	Proportionate Scaling
Equity	Transportation disadvantaged communities	Proportionate Scaling
	Health	Proportionate Scaling
Stakeholder Input	Local plan/TSP priorities	Binary Scaling (Yes = 10, No = 0)
Existing Conditions	Presence of existing facility	Proportionate Scaling

EVALUATION CRITERIA

The following summarizes the evaluation criteria and identifies how the criteria were scaled.

Bicycle and Pedestrian-Involved Crash Frequencies

This criterion prioritizes segments based on the frequency and severity of reported crashes involving bicyclists and pedestrians. Segments with Fatal and Injury A crashes were given a score of 100, while segments with Injury B and C crashes were given a score of 10, and segments with Property Damage Only (PDO) crashes were given a score of 1, representative of an equivalent property damage only (EPDO) methodology. Segments with multiple crashes were given a sum of the applicable scores.

Chart 1 summarizes the segment scores for bicycle-involved crashes. Of the 70,643 segments included in the evaluation, 69,881 have a segment score of 0. Segments with a score of 0 were removed from this chart for clarity.

Chart 1: Bicycle-Involved Crash Frequency

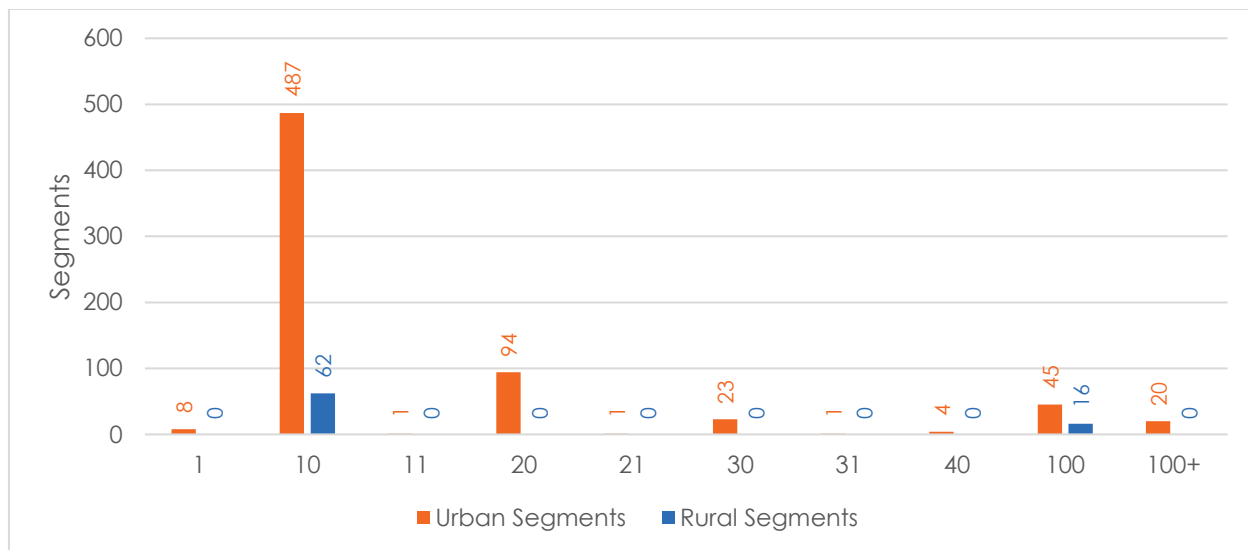
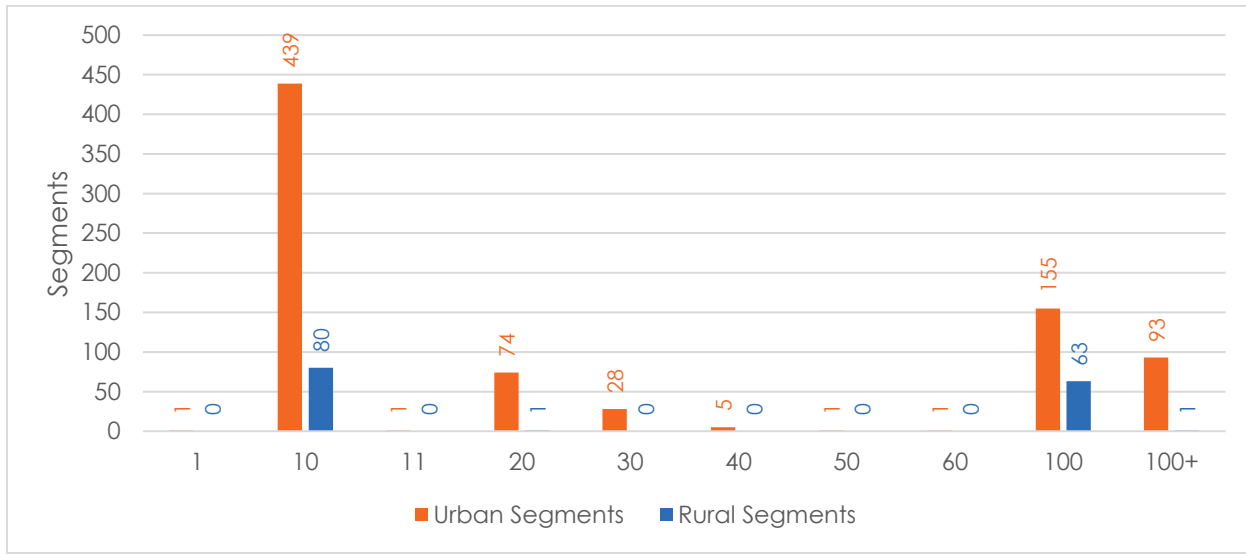


Chart 2 summarizes the segment scores for pedestrian-involved crashes. Of the 70,643 segments included in the evaluation, 69,700 have a segment score of 0. Segments with a score of 0 were removed from this chart for clarity.

