Pedestrian and Bicycle Improvement Scoring Method for SHIFT–2024

Report Number: KTC-23-10

DOI: https://doi.org/10.13023/ktc.rr.2023.10

Kentucky Transportation Center
College of Engineering, University of Kentucky, Lexington, Kentucky

in cooperation with
Kentucky Transportation Cabinet
Commonwealth of Kentucky

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University of Kentucky

Research Report

KTC-23-10

Pedestrian and Bicycle Improvement Scoring Method for SHIFT–2024

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Commonwealth of Kentucky

January 2023

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
KTC-23-10		

4. Title and Subtitle	5. Report Date
Pedestrian and Bicycle Improvement Scoring Method for SHIFT–2024	January 2023
	6. Performing Organization Code

7. Author(s):	8. Performing Organization Report No.
Nikiforos Stamatiadis, Daria Korostina, Teng Wang, Reginald Souleyrette	KTC-23-10

9. Performing Organization Name and Address	10. Work Unit No. (TRAIS)
Kentucky Transportation Center College of Engineering University of Kentucky Lexington, KY 40506-0281	
	11. Contract or Grant No. SPR 22-623

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
Kentucky Transportation Cabinet State Office Building Frankfort, KY 40622	Final
	14. Sponsoring Agency Code

15. Supplementary Notes
Prepared in cooperation with the Kentucky Transportation Cabinet

16. Abstract
State transportation agencies have limited funding to deliver multimodal transportation programs that address the needs of all users. To allocate project funding in an impartial and objective manner, many agencies have adopted data-driven scoring systems that are used to evaluate the merits of proposed capital improvement projects. The Kentucky Transportation Cabinet introduced the Strategic Highway Investment Formula for Tomorrow (SHIFT) for this purpose. Until now SHIFT, has evaluated projects based five core variables — congestion, safety, benefit-cost ratio, asset management, economic growth. To address local needs, SHIFT has also allocated points that Area Development Districts, metropolitan planning organizations, and Cabinet districts can use to boost scores, and thus increase their chances for funding. However, SHIFT has not explicitly addressed pedestrian/bicycle improvements in its scoring formula. Based on a literature review and experimentation with different methodologies, this report proposes a method of scoring proposed pedestrian and bicycle improvements for SHIFT—2024. Under the scoring system, up to 10% of SHIFT's available points may be awarded to pedestrian and bicycle improvements — 5% for pedestrian improvements and 5% for bicycle improvements. In addition to the new scoring component, the report proposes a list of general project categories that can be used to classify pedestrian/bicycle improvements. Categorization can facilitate benefit-cost analysis, establish a foundation for systematically evaluating projects, and inform the future refinement of the SHIFT process.

17. Key Words	18. Distribution Statement
project evaluation, pedestrian facilities, bicycle facilities, project prioritization	Unlimited with approval of the Kentucky Transportation Cabinet

19. Security Classification (report)	20. Security Classification (this page)	21. No. of Pages	19. Security Classification (report)
Unclassified	Unclassified	52	

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Executive Summary

From the 1970s through the 1990s, state departments of transportation (DOTs) focused primarily on building out infrastructure that catered to motorists, the consequence of which was many facilities designed during this period failed to accommodate bicyclists, pedestrians, and other system users who rely on non-motorized means of getting around. But with growing numbers embracing non-motorized transportation modes, state and local transportation agencies cannot afford to ignore the needs of these users. Agencies must formulate creative, impartial, and data-driven methods of stretching limited funding to deliver a balanced transportation program.

The Kentucky Transportation Cabinet (KYTC) uses the Strategic Highway Investment Formula for Tomorrow (SHIFT) to review and prioritize proposed capital improvement projects. Until now, 70% of the points available under SHIFT's scoring formula hinged five main components — congestion, safety, benefit-cost ratio, asset management, and economic growth. Another 30% of available points came from what are termed boosts. Area Development Districts (ADDs), metropolitan planning organizations (MPOs), and KYTC Districts have had the opportunity to boost scores for their highest priority projects in order to increase the likelihood of their being funded. Despite adopting a holistic approach to project scoring, SHIFT has not explicitly considered pedestrian/bicycle improvements in its scoring formula. This report proposes a method for incorporating consideration of these improvements into the scoring for SHIFT—2024.

Researchers designed the proposed scoring adjustments based on a review of practices adopted at other state DOTs (especially those in North Carolina and Virginia) as well as recently published literature. They experimented with several scoring scenarios to identify a balanced approach that attends to the needs of all users (for details on how scenarios were evaluated, see Chapter 4). Based on this effort, the research team recommends that the SHIFT–2024 scoring formula allocate *5 points for pedestrian improvements and 5 points for bicycle improvements* (for a total of 10 points). Dedicating fewer than 10 points would have a minimal impact on scoring and rankings and hinder KYTC's efforts to account for pedestrian/bicycle improvements in its funding decisions. These points will come from those originally allocated to main components. Allocating points in this manner ensures that projects earn points even if they only include either a pedestrian or bicycle improvement. Reducing the number of available points for SHIFT's main components keeps the number of points available for the MPO boost and District boost unchanged at 15 points apiece, so local issues can be addressed. Table E1 compares the SHIFT–2022 and SHIFT–2024 scoring methods.

Table E1 Comparison of SHIFT–2022 and SHIFT–2024 Scoring Methods

Element	SHIFT–2022 Point Value	SHIFT–2024 Point Value
Main Components • Congestion, safety, benefit-cost ratio, asset management, and economic growth	70	60
MPO Boost	15	15
District Boost	15	15
Pedestrian Improvements	—	5
Bicycle Improvements	—	5

Tables E2 and E3 capture how existing pedestrian/bicycle facilities and proposed pedestrian/bicycle improvements will be scored under SHIFT–2024. Indeed, while scoring proposed improvements is critical, it is equally critical for KYTC to consider existing facilities when rating projects. Existing facilities earn more points by having a high level of pedestrian/bicycle infrastructure in good condition along a project corridor. Proposed improvements tend to score highest if they entail building separated or buffered facilities.

Table E2 Revised Scores For Existing Pedestrian And Bicycle Facilities

Bicycle Facilities	Pedestrian Facilities	Points
• Bicycle lanes in both sides or path is present and in good condition	• Sidewalks in both sides are present and in good condition	5
• Bicycle lanes in both sides or path is present and in poor condition	• Sidewalks in both sides are present and in poor condition	4
• Bicycle lanes in both sides or path is present for <75% of project length	• Sidewalks in both sides are present for <50-75% of project length	3
• Bicycle lane or path is present for <50-75% of project length	• Sidewalk is present in one side	2
• Sharrows are present	• Sidewalks in both sides are present for <50% of project length	1
• No facilities	• No facilities	0

Table E3 Proposed Methods for Scoring Pedestrian and Bicycle Improvements in SHIFT–2024

Bicycle Project	Pedestrian Project	Points
• New bicycle multi- or shared-use path, protected bicycle lanes, rail-trail, bicycle signalization	• New pedestrian multi- or shared-use path, sidewalk or trail	5
• New buffered or separated bicycle lane	• Sidewalk improvement (widening, major repair/replacement of discontinuous or poor condition); Trail improvement	4
• Improve bicycle facility (create buffer on existing lanes, widen bicycle lanes, pave shoulder, extend bicycle lanes…)	• Crossing island, curb extensions, streetscape, adding enhanced crosswalks	3
• New bicycle lane (no separation)	• Signalization improvements	2
• Bicycle amenities (parking, signing, etc.); Sharrows	• Wayfinding	1
• No project defined	• No project defined	0

Along with the revised scoring methods, SHIFT will benefit from initial project documentation that integrates more detailed descriptions of proposed projects. Doing so can improve benefit-cost analysis, establish a foundation for systematically evaluating projects, and inform the future refinement of the SHIFT process. A proposed list of general project categories to aid in this effort was developed (Table E4).

Table E4 Proposed Pedestrian/Bicycle Project Types for SHIFT–2024

• New shared use path (off road)	• Add sharrows
• New shared path (on road)	• Add bike amenities (e.g., parking, signing)
• New bike path (off road)	• New pedestrian trail
• New bike lane (buffered)	• New sidewalk
• New bike lane (separated)	• Improve sidewalk (e.g., add buffer, repair condition/ connectivity, widen, add curb extensions)
• New bike lane (shoulder)	• Add crossing island or streetscape
• Improve bike facility (e.g., add a buffer, widen the lane, pave shoulders, etc.)	• Add signalization for pedestrians
• Add signalization for bikes	• Add pedestrian amenities (e.g., wayfinding, signing)

Chapter 1 Introduction

Highway design practices from the 1970s through the late-1990s focused on the mobility needs of motorists while mostly overlooking pedestrian and bicyclist needs. This design philosophy resulted in projects that had few — if any — facilities to accommodate non-motorized users. State departments of transportation (DOTs) have traditionally prioritized motor vehicle travel, using funding mechanisms that subsidize auto-oriented projects, which gave the US roadway network its current form. Recent legislative and policy initiatives, however, have placed greater emphasis on delivering multimodal projects. The Intermodal Surface Transportation Efficiency Act (ISTEA) was the first law that dedicated funds toward the expansion of walking and bicycling facilities. The emergence of Context Sensitive Solutions in the early-2000s underscored the need for multimodal transportation solutions and stressed the importance of state DOT plans and projects accommodating pedestrians and bicyclists.

The US has also witnessed a resurgence in walking and biking trips. The 2009 National Household Travel Survey estimated that walking and biking trips accounted for roughly 11.9 percent all trips, higher than the 9.5 percent in 2001 (USDOT 2010a). A review of recent trends also indicates an increase in the share of bicycles as a transport mode. Between 1977 and 2009, the share of bicycle trips as a percentage of total trips almost doubled from 0.6% to 1.0%.

Behavioral studies have also confirmed an increase bicycle ridership, with over 40% of people reporting they use a bicycle more often than in the past (NHTSA 2013). Interestingly, most of these trips are not recreational (Pucher et al. 2011). A review of bicycle facilities and policies in 14 cities found large increases in bicycling mobility following the adoption of comprehensive packages of interventions. (Pucher et al. 2010). Thus, public policy plays a critical role in increasing bicycle travel.

Dowell and Petraglia's (2012) study of jobs created by the American Recovery and Reinvestment Act found that walking and biking infrastructure projects, including trail construction, created 17.0 jobs (in design, engineering, and construction) per $1 million spent— more than any other project type (Figure 1.1). This, combined with the fact that such projects are typically less expensive to build, make active transportation projects a viable solution to improve multimodal access (Bhattacharya et al. 2019).

Identifying and delivering projects that address pedestrian and bicyclist needs is critical. With many projects typically competing for limited state funding, state DOTs must find a balanced approach that weighs pedestrian and bicycle facility needs against the needs and demands of motorists. Because not everyone can drive or access transit, people must recourse to walking and bicycling. Therefore, establishing a process to evaluate the needs of pedestrians and bicyclists and identifying projects that could fulfill those needs is critical.

The Kentucky Transportation Cabinet (KYTC) developed the Strategic Highway Investment Formula for Tomorrow (SHIFT) process to systematically evaluate projects and identify those with the greatest potential to improve the state roadway network. SHIFT is a data-driven approach that objectively compares capital improvement projects and prioritizes them so that limited funds can be used effectively. Five attributes are used to score projects — safety, asset management, economic growth, congestion, and benefit-cost ratio. Each factor has specific objectives that are examined in relation to a project's goals, and points are calculated for each. Scores can also be increased through the metropolitan planning organization (MPO) and District boost processes. A weighted score is computed to arrive at the project score.

Currently, SHIFT only incorporates metrics for motorized users (automobile and freight). As such, SHIFT needs to be updated so it can properly evaluate the benefits and costs of projects dealing with non-motorized transportation (i.e., pedestrians, bicyclists, e-scooters, wheelchair users) and their contributions to active transportation.

Wanting to add a pedestrian and bicycle component into SHIFT, KYTC commissioned our Kentucky Transportation Center (KTC) research team to provide insights on the best way of incorporating the transportation needs of non-motorized users and related projects and/or project components into SHIFT. Study objectives included:

- Identify efforts to evaluate projects for non-motorized users adopted by other transportation agencies.
- Determine metrics used in project evaluations pertinent to non-motorized users.
- Identify areas where a scoring process for non-motorized user projects could be included in SHIFT.
- Develop a process for scoring non-motorized user projects in SHIFT.
- Identify areas and develop feedback for updating the Cabinet's Pedestrian and Bicycle Travel Policy.
- Identify funding mechanisms for projects that address non-motorized users.

This report defines KYTC's current approach to handling the needs of non-motorized transportation users, looks at how other agencies contend with these user needs, and pinpoints factors that could be included in future SHIFT evaluations. It proposes a modified scoring method for SHIFT–2024 that makes points available for projects which include pedestrian/bicycle improvements, thus giving the Cabinet a way to ensure the needs of people who depend on non-motorized means of transportation are accounted for during project prioritization.

Chapter 2 Literature Review

This chapter summarizes information on Kentucky's bicycle and pedestrian program and reviews efforts from around the US focused on quantifying pedestrian and bicycle project impacts as well as project prioritization methods.

2.1 KYTC Practices

Kentucky has several laws and regulations that deal with bicycle travel and pedestrians. KRS 189.010 defines bicycles as vehicles and states that cyclists have the same rights and the same responsibilities to follow the rules of the road as motorists (KYTC 2016). It defines pedestrians as any person afoot or in a wheelchair. KRS 189.570 also describes which users have the right-of-way under different circumstances.