Chart 2: Pedestrian-Involved Crash Frequency



Proposed Scaling Method: Proportionate Scaling

Note: The previously completed Region 4&5 ATNI manually changed the scale for some scores. Segments with a score equal to 1 were manually scaled to "3" and segments with a score equal to 10 were manually scaled to "5" to make them more competitive to segments with higher injury crashes. Proportionate scaling was then applied for the higher scores with the highest score scaled to "10". Therefore, the scaled values included "0" to represent locations with no crash history and a range of 3 to 10 to represent locations with a crash history. For this statewide ATNI we have applied direct proportionate scaling, with no manual modifications, to best represent the differential created in the EPDO evaluation method.

Bicycle and Pedestrian Risk Factors

This criterion prioritizes segments based on the overall bicycle and pedestrian risk factor scores developed by ODOT as part of the recent Pedestrian and Bicycle Safety Implementation Plan – the overall bicycle and pedestrian risk factors scores reflect a combination of risk factor scores for roadway characteristics (e.g., classification, number of lanes, posted speed, presence of bike lanes or sidewalks), context (e.g., zoning, proximity to schools, proximity to transit stops), and demographics (e.g., population over 64). Segments with high overall risk factor scores were scored higher than segments with low overall risk factor scores. The original analysis identified different factors for urban and rural areas, so the team normalized the data so that segment scores for both rural and urban areas ranged from <1 to 10 and can be applied comparatively. Charts 3 and 4 summarize the normalized bicycle and pedestrian risk factor segment scores.

Chart 3: Bicycle Risk Factor

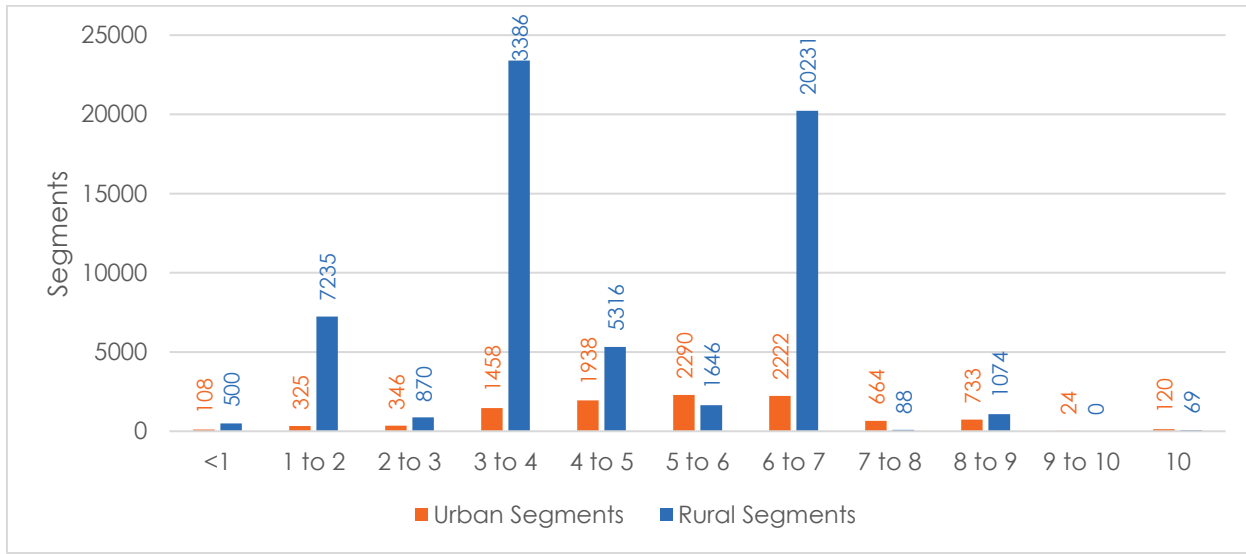
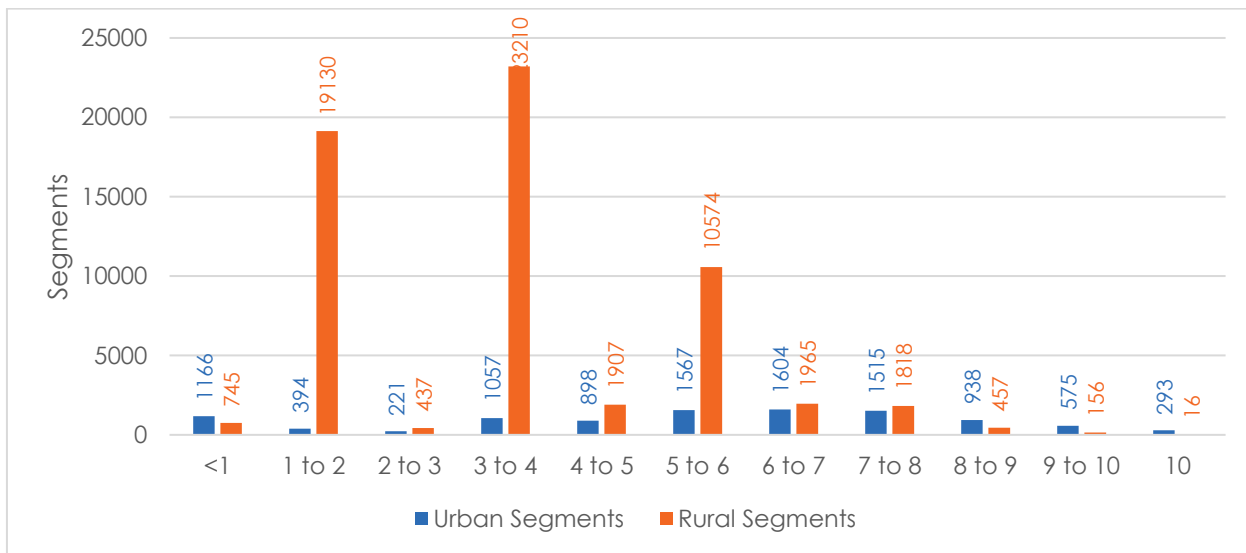


Chart 4: Pedestrian Risk Factor



Proposed Scaling Method: Proportionate Scaling

Note: This criterion was not used in the previous ATNI

Presence of Existing Facility

This criterion prioritizes locations with gaps or deficiencies in the existing bicycle and pedestrian networks. Segments with a gap were given a score of 2, while segments with a deficiency were given a score of 1, and segments that meet current ODOT Highway Design Manual (HDM) standards, were given a score of 0. Charts 5 and 6 summarize the segment scores for bicycle and pedestrian facilities.

Chart 5: Existing Bicycle Facilities

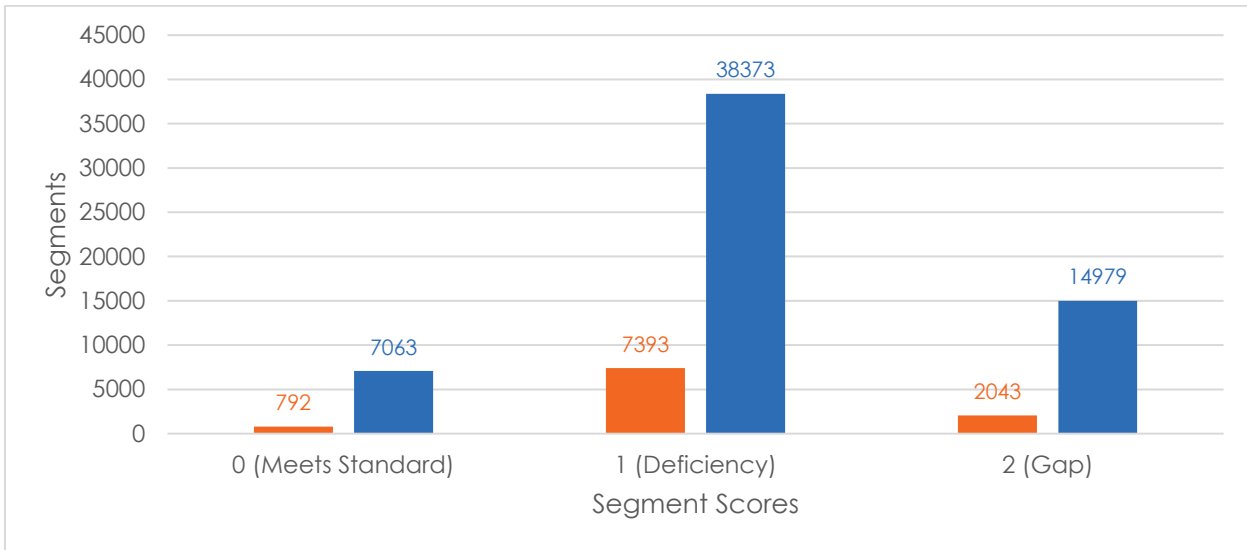
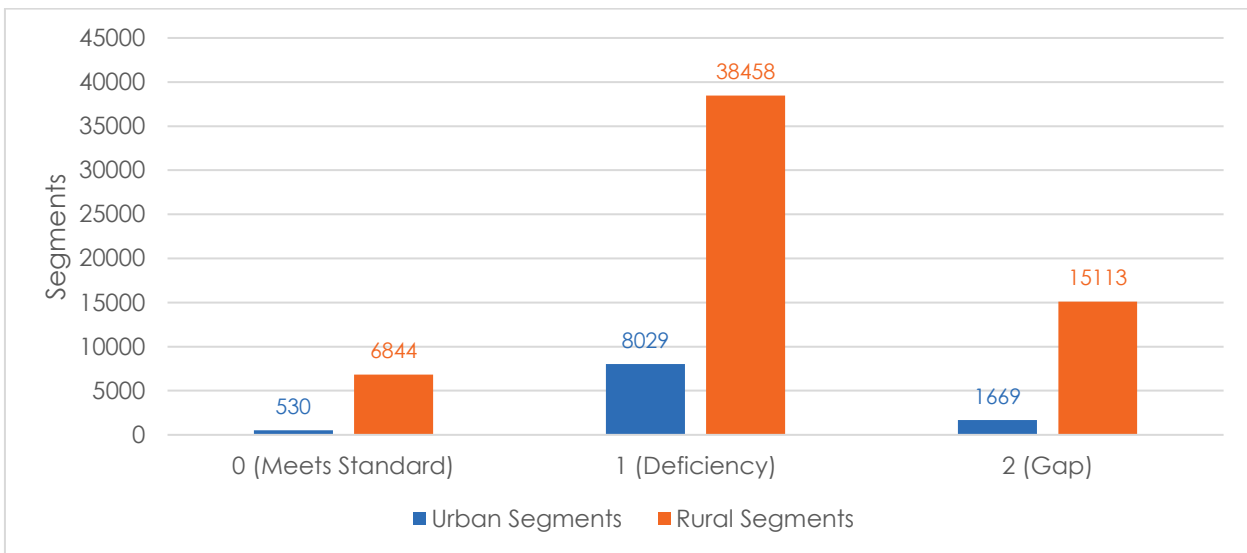