KYTC's 2002 *Pedestrian and Bicycle Travel Policy* describes where it may be necessary to include pedestrian or bicycle facilities as part of roadway projects in urban and rural areas and stipulates what entity is responsible for maintaining those facilities. Bicycle traffic may be expected on all roadways except interstate highways and other facilities with full access control. When deciding whether to install a bicycle facility it is important to select an appropriate facility type based on project needs and goals. Under the policy, KYTC considers accommodating bicycles on all new or reconstructed state-maintained roadways and when planning the resurfacing of roadways, including shoulders. KYTC's new *Complete Streets, Roads, and Highways Manual* replaces the 2002 policy and shifts from an autocentric approach to one more focused on the multimodal transportation needs of communities (KYTC 2022a). The manual offers guidance on design solutions that support motorists, bicyclists, pedestrians, transit users, and freight carriers.

The Bicycle and Pedestrian Master Plan (2022b) provides a framework for advancing pedestrian and bicycle projects within various Kentucky agencies and guidance for existing pedestrian bicycle facilities to determine which ones need improvement. An important part of this effort is identifying available funding and programs for future projects. Goals for supporting the Master Plan focus on safety, connectivity, equity, health/ environment, and thriving communities. A framework for accomplishing these goals is defined, and specific actions and practices discussed.

KYTC's *Highway Design Guidance Manual* (HDM) references the 2002 Pedestrian and Bicycle Travel Policy as the controlling guidance for addressing bicycle and pedestrian needs, although it contains more detail. Section 1500 (Pedestrian & Bicycle Accommodations) defines the selection of pedestrian or bicycle facilities and gives examples of designs/common practices for urban and rural areas (Table 2.1; KYTC 2020).

Table 2.1 Summary of KYTC HDM Design Practices for Pedestrian and Bicyclists

Facility	Area	
	Urban	**Rural**
Pedestrian	• 5' sidewalks with 2' buffer strip on both sides of the roadway (desirable) • 5' minimum, 6'-10' desirable for sidewalks in heavily traveled pedestrian areas, Central Business Districts (CBDs), and other special applications • 10' desirable, 8' minimum shared use path (two-way directional travel) • Shoulders (for rural cross-section in urban areas): minimum width based on KYTC policy as stated in HD-700, "Geometric Design Guidelines" • 10' shared use path with 5' sidewalk on opposite side	• Shoulders: minimum width based on KYTC policy as stated in Highway Design Manual, HD-700, "Geometric Design Guidelines" • 10' desirable, 8' minimum shared use path (two-way directional travel) • 5' sidewalk with 2' buffer strip on both sides of the roadway (desirable for urban cross-section in rural areas)
Bicycle	• Shared Lanes • Paved Shoulders • Kentucky Shoulder Bikeways • Min 4' beyond rumble strips, 5' when guardrail is present, 6' is preferred • No additional striping • The bicycle lane symbol should not be used • Wide Curb Lanes	• Same as Urban

	• 14’ of usable lane width is the recommended width • Restriping to provide wide curb lanes by making the remaining travel lanes and left-turn lanes narrower • Bicycle Lanes • 5 to 6’ from the face of a curb or guardrail to the lane stripe • 4’ min width with no curb and gutter or guardrail	

KYTC also maintains a webpage for bicycle and pedestrian plans and clubs at the city, MPO, and county levels. Maps and related documents of these plans are summarized and listed in Figure 2.1 (KYTC n.d.).

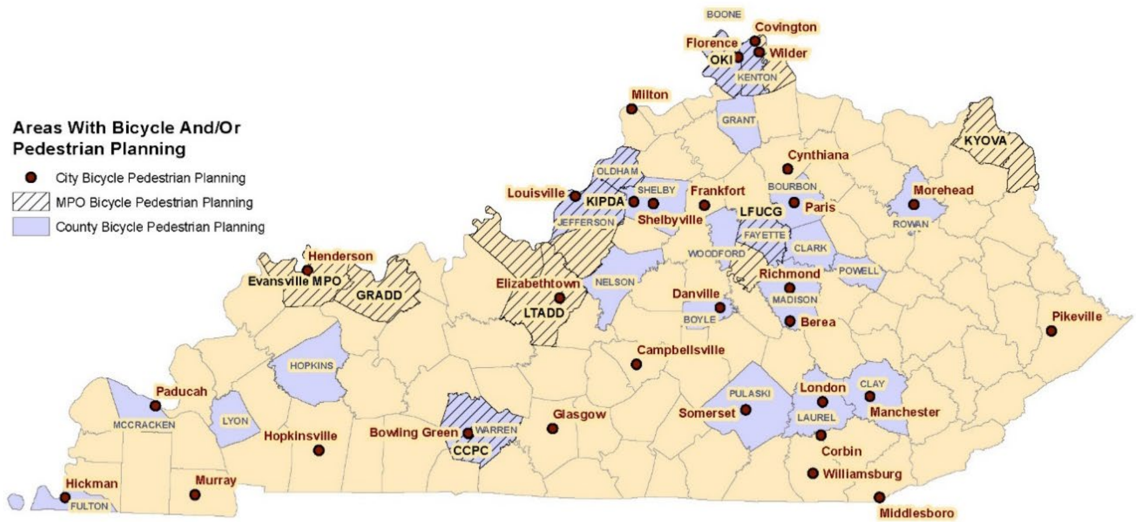


Figure 2.1 City, MPO and County Bicycle and Pedestrian Plans and Clubs, Kentucky

2.2 Benefits and Costs

Before incorporating bicycle and pedestrian projects into project prioritization processes, a method is needed to estimate their benefits and costs. An objective method helps agencies demonstrate project benefits and establish the relative importance of each project within the roadway network.

Estimating Benefits

Krizek (2006) developed a tool that estimates the cost of different bicycle facility types and their direct and indirect benefits to the users and community (Figure 2.2). The tool lets users identify the project type (new, overlay, or restriping) and facility type. Costs can be adjusted to reflect local values, and the tool estimates direct benefits (to users) and indirect benefits (to society). Direct benefits include health, safety, and mobility, while indirect benefits include lower externalities, increased livability, and cost savings. The tool also calculates demand, daily existing bicycle commuters, total daily existing adult cyclists, new commuters, new adult cyclists, mobility benefit, health benefit, recreation benefit, and reduced auto use benefit that can be used as indicators of the benefits from the bicycle investment.[1]

[1] http://www.pedbikeinfo.org/bikecost_x/

Total build year capital cost	$412,370
Annual operations and maintenance	$6,155

Demand

In a one and half mile (2,400 m) radius around the proposed facility:

	Low Estimate	Mid Estimate	High Estimate
Residents	25,469	25,469	25,469
Existing Commuters	306	306	306
New Commuters	106	106	106
Total Existing Cyclists	560	4,697	7,284
Total New Cyclists	300	1,734	2,631

Annual Benefits

	Low Estimate	Mid Estimate	High Estimate
Recreation	$709,052	$5,943,145	$9,217,676

Mobility - Proposed Facility Type	Per Trip	Daily	Annually
Bicycle lane with parking	$3.17	$1,305	$306,616

	Low Estimate	Mid Estimate	High Estimate
Health	$38,428	$221,980	$336,813
	Urban	Suburban	Rural
Decreased Auto Use	$6,131	$3,773	$472

Figure 2.2 Example of NCHRP Report 552 Benefit Estimation

A few studies have focused on the benefits non-motorized transportation users realize from safety interventions. Thomas et al. (2018) identified the benefits of systemic pedestrian improvements and reviewed Oregon DOT's *Statewide Bicycle and Pedestrian Implementation Plan*, which identifies and prioritizes candidate project corridors using a data-driven process to reduce fatal and severe-injury pedestrian and bicycle crashes. Using network screening for motor vehicle crashes and a roadway inventory of the state-owned road system, Thomas et al. scored each risk factor on a scale of 1–4 depending on certain conditions and a weighted value relative to other factors. They used two crash- and risk-based approaches to identify potential treatment sites. Countermeasures have also been developed to address crash patterns and risk factors identified through crash analysis. Finally, they developed a Cost-Effective Index (CEI) to prioritize projects based on the ratio of the project cost to the anticipated reduction in crash numbers following implementation of countermeasures.

Sanders et al. (2020) identified the most frequent pedestrian and bicyclist crash types and recommended two methods for conducting intersection safety assessments — (1) a hotspot approach that uses crash histories to pinpoint locations that have an elevated risk for future crashes and (2) a systematic approach identifies high-risk locations by examining combinations of site characteristics previous research identified as high-risk indicators. Following data collection and analysis, practitioners can select countermeasures to improve pedestrian and bicycle facilities. BIKESAFE and PEDSAFE are online countermeasure selection systems that can be used to develop a list of countermeasures to tackle specific crash types or meet safety performance objectives.

Based on surveys of walking and biking behaviors, attitudes about pedestrian and bicycle facilities within the state, and previous research, Colorado's Office of Economic Development and International Trade attempted to quantify the economic and health benefits of walking and biking (BBC Research & Consulting 2016). Researchers estimated the combined benefits exceed $3 billion and that increasing walking and biking has significant upsides (Figures 2.3 and 2.4)

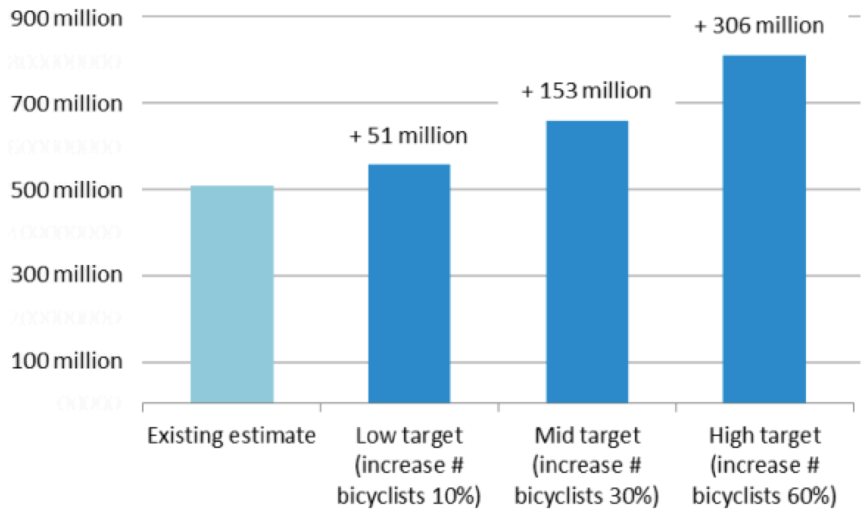


Figure 2.3 Estimated Health Benefits of Bicycling (Colorado)

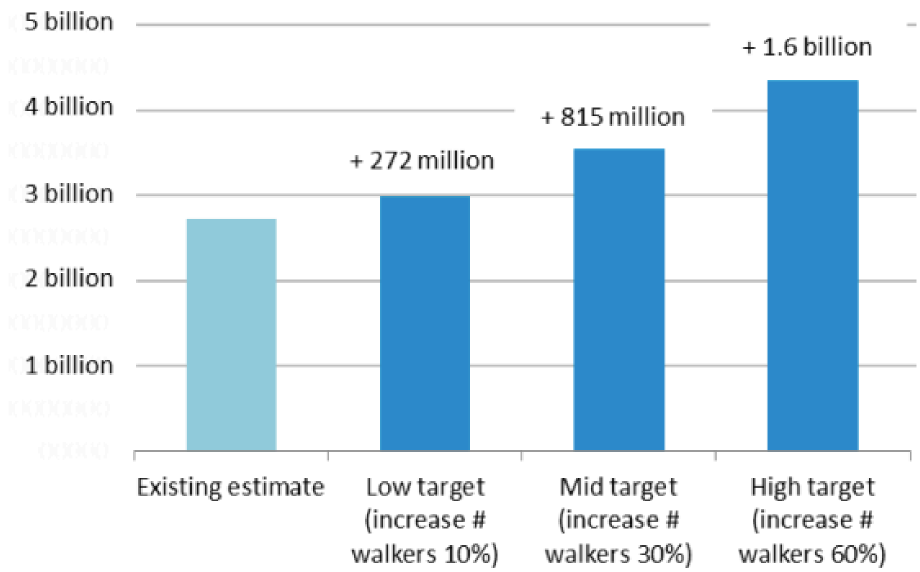


Figure 2.4 Estimated Health Benefits of Walking (Colorado)

Kahlmeier et al. (2017) created the Health Economic Assessment Tool (HEAT), a web-based tool used to estimate the health and economic impacts of walking and biking, plan new cycling or walking infrastructure, and evaluate the reduced mortality attributable to historical/current walking and biking levels. HEAT carries some limitations — it should not be used to assess individuals, evaluate one-day events (e.g., walking and biking days such that it will not reflect the average behavior), or investigate populations under the age of 20 (for walking, the tool's age range is 20–74 years and for biking it is 20–64 years) or with high average levels of physical activities.

Estimating Costs
Bushell et al. (2013) estimated the cost of 77 pedestrian and bicycle facilities/treatments based on data from around the US. Of the 1,700 cost observations in their data set, one came from Kentucky. Figure 2.5 provides an example entry from the report on pavement marking symbols.

Pavement Marking Symbols

Pavement marking symbol costs have been separated by the type of symbol. "Pedestrian Crossing" symbols notify pedestrians and/or motorists of places where pedestrians cross the street. "Shared Lane/Bicycle" symbols identify bicycle lanes and/or shared-lanes (see Figure 32). School crossing symbols highlight areas where motorists should be aware of children and increased pedestrian activity.