Chart 6: Existing Pedestrian Facilities

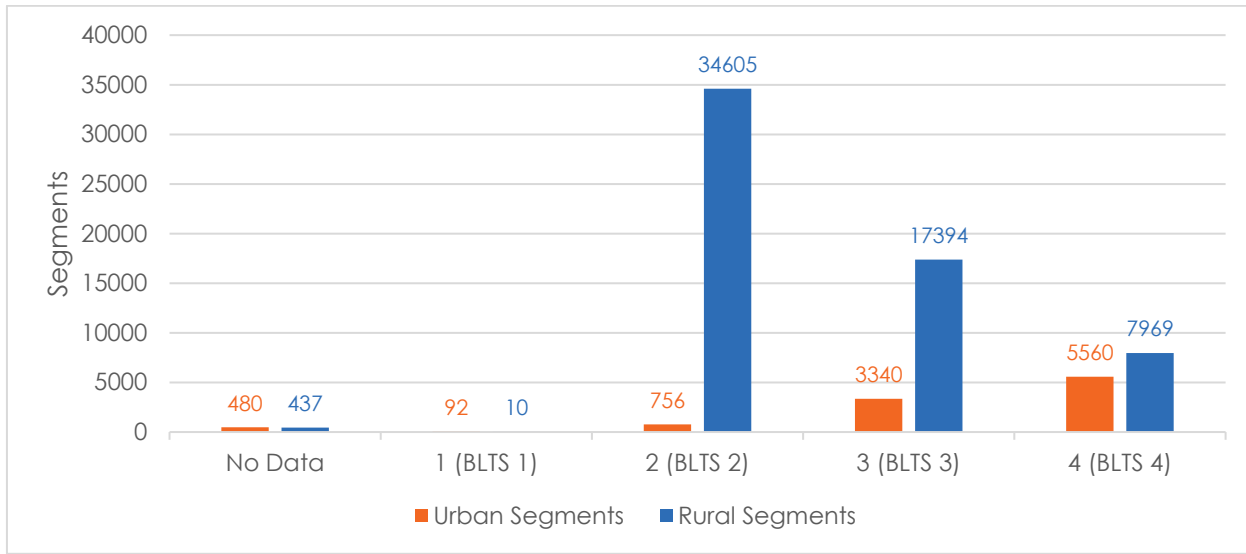


Proposed Scaling Method: Proportionate Scaling

Bicycle Level of Traffic Stress

This criterion prioritizes segments based on the bicycle level of traffic stress (LTS) scores developed by ODOT as part of a recent statewide analysis. Segments with low bicycle LTS scores were scored lower than segments with high bicycle LTS scores. The segment scores range from 1 to 4 and are consistent with those identified in the analysis. Chart 7 summarizes the segment scores for bicycle LTS.

Chart 7: Bicycle Level of Traffic Stress



Proposed Scaling Method: Proportionate Scaling with adjustments (Segments with bicycle LTS scores of 1 and 2 were scaled to 0, while segments with bicycle LTS scores of 3 and 4 were scaled proportionately)

Fills a Gap in an Area Surrounded by Existing Facilities

This criterion prioritizes segments with small gaps in otherwise complete bicycle and pedestrian networks, to best leverage and connect the networks that are already in place. Segments with small gaps were scored higher than segments with large gaps and segments in areas with otherwise completed networks were scored higher than areas with less complete networks. The segment scores range from <1 to 7. Charts 8 and 9 summarize the segment scores for bicycle and pedestrian facilities.