Costs will vary due to the type of paint used and the size of the symbol, as well as whether the symbol is added at the same time as other road treatments.

Figure 32: Shared Lane Marking

Infrastructure	Description	Median	Average	Minimum	Maximum	Cost Unit	Number of Sources (Observations)
Pavement Marking Symbol	Pedestrian Crossing	$310	$360	$240	$1,240	Each	4 (6)
Pavement Marking Symbol	Shared Lane/Bicycle Marking	$160	$180	$22	$600	Each	15 (39)
Pavement Marking Symbol	School Crossing	$520	$470	$100	$1,150	Each	4 (18)

Figure 2.5 Example from Bushell et al. (2017) Cost Study

Researchers have also developed several cost estimation tools. One example is Pulugurtha et al.'s (2016) Excel-based bicycle and pedestrian facility cost tool with recommended values (Figure 2.6). This tool bases estimates on design elements (e.g., length of facility, terrain type) and construction activities. It can also calculate cost-effectiveness.

Bicycle Lanes Cost Estimator Tool

Name of Project:	Current Date (mm/dd/yy)	Proposed Year of Construction
Location/Description:		2016

Enter the Following Information for Cost Estimate

Length of Bicycle Lane (Feet)	1320	
Width of Bicycle Lane (Feet)	5	
Required Length of Curb & Gutter (Feet)	1320	Enter the required length of curb & gutter to be constructed
No. of Intersections	0	
No. of Signal Heads	0	Enter the total number of signal heads required for the project
No. of Pedestrian Signal Heads	0	Enter the total number of pedestrian signal heads required
No. of Driveways	10	
Terrain	Level	
Crosswalk Thermoplastic Lines Length (Feet)	0	Enter either the length of crosswalk thermoplastic lines or no. of crosswalks, whichever value is known
No. of Crosswalks	0	
Include Preliminary Eng., Design & Environmental Review	NO	
Include Right-of-Way	NO	Select 'NO' if these costs are internal
Include Construction Engineering & Inspection	NO	

You are only required to enter data above this row. If you are not familiar with the tool framework, coding and possible changes to estimates, we recommend not making any changes below this row.

Construction Costs Breakdown

Items	Units	Minimum Cost	Percentile (10)	Percentile (25)	Percentile (50)	Average Cost	Percentile (75)	Percentile (90)	Maximum Cost
Clearing and Grubbing	(AC/Ft)	$0.21	$0.61	$1.02	$2.05	$5.28	$3.63	$9.11	$48.86
Crosswalk	(EA)	$2,290.10	$2,432.24	$2,645.46	$3,000.81	$3,000.81	$3,356.17	$3,569.38	$3,711.52
Crosswalk Stripes	(Per Ft)	$4.30	$4.95	$5.48	$5.74	$6.21	$6.60	$7.83	$9.25
Curb and Gutter	(Per Ft)	$7.63	$14.96	$17.77	$21.14	$23.43	$28.84	$34.42	$45.80
Drainage (Per Ft)	(Per Ft)	$0.001	$0.01	$0.08	$0.47	$0.88	$1.07	$2.46	$4.51

... | All | CostDatabase | Tool-Instructions | Pedestrian Sidewalk | Bicycle Lanes | Shared Use Path | Midblock Crosswalk | Paved Shoulder | Ped Intersection Treatments | Pedestrian Bridge

Figure 2.6 North Carolina DOT Bicycle and Pedestrian Facility Cost Calculator

The North Carolina DOT also developed guidance for evaluating the economic impacts of shared use paths (ITRE 2018). While the agency's prioritization program considers bicycle and pedestrian elements in the scoring process, these metrics do not fully account for the range of economic benefits of bicycle or pedestrian features. This report discusses the potential impacts on property value, property tax, retail tax, health benefits, and social benefits of shared use paths. The North Carolina DOT has a dedicated portion of state funds (approximately 5%) to pedestrian and bicycle projects, along with funds that could be used where pedestrian and bicycle facilities are integrated into a roadway project.

Combined Benefit and Cost Estimates

The Victoria Transport Policy Institute has studied the benefits and costs of providing facilities to accommodate bicyclists and pedestrians (Tables 2.2 and 2.3; Litman 2010; Litman 2021). Benefits include cost savings, improved health, better traffic safety, economic development opportunities, community livability, better mobility options, and environmental gains. Table 2.2 reviews these in greater detail and provides a list of associated costs. Litman (2021) argued that conventional economic evaluations overlook or undervalue many active transport benefits and that a proper benefit-cost analysis of pedestrian and bicycle facilities requires a detailed accounting of all benefits non-motorized transport generates.

Table 2.2 Estimated Benefits of Nonmotorized Transport

Benefits	Applies	Urban Peak	Urban Off-Peak	Rural
Congestion Reduction	C	$0.20	$0.02	$0.00
Roadway Cost Savings	C	$0.05	$0.05	$0.03
Vehicle Cost Savings	C	$0.25	$0.20	$0.15
Parking Costs (per trip)	C	$2.00	$1.00	$0.50
Air Pollution Reduction	C	$0.10	$0.05	$0.01
Noise Pollution Reduction	C	$0.03	$0.02	$0.01
Energy Conservation	C	$0.05	$0.04	$0.03
Traffic Safety Benefits	C	$0.05	$0.04	$0.03
Health and Fitness Benefits	B & C	NA	NA	NA
Improved Mobility For Non-Drivers	A, B & C	NA	NA	NA
Strategic Land Use Objectives	A, B & C	NA	NA	NA
Economic Development	A & C	NA	NA	NA
User Enjoyment	A & B	NA	NA	NA
Community Livability	A, B & C	NA	NA	NA
Additional Environmental Benefits	C	NA	NA	NA
Total Per Mile		*> $2.73*	*> $1.42*	*> $0.76*
Average Walking Trip (0.6 miles)		*> $1.67*	*> $0.85*	*> $0.46*
Average Cycling Trip (2.0 miles)		*> $5.56*	*> $2.84*	*> $1.52*

(*Applies*: A = Improved nonmotorized conditions; B = Increased nonmotorized travel; C = Reduced automobile mileage. NA = Not available.).

This table lists various benefits of nonmotorized transport, and provides monetized estimates where possible. Many benefits not monetized, so the value of shifts from motorized to nonmotorized travel is likely to be greater than indicated by these estimated totals.

Table 2.3 Active Transportation Benefits and Costs

	Improved Active Travel Conditions	Increased Active Transport Activity	Reduced Automobile Travel	More Compact Communities
Potential Benefits	• Improved user convenience and comfort • Improved accessibility for non-drivers, which supports equity objectives • Option value • Supports related industries (e.g., retail and tourism) • Increased security	• User enjoyment • Improved public fitness and health • Increased community cohesion (positive interactions among neighbors due to more people walking on local streets) which tends to increase local security	• Reduced traffic congestion • Road and parking facility cost savings • Consumer savings • Reduced chauffeuring burdens • Increased traffic safety • Energy conservation • Pollution reductions • Economic development	• Improved accessibility, particularly for non-drivers • Transport cost savings • Reduced sprawl costs • Openspace preservation • More livable communities • Higher property values • Improved security
Potential Costs	• Facility costs • Lower traffic speeds	• Equipment costs (shoes, bikes, etc.) • Increased crash risk	• Slower travel	• Increases in some development costs

The study also identified methods to quantify benefits that are not traditionally used to analyze pedestrian and bicycle projects. For example, analysis of benefits usually focuses on how projects impact motorized traffic but neglect benefits to non-motorized users (i.e., bicyclists, pedestrians) and new users (i.e., those attracted to the facility due improvements).

Estimating the health benefits of active transportation is challenging. But recent efforts have begun addressing this and found improvements in health (Gotschi 2011) and life expectancy (de Hartog et al. 2014). Genter et al. (2008) estimated health benefits of $1.60/mile for bicycle improvements and $3.00/mile for pedestrian improvements.

The Caltrans California Life-Cycle Benefit/Cost Analysis Model (Cal-B/C) Active Transportation (AT) is part of a suite of spreadsheets used to perform benefit-cost analysis of bicycle and pedestrian projects (Caltrans 2019). They are similar to spreadsheets developed in the ActiveTrans Priority Tool (APT) (Lagerwey et al. 2015; see below). Cal-B/C AT has several features, including estimates for:

- Journey quality impacts for cyclists and pedestrians from facility improvements
- Additional travel time savings where bike facilities cross improved intersections
- User accident risks at improved intersections on existing facilities
- Auto accident costs due to diversions to active transportation
- Health benefits for employers due to reduced absenteeism based on increased productivity
- User benefits associated with reduced risks of mortality
- Highway emissions costs from diversions to active transportation

Estimating Demand

Understanding of demand is essential for providing appropriate bicycle and pedestrian facilities. Kuzmyak et al. (2014) provided guidance to better account for pedestrian and bicycle activity in plans and projects. Practitioners must consider factors that affect people's willingness to walk or bike and those which influence modal choice. Decisions about modal choice and routing are shaped by (1) land use and the built environment; (2) number, type, coverage, and connectivity of facilities; (3) natural environment (topography, climate); (4) sociodemographic factors; (5) trip purpose; and (6) perceptions and attitudes. The report identifies models for estimating pedestrian and bicycle activities, including trip generation models specific to walking and bicycling, accessibility evaluations, facility use estimates, and the Portland Pedestrian Model. Trip generation models include MoPeD and PedContext models. These models can be used for planning and estimating walking times under different land use and pedestrian network scenarios. Facility-use estimation models can predict user volumes and activity levels on pedestrian or bicycle networks for the purpose of guiding potential improvements or conducting safety studies.

2.3 Project Evaluation and Scoring

Several states, counties, and cities have incorporated pedestrian and bicyclist project prioritization into their local transportation prioritization programs. A few of these are described below.

Hillsborough County, Florida

The Hillsborough County MPO encompasses the Tampa Bay region and is nationally recognized for promoting the transportation and safety of bicyclists and pedestrians. After reviewing best practices, the MPO developed a method for evaluating pedestrian and bicyclist quality of service. Kittelson & Associates (2019) reviewed five methods for addressing quality of service along with data input needs, challenges, and opportunities for estimation. Table 2.4 summarizes the capabilities and limitations of methods used to estimate quality of service.

Table 2.4 Summary of Multimodal Methodology Applications

Methodology	Mode				Analysis Level			Data Needs	Difficulty	Application (Project or Network Level)
	Ped.	Bicycle	Transit	Auto	Intersection	Corridor	Network			
HCM Multi-Modal Level Of Service (MMLOS)	●	●	●	●	●	●	●	High*	High	Project or Network
Level of Traffic Stress (LTS)	○	●	○	○	◐	●	●	High	High	Project or Network
Bicycle Network Analysis (BNA) Score	◐	●	○	○	○	○	●	Low	Low	Network
Transit Capacity & Quality of Service Manual (TCQSM)	○	○	●	○	●	●	●	Varies	Varies	Varies
Charlotte PLOS and BLOS	●	●	○	○	●	○	○	Low	Low	Project or Network

● Meets the Need ◐ Partially Meets the Need ○ Does Not Meet the Need

*Agencies can rely on default values for many inputs to reduce the data requirements.

Hillsborough County settled on using level of traffic stress analysis for corridor conditions and adapting the Charlotte Pedestrian Level of Service (PLOS) and Bicycle LOS (BLOS) intersection methodology. The MPO uses decision-making flow charts to evaluate the quality of service for bicycle and pedestrian facilities, including corridor and intersection projects. Figure 2.7 diagrams the pedestrian Level of Traffic Stress (LTS) method.

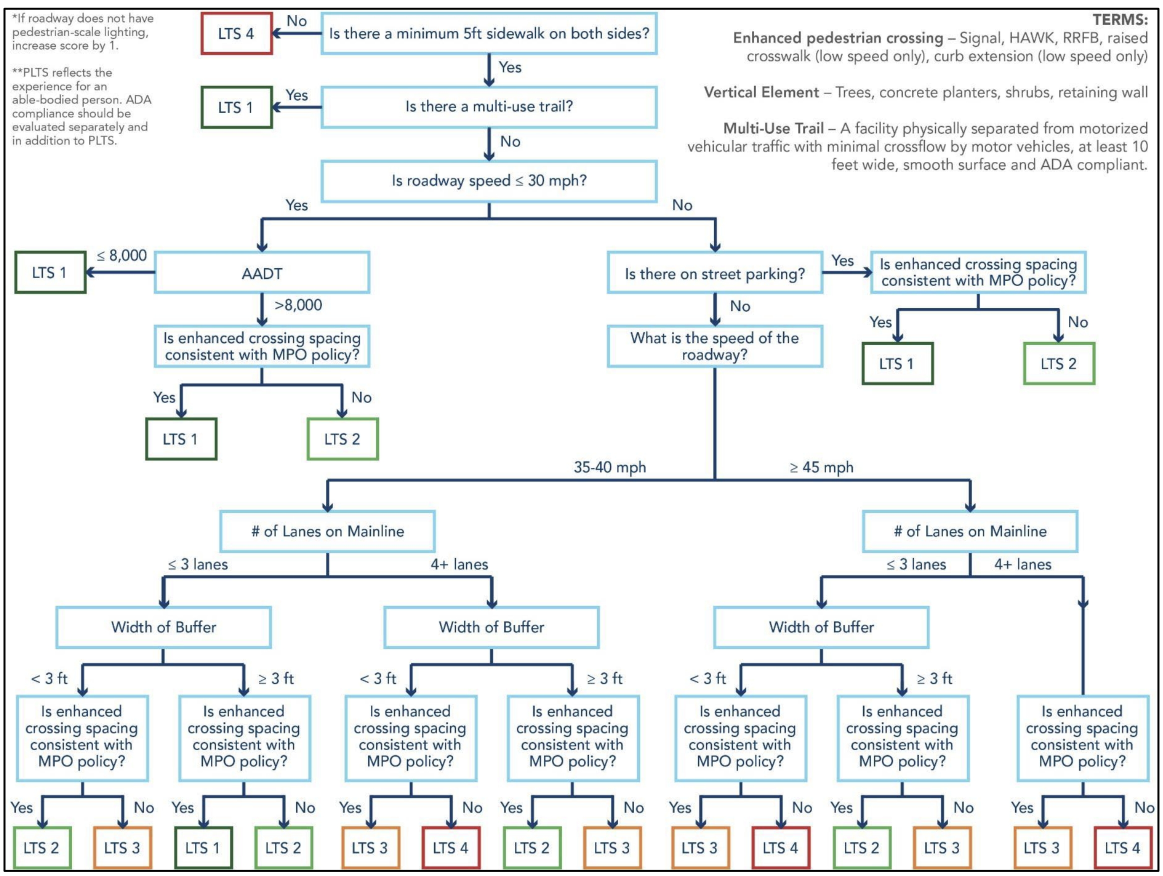


Figure 2.7 Hillsborough MPO Pedestrian LTS Methodology

Virginia DOT

The Virginia DOT has developed a statewide program — SMART SCALE — for scoring and ranking transportation projects (VDOT 2021). The method involves scoring each project in six categories — safety, congestion mitigation, accessibility, environmental quality, economic development, and land use coordination. Recognizing that regions differ in terms of their conditions and needs, the agency divided Virginia into four areas using input from their MPO and Planning District Commission and other entities. Scoring weights differ for each area. Bicycle and pedestrian improvement projects are eligible for SMART SCALE funding. Bicycle and pedestrian elements could add points to several evaluation categories instead of acting as an independent scoring component. The categories influenced by bicycle and pedestrian scoring are safety, accessibility, environmental quality, and economic development. Below are summarized the bicycle and pedestrian considerations in these categories.

Safety: Metric used — (1) Estimate of the equivalent property damage only crashes expected to be avoided due to project implementation (measured as both a number and rate per 100 million vehicle miles traveled (VMT)). For bicycle and pedestrian projects, crash modification factors (CMFs) are used to determine how pedestrian and/or bicycle elements influence safety.

Accessibility: Metrics used — Estimates of (1) access to jobs; (2) access to jobs for disadvantaged populations; (3) access to multimodal choices. Access to jobs is based on changes in the number of jobs within a 45-minute radius of a project (or a 60-minute radius for transit) and is estimated by Census block. This metric is measured based on the difference between existing and new opportunities opened up by the project, but without any specific mention of pedestrian or bicycle projects. Access to multimodal choices is measured using a point system, where points are awarded if a bicycle and/or pedestrian component is included (Table 2.5). Points are capped based on project type, and the maximum number of points can be reached through other options. For example, a project could max out on points if it includes a transit component. In this case, even if a bicycle facility is included no additional points are awarded.

Table 2.5 Virginia DOT Scoring Approach for Access to Multimodal Choices

Project Type (Mode) and Characteristics	Points (If Yes)
Project includes transit system improvements or reduces delay on a roadway with scheduled peak service of 1 transit vehicle per hour.	5
Project includes improvements to an existing or proposed park-and-ride lot. Ex. New lot, more spaces, entrance/exit, technology (payment, traveler information).	4
Project includes improvements to existing or new HOV/HOT lanes or ramps to HOV/HOT	2
Project includes construction, enhancement, or replacement of bike facilities. For bicycle projects, off-road or on-road buffered or clearly delineated facilities are required.	1.5
Project includes construction, enhancement, or replacement of pedestrian facilities. For pedestrian projects, sidewalks, pedestrian signals, marked crosswalks, refuge islands, and other treatments are required (as appropriate).	1.5
Project provides real-time traveler information or wayfinding specifically for intermodal connections (access to transit station or park&ride lot).	1
Provides traveler information or is directly linked to an existing TMC network/ITS architecture.	1
Total Points Possible	**5 points maximum**
Measure Scaling: Points are multiplied by the number of new peak period non-SOV users	

Environmental Quality: Metrics used — (1) Improvements to air quality and energy; (2) Minimization of impacts to natural and cultural resources within the project buffer. A point system is used to assess air quality impacts, and points can be awarded for bicycle and/or pedestrian projects (Table 2.6). A slightly more complicated approach is used to estimate impacts on natural and cultural resources.

Table 2.6 Virginia DOT Scoring for Air Quality and Energy Environmental Effects

Project Type (Mode) and Characteristics	Points (If Yes)
Non-SOV Project Characteristics	
Project includes improvements to rail transit or passenger rail facilities.*	3
Project includes construction or replacement of bike facilities. For bicycle projects, off-road or on-road buffered or clearly delineated facilities are required.*	2
Project includes construction or replacement of pedestrian facilities. For pedestrian projects, sidewalks, pedestrian signals, marked crosswalks, refuge islands, and other treatments are required (as appropriate).*	2
Project includes improvements to an existing or proposed park-and-ride lot. Ex. New lot, more spaces, entrance/exit, technology (payment, traveler information).*	2
Project includes bus facility improvements or reduces delay on a roadway with scheduled peak service of 1 transit vehicle per hour.*	1
Project include special accommodations for hybrid or electric vehicles, or space or infrastructure for electric vehicle parking/charging).*	0.5
Project includes energy efficient infrastructure or fleets, including: hybrid or electric buses, electronic/open road tolling, alternative energy infrastructure (e.g., roadside solar panels).*	0.5
Total Points Possible	**8.5 points maximum***
Measure Scaling: *Points are multiplied by the number of peak period non-SOV users.	
Freight Transportation Project Characteristics	**Points (If Yes)**
Project reduces traffic delay at a congested intersection, interchange, or other bottleneck with a high percentage of truck traffic (greater than 8 percent of AADT). ***	1
Project includes improvements to freight rail network or intermodal (truck to rail) facilities/ports/terminals.**	0.5
Total Points Possible	**1.5 points maximum****
Measure Scaling: **Points are multiplied by daily truck volumes ** Points awarded for projects with a decrease in person hour delay greater than zero and with truck traffic greater than 8% AADT	

Economic Development: Metrics used — (1) Consistency with regional and economic development plans; (2) Enhancement of intermodal access and efficiency; (3) Improvement in travel time reliability. Whether a project is eligible to earn points in this category depends on project type (Table 2.7). Development of pedestrian and bicycle facilities may be considered, but they have to be within a 0.5-miles buffer of the project. Scoring inputs include level of plan detail, type of development, and project location. For intermodal access and efficiency, scores are contingent on whether a project enhances and efficiently supports multimodal options. Travel time reliability is estimated based on a project's potential to reduce the frequency and/or duration of incidents, work zones slowdowns, and capacity bottlenecks.

Table 2.7 Virginia DOT Site Eligibility Considerations for Economic Development

Transportation Project Tier by Feature Type Selected	Distance from Transportation Project to be an Eligible ED Site
Tier 1 Add/Construct Bike Lane, Bike/Pedestrian Other, Construct or Convert Existing General Purpose or Parking Lane to Bus-only Lane, Construct or Improve Bus Stop / Shelter, Construct Shared-Use Path, Construct Sidewalk, Highway Other, Improve Bike/Pedestrian Crossing (At Grade), Improve Bike/Pedestrian Crossing (Grade Separated), Improve Park and Ride Lot, Improve Rail Crossing, Improve/replace existing bridge(s), Increase Existing Route Service – Additional Vehicles or Increased Frequency, ITS Improvement(s) / Adaptive Signal Control, New Intersection, New Park and Ride Lot, New Route/Service, New Traffic Signal, New/Expanded Vanpool or On-Demand Transit Service, Other Transit Technology Improvements, Rail Transit Other, Ramp Improvement(s), Right-of-Way/Easements acquisition required, Road Diet, Roadway Reconstruction/Realignment, Shoulder Improvement(s), TDM Other, Traffic Signal Modification, Turn Lane Improvement(s), Widen Existing Lane(s) (No New Lanes)	Up to 0.5 mile buffer
Tier 2 Access Management, Constuct/Expand Bus Facility, Innovative Intersection(s) / Roundabout(s), Intercity Passenger Rail Service Improvements, Intersection Improvement(s), Managed Lane(s) (HOV/HOT/Shoulder), New Interchange-Non-Limited Access Facility, Rail Service Improvements	Up to 1.0 mile buffer
Tier 3 Add New Through Lanes(s), Freight Rail improvements, Improve Grade-Separated Interchange, New Bridge, New Interchange-Limited Access Facility, New Intercity Passenger Rail Station or Station Improvements, New Station or Station Improvements, Roadway on New Alignment	Up to 3.0 mile buffer

Congestion Mitigation Measures: Metrics used — (1) Increase in total (multimodal) person throughput; (2) Reduction in person hours of delay as a result of the project. Increase in person throughput is estimated using quantitative analysis (no specific approach is defined). No benefits in delay hours are assumed for pedestrian and/or bicycle projects despite their potential contribution to this category.

Land Use Coordination: Metrics used — (1) Potential for supporting employment; (2) Increase in population and employment for areas with high non-work accessibility. A scoring method was developed for possible work access options. This category does not consider pedestrian and bicycle projects.

North Carolina DOT

The North Carolina DOT's Prioritization 6.0 program uses a systematic approach to prioritize infrastructure projects (NCDOT 2019). Pursuant to the agency's Strategic Transportation Investments (STIs), the program addresses statewide mobility, regional impacts, and division needs (Figure 2.8). Statewide mobility is based on evaluations of highway, rail, and aviation needs. Regional impact projects address other modes, but not bicycle and pedestrian projects. Divisions focus on all other projects, including pedestrian and bicycle projects, using 50% data-based scores and 50% local input scores. The latter are based on the population of MPOs, rural planning organizations (RPOs), and divisions. The STI law holds that a project not funded in one category can be funded under another. But this only applies when moving upward through the hierarchy (i.e., a statewide project could be funded through regional or division project funds if not funded as a statewide project, but a division project cannot be funded from any other funds). Projects are scored in all relevant categories and considered if not funded within their allotted category. Forty percent of funds go toward statewide mobility projects while the remaining funds are split evenly between regional and division projects. A new version of the prioritization scheme considers multimodal projects at the statewide mobility level, where points for bicycle and pedestrian improvements can be included.

STI Eligibility Definitions

Mode	Statewide Mobility	Regional Impact	Division Needs
Highway	• Interstates (existing & future) • NHS routes (July 1, 2012) • STRAHNET • ADHS Routes • Uncompleted Intrastate projects • Designated Toll Facilities	Other US and NC Routes	• All Secondary Roads (SR) • Federal-Aid Eligible Local Roads
Aviation	Large Commercial Service Airports ($500K cap)	Other Commercial Service Airports not in Statewide ($300K cap)	All Airports without Commercial Service ($18.5M cap)
Bicycle-Pedestrian	N/A	N/A	All projects ($0 state funds)
Public Transportation	N/A	Service spanning two or more counties (10% cap)	All other service, including terminals and stations
Ferry	N/A	Vessel or infrastructure expansion	Replacement vessels
Rail	Freight Capacity Service on Class I Railroad Corridors	Rail service spanning two or more counties not Statewide	All other service, including terminals and stations (no short lines)

Figure 2.8 North Carolina DOT Strategic Transportation Investment Categories

Bicycle and pedestrian projects are scored at the division level. Table 2.8 lists qualifying project types. Four criteria (safety, accessibility/connectivity, demand/density, and cost-effectiveness) are weighted to score projects (Figure 4.10). These criteria account for 50 percent of the division needs scores. Entries with red text are elements added to the most recent version of the Prioritization program. Each component is discussed below.

Table 2.8 North Carolina DOT Bicycle and Pedestrian Improvement Projects

Bicycle Improvements	Pedestrian Improvements
1. Grade-separated bicycle facility	6. Grade-separated pedestrian facility
2. Off-road/separated linear bicycle facility	7. Protected linear pedestrian facility
3. On-road; designated bicycle facility	8. Multi-site pedestrian facility
4. On-road bicycle facility	9. Improved pedestrian facility
5. Multi-site bicycle facility	

Table 2.9 North Carolina DOT Bicycle and Pedestrian Project Scoring

Criteria	Measure	Division Needs
Safety	(Number of Crashes x 40%) + (Crash Severity x 20%) + (Safety Risk x 20%) + (Safety Benefit x 20%)	20%
Accessibility/Connectivity	Points of Interest (pts) + Connections (pts) + Route (pts)	15%
Demand/Density	Number of Households and Employees Per Square Mile Near Project	10%
Cost-Effectiveness	(Safety + Accessibility/Connectivity + Demand/Density) / Cost to North Carolina DOT	5%

Safety: Metrics used — (1) Number of crashes; (2) Crash severity; (3) Road segment safety risk, (3) Safety benefit of improvement. Crash-related metrics focus on pedestrian and bicycle crashes over the last five years. Safety risk is estimated based on various factors related to the project context and crash history, while the safety benefit is estimated based on project type.

Accessibility/Connectivity: Metrics used — (1) Number of destinations near the project (within 1.5 miles for bicyclists and 0.5 miles for pedestrians); (2) Number of connections to existing or planned bicycle/pedestrian facilities; (3) Connectivity to a designated bicycle route. Connectivity is based on points awarded for connections to bicycle/pedestrian facilities and is calculated manually. Points are awarded for improving national/state/regional bike routes or designated state/federal trails. All three components are added to arrive at a score.