Chart 8: Fills a Gap in an Area Surrounded by Existing Bicycle Facilities

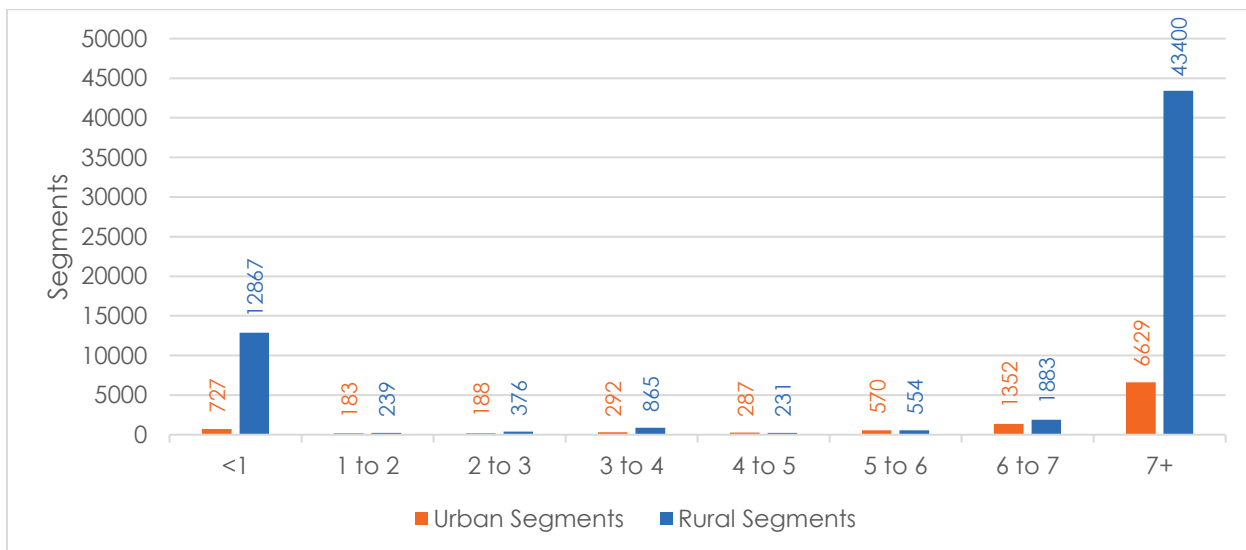
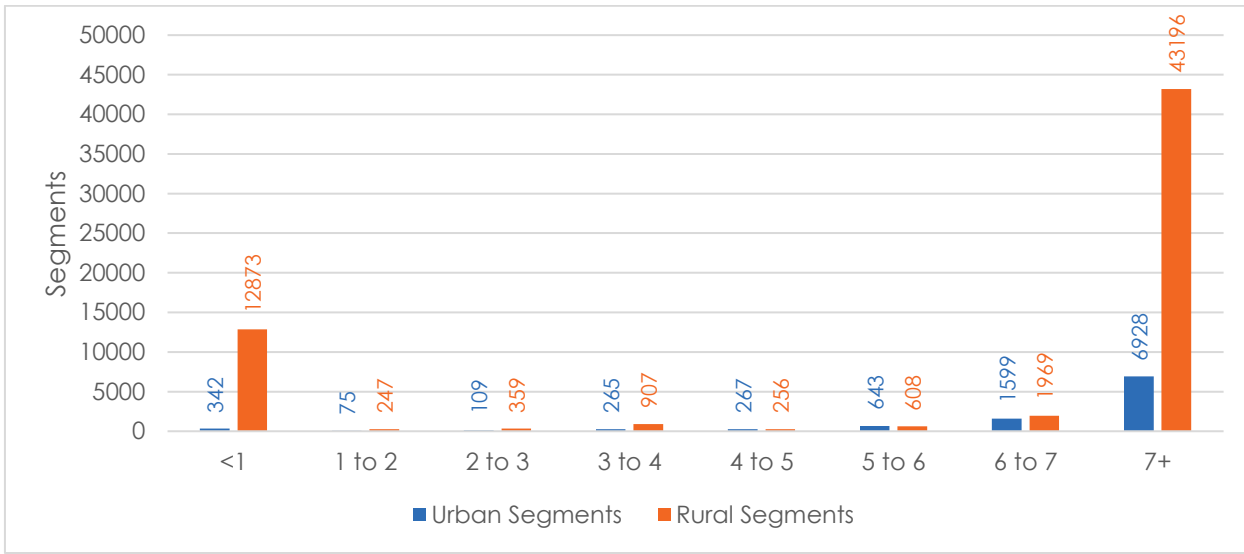