Demand/Density: Metric used — (1) Population and employment density within a walkable or bikeable distance of a project (1.5 miles for bicycles and 0.5 miles for pedestrians). Bicycle and pedestrian scores receive equal weights.

Cost-Effectiveness: A metric based on the safety, accessibility/connectivity, and demand/density criteria scores. These are compared to the project cost..

Other State Practices

Perrin et al.'s (2021) review of agency practices identified four steps in selecting bicycle and pedestrian projects — (1) Establish policy goals, objectives, and performance measures; (2) Identify proposed projects; (3) Evaluate and prioritize proposed projects; and (4) Select projects. Two methods are available for ranking projects, one for pedestrian-focused projects and one for projects that tackle bicycle and pedestrian needs. Echoing Litman (2021), Perrin et al. (2021) recommended looking at four factors — (1) Magnitude of impact; (2) Demand (number/type of users and destinations); (3) Support of special objectives (e.g., improving mobility for individuals with disabilities); and (4) Network/synergetic effects. For projects that address pedestrians and bicyclists, they recommended using the ActiveTrans Priority Tool for ranking and prioritizing pedestrian and bicycle projects.

Perrin et al. also listed available funding sources for pedestrian and bicycle facilities: Congestion Mitigation and Air Quality Improvement (CMAQ), Federal Lands Access Program, High-Risk Rural Roads (HRRR) Program, Highway Safety Improvement Program (HSIP), National Highway Performance Program, Section 402 State and Community Highway Safety Grant Program, Surface Transportation Block Grant Program (Non-Transportation Alternatives), Transportation Alternatives (TA), and USDOT Discretionary Grants Program.

Prioritization Tools

The ActiveTrans Priority Tool (APT) is an online, customizable tool for prioritizing pedestrian and bicycle improvements along existing roads (Lagerwey et al. 2015). It addresses the needs of each mode separately. APT uses a two-phase scoring process, with the first focused on project scoping and identifying a project's purpose, facility targeted, mode targeted for improvement, type of improvement, and number and types of locations under consideration for improvement. In the second phase, APT users select factors to optimize resource use and maximize community benefits. Factors include stakeholder input, constraints, opportunities, safety, existing conditions, demand, connectivity, equity, and compliance. Each factor is then assigned a weight based on community values and the purpose of prioritization. Then variables are chosen to measure the selected factors. Variables must be measurable (e.g., for the cost/benefit factor, one variable could be the cost/benefit of public health due to increased bicycle mode share). Data analysis ensues, with data availability varying across cities, towns, counties, MPOs, and state DOTs. The process wraps up with an assessment of technical resources to identify a platform that will be used to implement prioritization.

The second phase begins with establishing a prioritization tool based on information collected in phase one. Next, data are measured and inserted into the prioritization tool. Scaling ensures all variables are commensurate, which requires converting non-numeric values (e.g., *no*, *yes*, *high*, *low*) to numeric values, selecting a common numerical scale, and adjusting raw values to fit the common scale. The last step is creating a ranked list to sum the weighted values for each factor to determine the prioritization score.

Prioritization Impact on Project Delivery

Following prioritization, practitioners can experience challenges delivering infrastructure projects that target non-motorized users (Raulerson et al. 2018). For example, sometimes a project is delayed because it winds up being ineligible to apply funds from a grant funding source, or funding is limited. Making sure that scoring systems include pedestrian and bicycle-related prioritization criteria can mitigate this issue. For instance, the Virginia DOT's SMART SCALE guides project selection so that resources are distributed fairly between all state projects. A good practice for funding these projects is to identify them in the statewide transportation improvement program/ transportation improvement program (STIP/TIP) and verify they meet all requirements. Because pedestrian and bicycle projects are often small scale and low cost, approval times can be longer compared to larger roadway projects. Grouping small-scale projects based on function, work type, and geographic area, provides flexibility in funding small-scale projects. Using this method, the Georgia DOT in 2006 financed the creation of safe, convenient, and fun routes to walk or bike to school. Program benefits have been far-reaching. For example, one school saw a 229 percent increase in the number of students walking and biking to school.

Statewide Pedestrian and Bicycle Planning Handbook

Chapter 7 of the *Statewide Pedestrian and Bicycle Planning Handbook* provides guidance on identifying needs and priority areas (FHWA 2014). This document references the Colorado scoring tool plus examples from Wisconsin, Massachusetts, Tennessee, and Hawaii. It also addresses the need for network and gap analysis, and using metrics such as cohesion, directness, alternatives, safety and security, and comfort to evaluate needs.

2.4 Summary

Agencies have expressed significant interest in adopting formal procedures for evaluating pedestrian and bicyclist projects. Any method must properly define and account for project benefits and costs. But despite many efforts, no currently available method fully captures the full extent of project benefits (Litman 2021). Several methods and tools have been developed to estimate the costs of bicycle and pedestrian facilities. For example, the North Carolina DOT's cost calculator can be used to estimate project costs and allows for adjustments to reflect current conditions.

Several methods can be used to estimate project benefits (e.g., Krizek 2006; Litman 2021). A general approach is to identify benefits, estimate their magnitude, and convert benefits to a monetary value so that benefit-cost analysis can be done. Benefits include safety improvements (e.g., reduction in bicycle and pedestrian crashes, safety gains derived from CMFs), health benefits, and environmental impacts (measured in potential new users and reductions in motorized trips).

Several agencies have developed data-driven prioritization processes that score and rank individual projects. North Carolina and Virginia are leaders, and both have unique approaches SHIFT could benefit from. The North Carolina DOT scores bicycle and pedestrian projects by using information on safety outcomes, accessibility and connectivity, demand and density, and the cost-effectiveness of proposed improvements. The Virginia DOT approach does not explicitly score bicycle and pedestrian projects; it considers their impacts indirectly through safety, accessibility, environmental quality, and economic development criteria. Another valuable approach is the Hillsborough County MPO method for evaluating quality of service. Flow charts developed for this process could be used to determine level of traffic stress (LTS) for pedestrian and bicycle projects.

Chapter 3 Scoring Approach

The research team reviewed SHIFT's process for evaluating projects as well as the availability of pedestrian and bicycle project data to identify methods for evaluating and scoring their costs and benefits. Although SHIFT data contain a field that indicates whether a project includes a bicycle- or pedestrian-related component, they lack specific information on the project type and extent. The data do not define what type of bicycle facility is under consideration nor whether pedestrian facilities will be added along the entire project corridor or only part of it. Without this information, a systematic analysis and evaluation of projects using a data-driven approach is not possible.

The research team recommends introducing an explicit scoring component in SHIFT– 2024 that addresses bicycle and pedestrian projects. Under the proposed system, when regional projects are scored, they can be awarded up to five (5) points for pedestrian projects and five (5) points for bicycle projects. The team also proposes including a list of detailed project categories that would support the systematic evaluation of these projects. The rest of this chapter elaborates on these proposals.

3.1 State Efforts

As the previous chapter showed, several DOTs use data-driven approaches for project prioritization. Under these systems, each project is scored and ranked to establish the order in which it will be implemented. Drawing from the examples of the North Carolina and Virginia DOTs, the research team arrived at the proposed scoring mechanism for bicycle projects and pedestrian projects and developed a list of project categories.

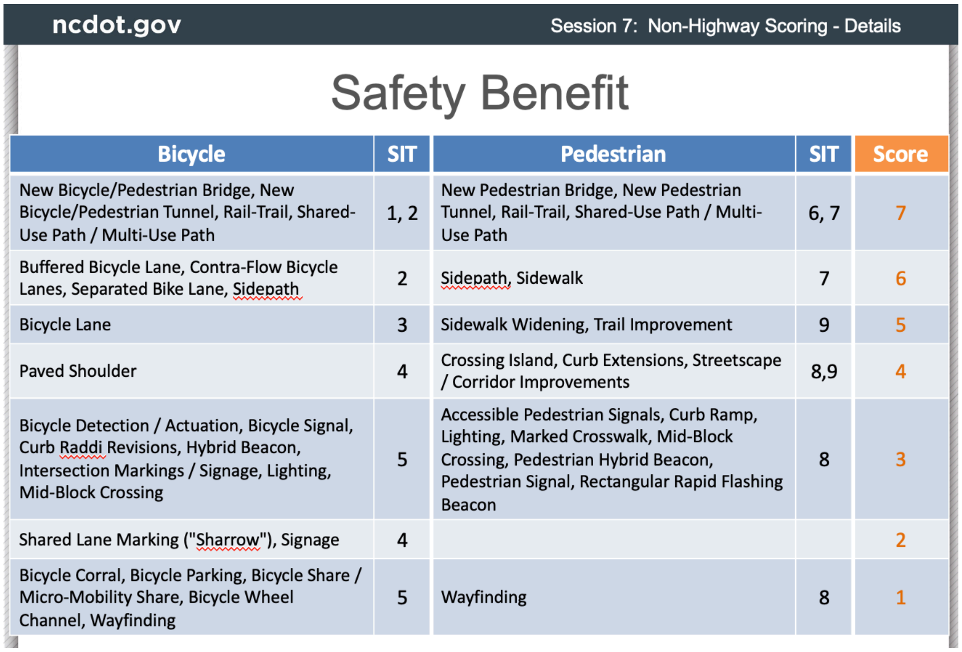
The Virginia DOT's scoring approach for bicycle and pedestrian projects centers on job accessibility and multimodal choices, improvements to air quality and in energy usage, and how well the project minimizes impacts to natural and cultural resources within a buffer zone. Table 3.1 presents the scoring method used by the Virginia DOT.

Table 3.1 Virginia DOT Scoring for Bicycle and Pedestrian Projects

Category	Project Type	Points
Accessibility (Max 5 Points)	Project includes construction, enhancement, or replacement of bike facilities. For bicycle projects, off-road or on-road buffered or clearly delineated facilities are required.	1.5
	Project includes construction, enhancement, or replacement of pedestrian facilities. For pedestrian projects, sidewalks, pedestrian signals, marked crosswalks, refuge islands, and other treatments are required (as appropriate).	1.5
Environmental Quality (Max 8.5 Points)	Project includes construction or replacement of bike facilities. For bicycle projects, off-road or on-road buffered or clearly delineated facilities are required	2
	Project includes construction or replacement of pedestrian facilities. For pedestrian projects, sidewalks, pedestrian signals, marked crosswalks, refuge islands, and other treatments are required (as appropriate).	2

Each project can receive a maximum number of points, and multiple avenues are available for earning points. For example, if a project includes a transit component that exhausts all available points, no additional points are awarded if it includes a bicycle facility. However, points for environmental quality are additive, so the presence of bicycle and/or pedestrian components can increase the project score.

The North Carolina DOT scores bicycle and pedestrian projects at the division level, and a list of possible projects is available to guide the process (Table 2.8). Figure 3.1 lists the number of points a project can earn by incorporating different features. Numbers in the SIT column refer to project types listed in Figure 2.8.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Safety Benefit

Bicycle	SIT	Pedestrian	SIT	Score
New Bicycle/Pedestrian Bridge, New Bicycle/Pedestrian Tunnel, Rail-Trail, Shared-Use Path / Multi-Use Path	1, 2	New Pedestrian Bridge, New Pedestrian Tunnel, Rail-Trail, Shared-Use Path / Multi-Use Path	6, 7	7
Buffered Bicycle Lane, Contra-Flow Bicycle Lanes, Separated Bike Lane, Sidepath	2	Sidepath, Sidewalk	7	6
Bicycle Lane	3	Sidewalk Widening, Trail Improvement	9	5
Paved Shoulder	4	Crossing Island, Curb Extensions, Streetscape / Corridor Improvements	8,9	4
Bicycle Detection / Actuation, Bicycle Signal, Curb Raddi Revisions, Hybrid Beacon, Intersection Markings / Signage, Lighting, Mid-Block Crossing	5	Accessible Pedestrian Signals, Curb Ramp, Lighting, Marked Crosswalk, Mid-Block Crossing, Pedestrian Hybrid Beacon, Pedestrian Signal, Rectangular Rapid Flashing Beacon	8	3
Shared Lane Marking ("Sharrow"), Signage	4			2
Bicycle Corral, Bicycle Parking, Bicycle Share / Micro-Mobility Share, Bicycle Wheel Channel, Wayfinding	5	Wayfinding	8	1

Figure 3.1 North Carolina DOT Bicycle And Pedestrian Safety Benefit Scores

Projects that install new, separated facilities garner the highest scores. Bicycle lanes and sidewalk widening also score highly. Building a paved shoulder that can be used as a bicycle lane, installing curb extensions and crossing islands, or adding signals for pedestrians or signs for bicyclists results in more modest benefits, and therefore lower scores.

3.2 Proposed Scoring Approach

Project Type

Our proposed method of scoring bicycle and pedestrian projects takes cues from the Virginia and North Carolina approaches, but draws more heavily on the latter because it offers clarity on the benefits of specific improvement types. Under the proposed scoring system for SHIFT–2024, a project can earn up to 10 points — 5 for bicycle projects and 5 for pedestrian projects (Table 3.2).