Chart 9: Fills a Gap in an Area Surrounded by Existing Pedestrian Facilities

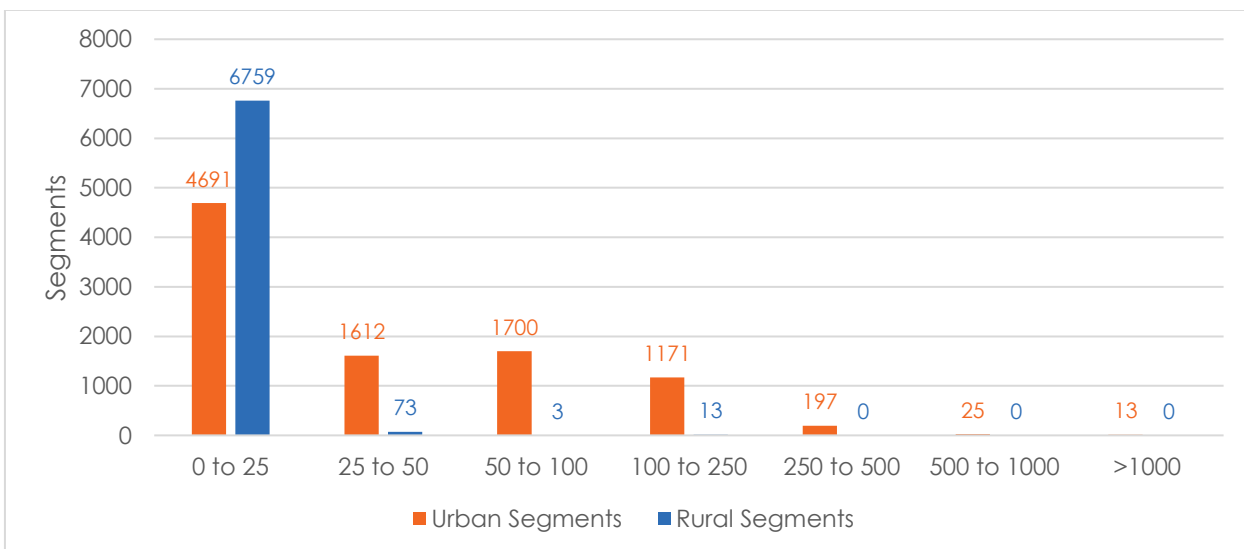


Proposed Scaling Method: Proportionate Scaling

Access to Essential Destinations

This criterion prioritizes segments that provide access to essential destinations (e.g., schools, parks, employment centers) on or near a State highway. Segments with an essential destination on the highway (or within 300-feet of the centerline) were given a score of 3, while segments with an essential destination near the highway (or ¼ mile from the centerline) were given a score of 2, and segments with an essential destination on a local facility within ½ mile of a State highway were given a score of 1. Segments with multiple essential destinations were given a sum of these scores based on the destination’s proximity to the segment. Chart 10 summarizes the segment scores for access to essential destinations.

Chart 10: Access to Essential Destinations

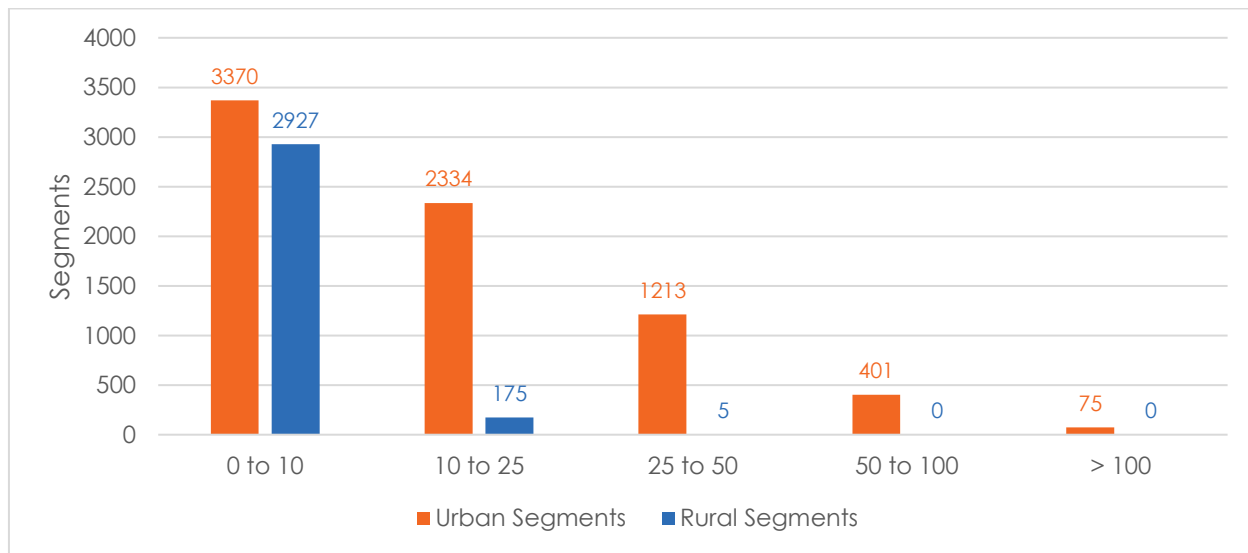


Proposed Scaling Method: Rank Order Scaling with adjustments (segments with a score of 1 were scaled to 1 to distinguish them from segments with a score of 0)

Access to Transit

This criterion will prioritize segments that provide access to transit facilities on or near a State highway. Segments with a transit stop on the highway (or within 300-feet of the centerline) were given a score of 3, while segments with a transit stop near the highway (or ¼ mile from the centerline) were given a score of 2, and segments with a transit stop on a local facility within ½ mile of a State highway were given a score of 1. Segments with multiple transit stops were given a sum of these scores based on the stop’s proximity to the segment. Chart 11 summarizes the segment scores for access to essential transit.

Chart 11: Access to Transit

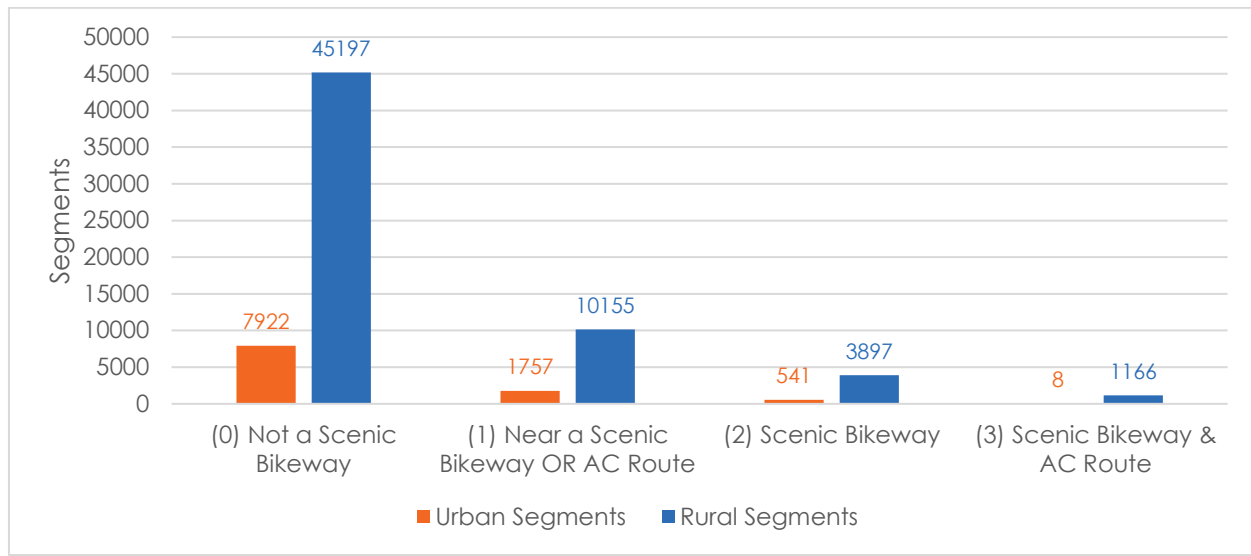


Proposed Scaling Method: Rank Order Scaling with adjustments (segments with a score of 1 were scaled to 1 to distinguish them from segments with a score of 0)

Bicycle Tourism Routes

This criterion prioritizes routes that are currently used as recreational/touring routes and the key connections that are needed for these routes. Segments that are part of an Oregon Scenic Bikeway were given a score of 2 while segments within three miles of a Scenic Bikeway were given a 1. Segments that are part of an adventure cycling route were also given a 1. Segments with multiple designations were given a sum of these scores. Chart 12 summarizes the segment scores for bicycle tourism routes.

Chart 12: Bicycle Tourism Routes

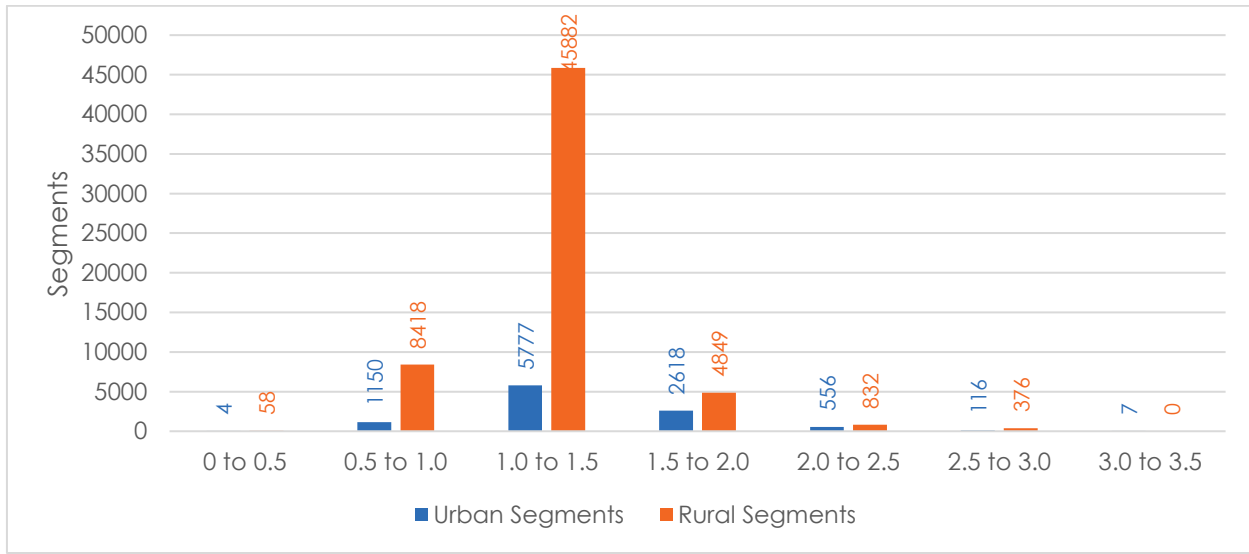


Proposed Scaling Method: Proportionate Scaling

Transportation Disadvantaged Index

This criterion prioritizes segments located in or adjacent to census tracts that have relatively high concentrations of transportation disadvantaged communities. The transportation disadvantaged communities score was calculated at the census block group level as the sum of people 65 and older, 17 and younger, under 200% of the poverty line, non-white or Hispanic, speak English “not well” or “not at all”, with a disability, living in households with more than one person per room, or living in households without vehicle access. That sum is divided by total block group population. People fitting into multiple vulnerability categories are counted multiple times. The higher the index number the more disadvantaged the population is expected to be with respect to transportation and the higher the score. Chart 13 summarizes the segment scores for the transportation disadvantaged index.