Table 3.2 Proposed Scoring for SHIFT–2024 Bicycle and Pedestrian Facilities

Bicycle Project	Pedestrian Project	Points
New bicycle multi- or shared-use path, buffered bicycle lane, separated bicycle lanes, rail-trail	New pedestrian multi- or shared-use path, sidewalk or trail	5
New bicycle lane	Sidewalk improvement (widening, major repair/replacement of discontinuous or poor condition); Trail improvement	4
Improve bicycle facility (create buffer on existing lanes, widen bicycle lanes, pave shoulder, extend bicycle lanes…)	Crossing island, curb extensions, streetscape	3
Signalization for bicycles; Sharrows	Signalization improvements	2
Bicycle amenities (parking, signing, etc.)	Wayfinding	1
No project defined	No project defined	0

Existing Facilities

It is also important for KYTC to consider existing facilities when rating projects. Existing facilities can be identified through agency databases or Google Maps. Scoring for existing facilities is done using a five (5) point scale as well and is based on the level of infrastructure available for pedestrians and bicyclists, with high scores indicating that a facility is present throughout the project corridor in both directions and in good condition, while lows scores are given when limited portions of the corridor is serviced by bicycle or pedestrian facilities. Table 3.3 summarizes the scoring criteria used for existing pedestrian and bicycle facilities. Bicycle and pedestrian facilities are evaluated individually using the same scale, resulting in two scores.

Table 3.3 Scoring Criteria for Existing Pedestrian and Bicycle Facilities

Points	Facility Condition
5	The facility is present and in good condition
4	The facility is present and in poor condition (improvement); some facility is present for ⩾ 75% of project length
3	Some facility is present for < 75% of project length
2	Some facility is present for <25% of project length; project length ⩽1 mile
1	Some facility is present for <25% of project length; project length >1 mile
0	No facilities

Chapter 4 Methodology

4.1 Data Collection

The research team evaluated data for all 1,182 SHIFT–2022 projects, focusing on projects that include pedestrian and/or bicycle improvements. Of these projects, 274 incorporated pedestrian and/or bicycle improvements. Taking a closer look at the setting of each project revealed that 31 involved building a new road (i.e., there was no existing road). Of these, 26 lacked information on existing or affected road mile points. As such, they were excluded from the study.

After using the KYTC Interactive Statewide Traffic Counts Map to identify project locations, our team virtually drove through each project to analyze data on location, context, land use, potential attractions for pedestrian and bicyclist activities, speed limit, and existing pedestrian and bicycle facilities by mile points. Annual average daily traffic (AADT) data were also obtained. For the several projects that could not be driven virtually, our team collected data from Google Street View and Google Maps. However, Google Maps sometimes lacked accurate mile points for existing pedestrian and bicycle facilities.

The research team prepared walk score heat maps for each project to estimate the walkability and bikeability of the surrounding area.[2] Walk scores indicate how easy it is to walk and bike to the area's attractions, complete errands, and the presence of these attractions. A score of 0 indicates that all errands require a car, while a score of 100 indicates a that all trips could be done on foot or by bike. Figure 4.1 is a walk score heat map for the University of Kentucky and surrounding areas. Scores are based mainly on the presence of attractions that would encourage walking and biking, but do not reflect activity levels. Because these scores were not available for all projects, the research team decided they could not be used for scoring projects in SHIFT.

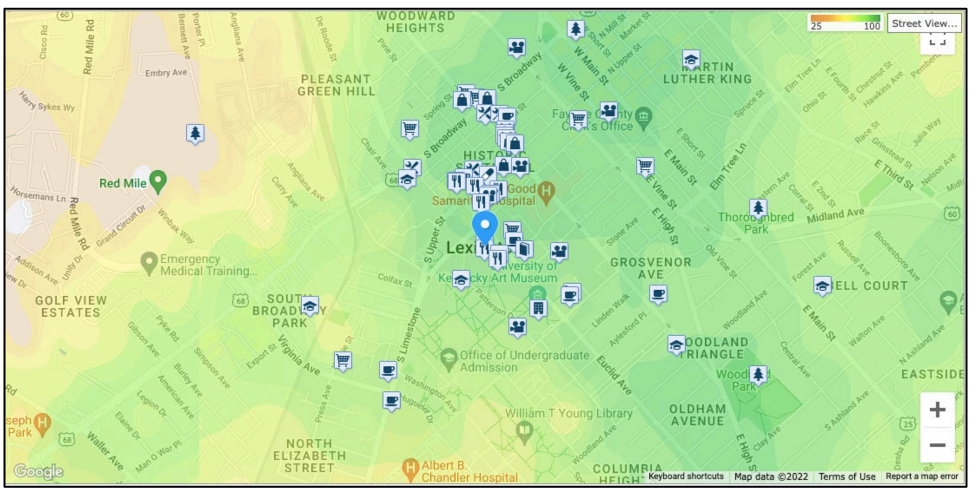

Figure 4.1 Heat Map of the University of Kentucky and Surrounding Areas

4.2 Project Scoring

Most of the 248 projects focused on improving the motorized vehicle network and lacked information on what should be improved for non-motorized users. To score projects, researchers first determined the type of pedestrian and/or bicycle improvement under consideration. Twenty randomly selected projects were reviewed to check on the availability of this information. Our review found there was not enough information to clearly define what pedestrian and/or bicycle project types were to be implemented. Efforts to contact KYTC districts for more information proved mostly fruitless as people who may have more information either could not be identified, had retired, or moved to another position and could not be reached.

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[2] Maps were prepared using www.walkscore.com.

With input from KYTC State Bicycle and Pedestrian Coordinator and the Assistant Director of Planning, researchers identified project types and potential improvements. The review process helped establish a method for determining potential pedestrian and/or bicycle project types for the remaining projects. The research team decided each project should evaluated in a manner that accounts for pedestrian and/or bicycle improvements (rather than potential improvements). After evaluating the 20 sample projects, another 40 projects were examined to determine the pedestrian and/or bicycle project type and requested KYTCs feedback. This step let us further refine our approach for identifying pedestrian and/or bicycle project type. Ultimately all 248 projects were scored based on (1) existing facilities and (2) proposed project type. This resulted in four scores: (1) existing pedestrian facilities, (2) existing bicycle facilities, (3) proposed pedestrian projects, and (4) proposed bicycle projects. The research team adopted the SHIFT–2022 approach funding allocations being tied to project rankings within each region. Table 4.1 gives the regional distribution of projects by proposed project type. Many projects received scores of zero (0), indicating there was no information available on the proposed project or that a judgment could not be reached based on available data.

Table 4.1 Number of Projects By Proposed Project Type Score and Region

Score	East		North		West		South	
	Pedestrian	**Bicycle**	**Pedestrian**	**Bicycle**	**Pedestrian**	**Bicycle**	**Pedestrian**	**Bicycle**
5	0	0	17	1	17	1	2	1
4	1	1	14	27	6	10	1	2
3	0	1	5	26	3	9	1	0
2	2	0	27	0	9	0	2	0
1	0	0	9	5	6	2	2	0
0	14	15	64	77	28	47	16	21
Total	17	17	136	136	70	70	24	24

Next, the research team adjusted the scoring system so that each project would have one score for pedestrian improvements and one score for bicycle improvements. Three approaches were considered:

- Subtract the existing facilities score from the proposed project type score.
- Calculate the average score of existing facilities and proposed project type scores.
- Use only the score for the proposed project type.

Option 2 — using the average score — was dismissed because projects that replace facilities would generate higher scores than projects that lack existing facilities; it also fails to account for system improvements. The disadvantage of Option 3 — using only the score for the proposed project type — is that it fails to consider existing facilities. As such, a facility that is an in-kind replacement would receive the same score as a brand new facility.

Option 1 — subtracting existing facility scores from the proposed project type score — was selected as this yields a single value for each pedestrian and bicycle component. This approach captures relative system changes and can reward projects that advance pedestrian and bicyclist mobility. One issue with this method is the problems raised by lack of information. For example, a project with existing facilities but with no information on the project type would result in a negative score. This requires (1) assuming that all projects will at least replace existing pedestrian and/or bicycle facilities with in-kind facilities, or (2) developing a way to handle negative scores. In the first case, the score would simply be zero (0) and could be used directly in scoring. The second scenario produces negative scores, but SHIFT does not otherwise allow negative scores. Because in-kind replacement does not advance the overall state of the pedestrian and bicycle system, assigning a score of zero (0) is most appropriate.

In alignment with SHIFT–2022 project sensitivity analysis, to characterize pedestrian and bicycle improvements the research team used the difference between the proposed and existing facilities to calculate the relative change.

4.3 SHIFT Scoring Scenarios

The proposed approach will introduce a score for the pedestrian and/or bicycle projects based on existing and proposed facilities. The first step in developing the scoring system was to determine the number of points that could be allocated to pedestrian and bicycle projects from the existing pool of points. At the regional level, SHIFT awards up to 100 points — 70 points go toward congestion, safety, benefit-cost ratio, asset management, and economic growth. The remaining 30 points are evenly distributed between MPO and District boosts (15 points each).

Researchers developed three scenarios for scoring pedestrian/bicycle improvements. Scenarios 2 and 3 reallocate up to 10 points for pedestrian and bicycle projects from boost scores. Scenario 1 reallocates up to 2.5 points for pedestrian and 2.5 for bicycle projects from District boost scores.

- Scenario 1: Reduces the District boost by 10 while retaining all 15 points for the MPO boost
- Scenario 2: Reduces each of the MPO and District boosts by 5 points
- Scenario 3: Reduces the District boost by 5 points and retains the 15 MPO boots points

To determine the impact of each scoring scenario, all SHIFT–2022 projects for which data were available were scored. Projects were divided into regions and evaluated separately to account for local variability — East (204 projects), North (388 projects), South (245 projects), West (293 projects), and Statewide (52 projects).

Researchers scored each project using SHIFT's current scoring method and the new scoring scenarios. Next, each project was ranked under the four scoring approaches and for each region. Projects with pedestrian and/or bicycle improvements were identified so they could be tracked under each scenario to understand how the scoring method impacted rankings. Differences in rank were calculated for each scenario by subtracting the new scoring rank from the rank under the current system. Negative scores indicate a drop in ranking, while positive scores indicate a higher ranking. For example, a project that ranked 6th under the current system and 10th under a proposed scenario would have fallen four positions (-4). Researchers calculated the average change in rank order for each scoring scenario.

Completing the rank difference for all five regions and all three new scenarios showed that no project moved up or down within the Statewide region rankings because there were no District or MPO boosts. As such, the next chapter omits discussion of the analysis of the Statewide region. Analyses focus entirely on projects in the North, South, East, and West regions. Each analytical scenario is sketched out below.

Analysis 1

This analysis compared project rankings under each new scoring scenario to scores calculated under the current system (which does not award points for pedestrian and/or bicycle components). First, researchers identified the projects ranked in the top 50% under the current system. Next it was determined if any projects with pedestrian and/or bicycle components ranking in the top 50% under the current system remained in the top 50% under the new scoring scenarios. Researchers then compared project ranks under the current system and proposed scenarios to determine how many had a higher, lower, or the same rank under each scenario.

Analysis 2

Focusing again on projects that ranked in the top 50%, the research team determined changes in ranking for all project types (i.e., regardless of whether they were identified as pedestrian and/or bicycle projects). Again, the rank order for projects under the current system was compared to rankings under each new scenario.

Analysis 3

Our third analysis was a sensitivity analysis. Analyses 1 and 2 assumed that only 50% of the projects in a region have a chance to receive funding. But this rule does not always hold true. To evaluate the sensitivity of each scenario, projects ranked in the top 10%, 20%, 30%, 40%, and 50% were assessed. The same methods used for Analyses 1 and 2 were used, including calculating the percentage of projects that remained within each percentile under the current system and under the proposed scenarios.

For Analyses 1 and 2 researchers performed Spearman's rank-order correlation test to identify the statistical relationship between ranks under the current system and ranks under each new scenario. A correlation coefficient close to zero (0) indicates a significant difference in ranks between the current system and the scenario tested, whereas a correlation coefficient close to 1 denotes no significant difference in ranks.

Chapter 5 Analysis of SHIFT–2024 Scoring Scenarios

This chapter presents the findings of our sensitivity analyses. Table 5.1 lists the parameters of our first three analyses, which are described in Sections 5.1 – 5.3. Section 5.4 explores two further scenarios, which are intended to address the potential shortcomings of the first three scenarios.

Table 5.1 Types of Analysis and Scenarios Evaluated

Analysis	Description
1	• Focused on the **top 50%** of SHIFT projects in each region. • Determine the number of pedestrian/bicycle projects in the top 50% of projects under the current scoring system and Scenarios 1–3 and the number of projects that are retained in or enter the top 50%. • Calculate the number of pedestrian/bicycle projects that increase or decrease in rank under Scenarios 1–3 relative to the current scoring system. • Determine the average change in rank for pedestrian/bicycle projects under Scenarios 1–3 relative to the current scoring system.
2	• Focused on the **top 50%** of SHIFT projects in each region. • Determine the number of projects that enter the top 50% under Scenarios 1 –3 relative to the current scoring system. • Calculate the number projects that increase or decrease in rank under Scenarios 1–3 relative to the current scoring system. • Determine the average change in rank under Scenarios 1–3 relative to the current scoring system.
3	• Replicates Analysis 1 and Analysis 2 for the projects in the 10th – 50th percentiles.
Scenarios Evaluated	
• Scenario 1: Reduces the District boost by 10 while retaining all 15 points for the MPO boost • Scenario 2: Reduces both the MPO and District boosts by 5 points • Scenario 3: Reduces the District boost by 5 points and retains the 15-point MPO boost	

Recall that analysis was done at the regional level. To ensure consistency in the presentation of results throughout this chapter, the color coding scheme in Table 5.2 was adopted so readers can quickly distinguish between findings for each region.

Table 5.2 Color Coding Scheme for Regions

	East
	North
	West
	South

5.1 Key Findings of Analysis 1 — Pedestrian/Bicycle Projects

- Tables 5.4 – 5.7 present the results for each region.
- Correlation analysis found a strong, positive relationship between project rankings under the current system and rankings under the three scenarios (Table 5.3). Except for one comparison, Spearman's ρ coefficients were > 0.90. Scenario 3 Spearman's ρ coefficients were the highest, which is understandable because it applies the smallest change to the total boost score (5 points).
- Across all regions, Scenarios 1 and 2 produced the largest average change in rankings. Scenario 2 generated the most significant average increase in ranking, with an average increase of between 8 and 25 positions. With respect to changes in rank, Scenario 2 also generated the highest total average score, and among projects that fell in ranking had a lower average decline in position.
- Under Scenario 2 more pedestrian and/or bicycle improvements achieved a higher ranking and potentially have a higher chance of being funded.

Table 5.3 Spearman's ρ Coefficients for Analysis 1

	Spearman's ρ (Ranking Under Current System vs. Scenarios 1–3)		
Region	**Scenario 1**	**Scenario 2**	**Scenario 3**
East	0.79	0.93	0.93
North	0.91	0.92	0.98
West	0.92	0.95	0.98
South	0.97	0.96	1.00

* Values closer to 1 indicate greater agreement in rankings

Table 5.4 East Region — Changes in Rank for Pedestrian and/or Bicycle Projects (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	15	14	0	7 (11)	7 (-17)	1	-2
2		15	0	10 (8)	4 (-7)	1	4
3		15	0	7 (5)	6 (-7)	2	0

Table 5.5 North Region — Changes in Rank for Pedestrian and/or Bicycle Projects (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	102	100	3	67 (27)	31 (-18)	4	12
2		101	3	70 (25)	29 (-13)	3	14
3		101	2	66 (12)	31 (-9)	5	5

Table 5.6 West Region — Changes in Rank for Pedestrian and/or Bicycle Projects (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	54	53	5	39 (16)	15 (-14)	0	8
2		54	5	41 (15)	11 (-12)	2	9
3		54	3	37 (9)	16 (-5)	1	4

Table 5.7 West Region — Changes in Rank for Pedestrian and/or Bicycle Projects (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	18	18	2	11 (12)	5 (-2)	2	7
2		18	2	12 (13)	5 (-1)	1	8
3		18	0	10 (5)	1 (-1)	7	3

5.2 Key Findings of Analysis 2 — All Projects

- Tables 5.9 – 5.12 present the results for each region.
- Correlation analysis found a strong, positive relationship between project rankings under the current system and rankings under the three scenarios (Table 5.3). All Spearman's ρ coefficients were ≥ 0.89. Scenario 3 Spearman's ρ coefficients were the highest, which is intuitive because it applies the smallest change to the total boost score (5 points).
- Relative to the current scoring method, under Scenario 3 all regions retained the greatest number of projects in the top 50%. Other scenarios excluded 1–3 projects.
- The most common average change in rank was zero (0). There were nominal average changes in rank under Scenario 1 (North and West regions) and Scenario 2 (West region).
- Scenario 2 had largest average increases in rankings, with average increases of between 7 and 24 positions.

Table 5.8 Spearman's ρ Coefficients for Analysis 2

	Spearman's ρ (Ranking Under Current System vs. Scenarios 1–3)		
Region	**Scenario 1**	**Scenario 2**	**Scenario 3**
East	0.89	0.93	0.98
North	0.90	0.90	0.98
West	0.91	0.94	0.98
South	0.93	0.93	0.99

* Values closer to 1 indicate greater agreement in rankings

Table 5.9 East Region — Changes in Rank for All Projects (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	102	99	—	57 (10)	42 (-14)	3	0
2		100	—	58 (7)	38 (-12)	6	0
3		102	—	55 (4)	37 (-6)	10	0

Table 5.10 North Region — Changes in Rank for All Projects (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	194	191	—	72 (27)	111 (-18)	11	-1
2		191	—	76 (24)	112 (-17)	6	0
3		192	—	74 (12)	114 (-8)	6	0

Table 5.11 West Region — Changes in Rank for All Projects (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	147	142	—	75 (13)	72 (-17)	0	-2
2		142	—	68 (13)	73 (-15)	6	-1
3		144	—	69 (7)	76 (-7)	2	0

Table 5.12 West Region — Changes in Rank for All Projects (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
1	123	119	—	60 (10)	56 (-11)	7	0
2		120	—	61 (9)	56 (-10)	6	0
3		121	—	58 (4)	34 (-7)	31	0

5.3 Analysis 3 — Key Findings of Percentile-Based Analysis for Pedestrian and/or Bicycle Projects

- Tables 5.13 – 5.17 and the appended figures present the results for each region and scenario. Tables list the percentile under analysis, the number of projects included under the current system and each scenario, and the average change in ranking under each scenario. For each scenario, line graphs show the percentage of projects that would be retained in the designated percentile.
- There was relatively good alignment in project numbers and rankings across regions and scenarios for all percentiles. Generally, smaller percentages of projects were retained at the lower percentiles (10th, 20th). And typically no more than 2–3 projects fell off under any scenario, although there was a little more variability in the average change in rankings, especially for Scenarios 1 and 2, which is consistent with our findings from the previous analyses as Scenario 3 produces results nearest to the current scoring system.

Table 5.13 East Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	2	2 (+3)	2 (+6)	2 (+1)
20	6	4 (-9)	6 (+2)	4 (-3)
30	10	8 (-5)	9 (+3)	10 (-1)
40	12	12 (-2)	12 (+5)	12 (0)
50	15	14 (-2)	15 (+4)	15 (0)

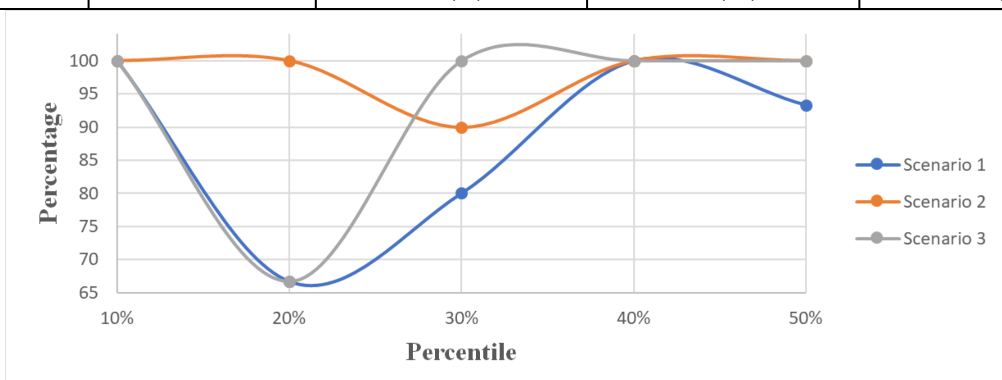


Table 5.14 North Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	15	12 (+2)	14 (+3)	14 (+3)
20	32	29 (+4)	30 (+4)	30 (+4)
30	54	53 (+13)	54 (+7)	54 (+7)
40	77	74 (+13)	74 (+6)	74 (+6)
50	102	100 (+12)	101 (+5)	101 (+5)

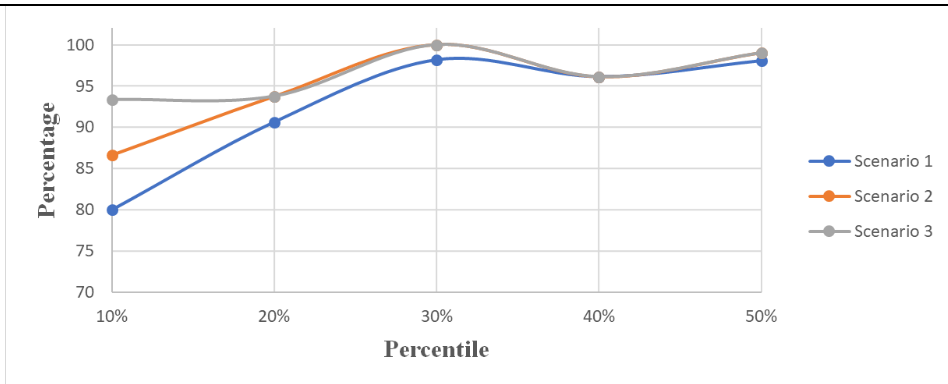


Table 5.15 West Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	12	11 (+2)	11 (+3)	11 (0)
20	25	21 (0)	23 (+3)	23 (+1)
30	34	33 (+4)	33 (+5)	33 (+3)
40	43	42 (+9)	42 (+9)	43 (+5)
50	54	53 (+8)	54 (+9)	54 (+4)

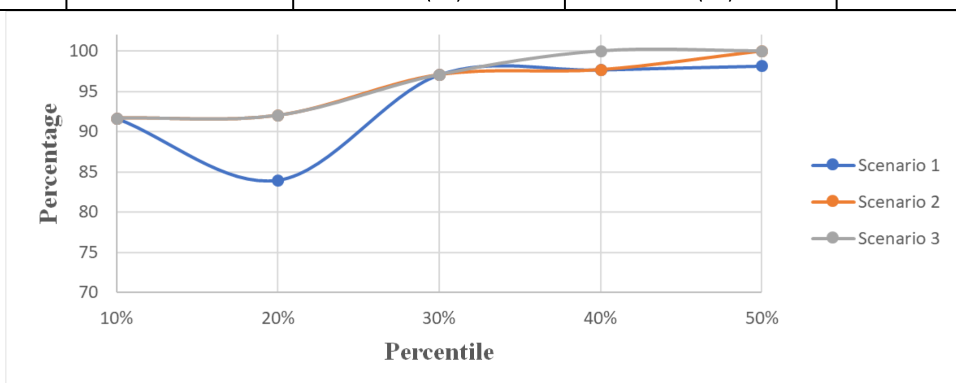
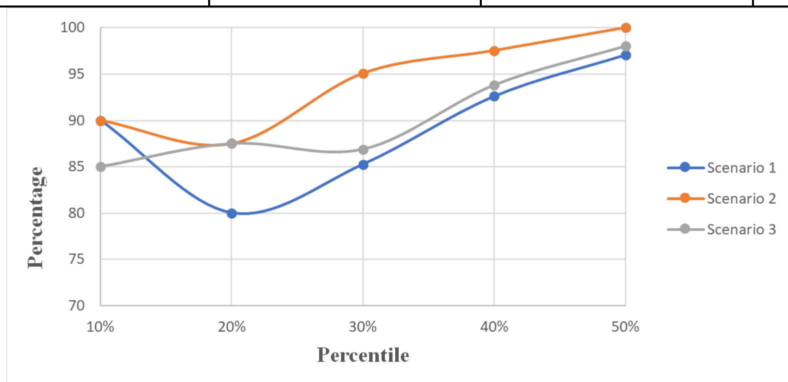


Table 5.16 South Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	6	6 (-1)	6 (-1)	2 (0)
20	9	9 (0)	9 (+1)	4 (0)
30	10	10 (+1)	10 (+3)	10 (+1)
40	16	15 (+7)	15 (+8)	12 (+2)
50	18	18 (+7)	18 (+8)	15 (+3)

Table 5.17 East Region — Changes in Number and Rank for All Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	20	18 (-1)	17 (-1)	18 (0)
20	40	32 (-5)	35 (-3)	35 (-1)
30	61	52 (-3)	53 (-2)	58 (-0)
40	81	75 (-1)	76 (-1)	79 (0)
50	102	99 (0)	100 (0)	102 (0)



5.3.1 Analysis 3 — Key Findings of Percentile-Based Analysis for All Projects

- Tables 5.18 – 5.22 and the appended figures present the results for each region. Tables list the percentile under analysis, number of projects included under the current system and each scenario, and the average change in ranking under each scenario. For each scenario, line graphs indicate the percentage of projects that would be retained for the designated percentile.
- As with the first portion of Analysis 3, there was reasonable agreement between project numbers and rankings across regions and scenarios for all percentiles. The most noticeable general — but not universal — trend was that smaller percentages of projects were retained at lower percentiles (10th, 20th) than at higher percentiles. But this was not the case in the South region. Except for the East region, Scenario 3 produced rankings that were closest to the current scoring system, while Scenarios 1 and 2 showed greater divergence, especially at lower percentiles. Average changes in rankings were modest across all scenarios and for all percentiles. The average change in rank for most percentile – scenario combinations was < +/- 5, however, the North region had a couple outliers.