Chart 13: Transportation Disadvantaged Index

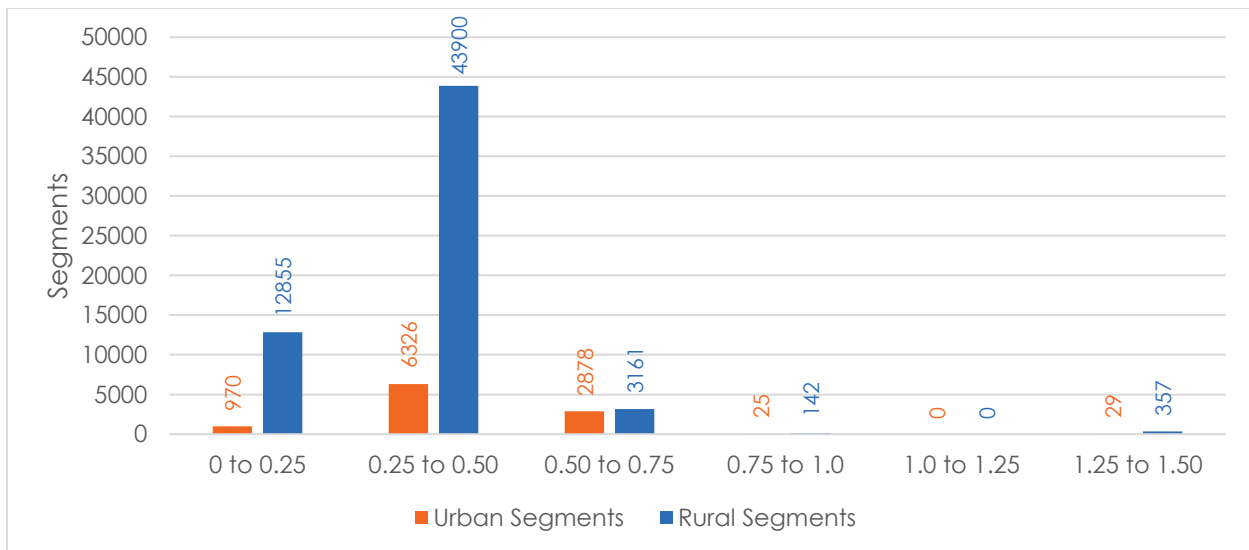


Proposed Scaling Method: Proportionate Scaling

Health

This criterion prioritizes segments located in or adjacent to census tracts that have relatively high concentrations of people with chronic health issues. This criterion utilizes the Environmental Protection Agency’s Respiratory Hazard Index to evaluate health throughout the state. Segments in areas with high respiratory hazard index scores were scored higher than segments in areas with low respiratory hazard index scores. Chart 14 summarizes the segments scores for health.

Chart 14: Health

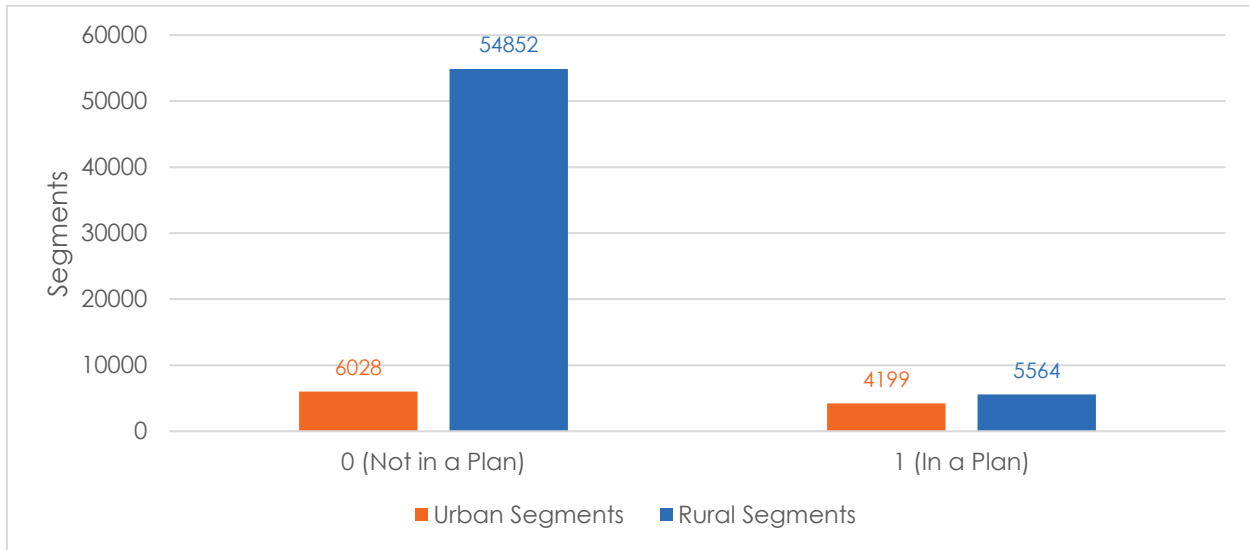


Proposed Scaling Method: Proportionate Scaling

Local Plan/TSP Priorities

This criterion prioritizes segments that have been previously identified through the planning efforts of a local jurisdiction. Segments that appear in local plans, including transportation system plans, were given a score of 1 while segments that do not appear in local plans were given a 0. Chart 15 summarizes the segment scores for local plan/TSP priorities.

Chart 15: Local Plan/TSP Priorities



Proposed Scaling Method: Segments with a score of 1 will be scaled to 10 while segments with a score of 0 will be scaled to 0.