Table 5.18 East Region — Changes in Number and Rank for All Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	20	18 (-1)	17 (-1)	18 (0)
20	40	32 (-5)	35 (-3)	35 (-1)
30	61	52 (-3)	53 (-2)	58 (-0)
40	81	75 (-1)	76 (-1)	79 (0)
50	102	99 (0)	100 (0)	102 (0)

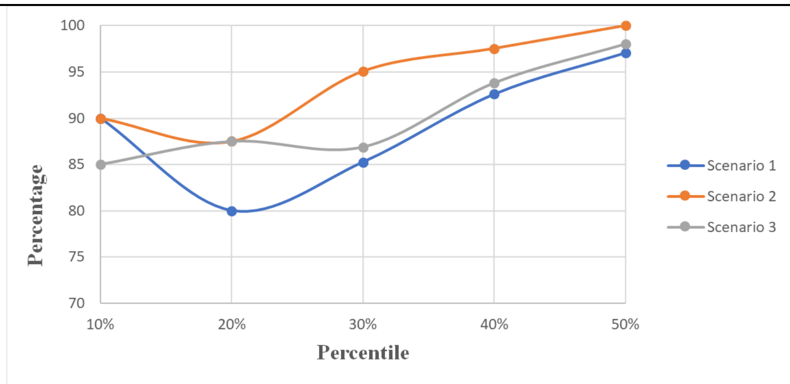


Table 5.19 North Region — Changes in Number and Rank for All Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	39	30 (-5)	31 (-4)	36 (-1)
20	78	60 (-8)	61 (-7)	69 (-2)
30	116	105 (-4)	106 (-4)	112 (-1)
40	155	143 (-2)	142 (-2)	150 (0)
50	194	191 (-1)	191 (0)	192 (0)

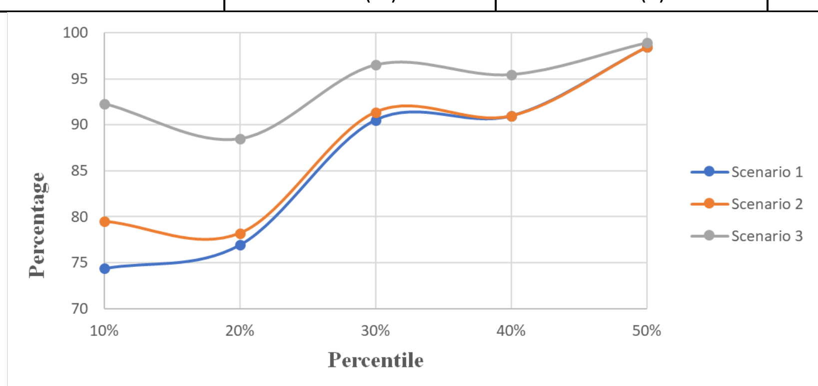


Table 5.20 West Region — Changes in Number and Rank for All Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	29	24 (-2)	24 (-2)	26 (-1)
20	59	49 (-4)	52 (-3)	54 (-1)
30	88	77 (-4)	77 (-3)	82 (-1)
40	117	106 (-3)	106 (-2)	113 (-1)
50	147	142 (-2)	142 (-1)	144 (0)

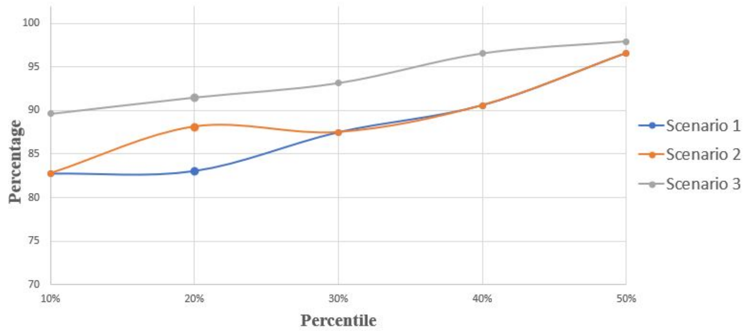
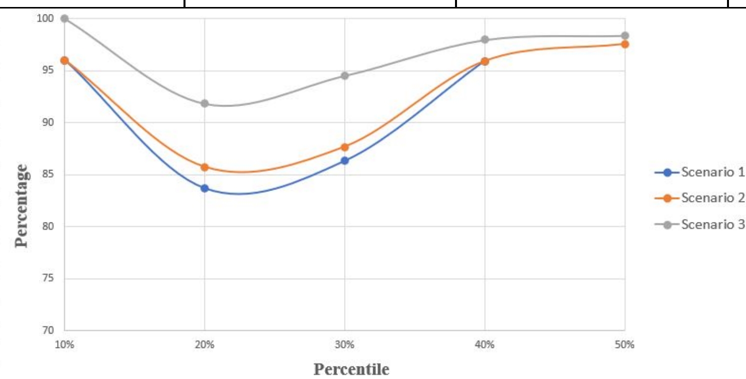


Table 5.21 South Region — Changes in Number and Rank for All Projects (By Scenario)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 1 (Avg. Change in Rank)	Projects Included Under Scenario 2 (Avg. Change in Rank)	Projects Included Under Scenario 3 (Avg. Change in Rank)
10	25	24 (-1)	24 (0)	25 (0)
20	49	41 (-3)	42 (-2)	45 (0)
30	73	63 (-3)	64 (-3)	69 (0)
40	98	94 (-1)	94 (-1)	96 (0)
50	123	119 (0)	120 (0)	121 (0)



5.4 Evaluation of Revised Scoring Method for Pedestrian/Bicycle Projects and All Projects

Deducting facility scores from the proposed project type score can negatively impact the scoring of projects with pedestrian/bicycle improvements. This is problematic because it may reduce their likelihood of being funded. Our analysis of pedestrian/bicycle projects found that several projects wound up with lower rankings than they do under the current scoring system. For example, in the North region, 33 of the 102 (50^{th} percentile evaluation) projects with pedestrian/bicycle improvement projects received at least one of the boost scores, and 26 received both. Among these projects, 14 garnered lower rankings under all three scenarios due to the reduction in boost scores. We observed a more drastic change for projects with low overall scores in SHIFT's five major categories (congestion, safety, benefit-to-cost ratio, asset management, economic growth) but with a boost score. In these cases, reducing boost scores by 10 points while at the same time pedestrian/bicycle projects did not receive a similar score resulted in large rank changes and sometimes dropped projects below the 50^{th} percentile score.

To resolve these issues, researchers evaluated a new scoring method that involves lowering the number of available points for the five main SHIFT elements and reallocating these to pedestrian and bicycle improvements. With this method, MPOs and Districts can award points as they see fit to advance local issues and promote projects that address their needs. As such, pedestrian and bicycle improvements would be placed on equal footing with other SHIFT elements. Two scenarios were evaluated:

- Scenario 4: Reduces available points for the five main SHIFT elements by 10. Retains 15 points for the MPO and District boosts, respectively. Allocates 5 points for pedestrian and 5 points for bicycle improvements.
- Scenario 5: Reduces available points for the five main SHIFT elements by 5. Retains 15 points for the MPO and District boosts, respectively. Allocates 2.5 points for pedestrian and 2.5 points for bicycle improvements.

To analyze these scenarios, the same approaches used in Sections 5.1 – 5.3 were leveraged. That is, focusing on the top 50% of projects, researchers first assessed the impact of each scenario on (a) pedestrian and/or bicycle improvements only and (b) all projects. Next, the team examined how these scenarios play out for the number and rankings of projects in the 10^{th} – 50^{th} percentiles.

5.4.1 High-Level Key Findings for Updated Scoring Scenarios

- Tables 5.22 – 5.25 present results for each region for projects with pedestrian/bicycle improvements.
- Except when Scenario 4 was applied to the North region, all projects were retained under the updated scoring methods. Average change in rankings were very modest, with all scenarios logging average changes in position of less than 4.

- Tables 5.26 – 5.29 present results for each region for all projects.
- Applying Scenarios 4 and 5 to all projects resulted in the retention of most projects in the top 50%. The number of projects that fell out of the top 50% varied by region and scenario, but in no case was > 3. With the exception of Scenario 4 for the West region, the overall average change in ranking was zero (0). As with other analyses presented in this chapter, the overall average tends to wash out average increases and decreases.

- Scenario 4 confers the greatest benefits to projects with pedestrian/bicycle improvements. It retained the most projects in the top 50% and resulted in the most significant upward movement in rankings.

Table 5.22 East Region — Changes in Rank for Pedestrian and/or Bicycle Projects Under Revised Scoring System (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	15	15	0	6 (7)	6 (-3)	3	2
5		15	0	6 (4)	5 (-2)	4	1

Table 5.23 North Region — Changes in Rank for Pedestrian and/or Bicycle Projects Under Revised Scoring System (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	102	101	3	56 (15)	42 (-9)	4	4
5		102	2	57 (8)	40 (-5)	5	2

Table 5.24 West Region — Changes in Rank for Pedestrian and/or Bicycle Projects Under Revised Scoring System (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	54	53	5	31 (9)	22 (-5)	1	3
5		53	3	33 (5)	17 (-2)	4	2

Table 5.25 West Region — Changes in Rank for Pedestrian and/or Bicycle Projects Under Revised Scoring System (By Scenario)

	Change in Number of Bike/Ped Projects			Change in Bike/Ped Project Rankings			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	18	18	2	6 (7)	8 (-2)	4	1
5		18	0	6 (4)	6 (-1)	6	1

Table 5.26 East Region — Changes in Rank for All Projects Under Revised Scoring System (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	102	101	—	33 (4)	50 (-3)	19	0
5		101	—	26 (3)	42 (-2)	34	0

Table 5.27 North Region — Changes in Rank for All Projects Under Revised Scoring System (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	194	191	—	67 (13)	114 (-8)	13	0
5		192	—	72 (7)	99 (-5)	23	0

Table 5.28 West Region — Changes in Rank for All Projects Under Revised Scoring System (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	147	141	—	53 (6)	87 (-5)	7	-1
5		144	—	49 (4)	72 (-3)	26	0

Table 5.29 West Region — Changes in Rank for All Projects Under Revised Scoring System (By Scenario)

	Change in Number of Projects (All)			Change in Project Rankings (All)			
Scenario	Projects in Top 50% Under Current Scoring System	Projects Retained in Top 50%	New Projects Entering Top 50%	Projects Increasing Rank (Avg. Position Change)	Projects Falling in Rank (Avg. Position Change)	Projects With No Change in Rank	Average Change in Ranking
4	123	120	—	32 (5)	64 (-3)	27	0
5		122	—	30 (3)	57 (-2)	36	0

5.4.2 Key Findings of Percentile-Based Analysis for Pedestrian and/or Bicycle Projects (Scenarios 4 and 5)

- Tables 5.30 – 5.33 and the present the results for each region. Tables list the percentile under analysis, number of projects included under the current system and Scenarios 4 and 5, and average change in ranking under each scenario.
- In most cases, Scenarios 4 and 5 retained the same, or nearly the same, number of projects with pedestrian/bicycle improvements. In a few cases, a small number of projects were not retained (e.g., East and North regions in the 20th and 30th percentiles). Scenario 4 tended to generate slightly more pronounced changes in rank, but on the order or 1–2 more positions than Scenario 5. Across all four regions, the fewest changes occurred in the 40th and 50th percentiles, both in terms of projects retained and their rankings.

Table 5.30 East Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	2	2 (+3)	2 (+1)
20	6	5 (+1)	5 (+0)
30	10	10 (+2)	10 (+1)
40	12	12 (+2)	12 (+1)
50	15	15 (+2)	15 (+1)

Table 5.31 North Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	15	15 (+3)	15 (+3)
20	32	29 (+2)	30 (+1)
30	54	52 (+3)	52 (+1)
40	77	73 (+3)	75 (+2)
50	102	101 (+4)	102 (+2)

Table 5.32 West Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	12	11 (+2)	11 (+2)
20	25	24 (+3)	25 (+2)
30	34	33 (+4)	34 (+2)
40	43	42 (+5)	43 (+3)
50	54	53 (+3)	53 (+2)

Table 5.33 South Region — Changes in Number and Rank for Pedestrian and/or Bicycle Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	6	6 (+1)	6 (+1)
20	9	9 (+1)	9 (+0)
30	10	10 (+0)	10 (+0)
40	16	15 (+1)	15 (+1)
50	18	18 (+1)	18 (+1)

5.4.3 Key Findings of Percentile-Based Analysis for All Projects (Scenarios 4 and 5)

- Tables 5.34 – 5.37 and the present the results for each region. Tables list the percentile under analysis, number of projects included under the current system and Scenarios 4 and 5, and average change in ranking under each scenario.
- In most cases, Scenarios 4 and 5 retained the same or a similar number of projects. A few outliers were observed. For example, the North region's 40th percentile recorded a significant drop in projects (-10 under Scenario 4 and -5 under Scenario 5) relative to the current scoring system. Typically, the number of projects not retained was < 5, and overall Scenario 5 had a higher retention rate than Scenario 4. Average change in ranking across all scenarios, projects, and regions was zero (0). Except for the East region's 30th percentile, all changes in average rank were +/- 1.

Table 5.34 East Region — Changes in Number and Rank for All Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	20	20 (0)	20 (0)
20	40	38 (0)	38 (0)
30	61	58 (-3)	58 (-2)
40	81	78 (0)	79 (0)
50	102	101 (0)	101 (0)

Table 5.35 North Region — Changes in Number and Rank for All Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	39	36 (-1)	37 (0)
20	78	74 (-1)	76 (0)
30	116	112 (0)	114 (0)
40	155	145 (-1)	150 (0)
50	194	191 (0)	192 (0)

Table 5.36 West Region — Changes in Number and Rank for All Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	29	26 (-1)	27 (0)
20	59	52 (0)	58 (0)
30	88	84 (0)	86 (0)
40	117	113 (0)	115 (0)
50	147	141 (-1)	144 (0)

Table 5.37 South Region — Changes in Number and Rank for All Projects (Scenarios 4 and 5)

Percentile	Projects Included Under Current Scoring System	Projects Included Under Scenario 4 (Avg. Change in Rank)	Projects Included Under Scenario 5 (Avg. Change in Rank)
10	25	25 (0)	25 (0)
20	49	49 (0)	49 (0)
30	73	71 (0)	71 (0)
40	98	96 (0)	97 (0)
50	123	120 (0)	122 (0)

Chapter 6 Recommendations for SHIFT–2024

6.1 Point Allocation

The SHIFT–2024 scoring formula should allocate 5 points for pedestrian improvements and 5 points for bicycle improvements (for a total of 10 points). Structuring the allocation in this manner ensures that projects are awarded points even if they only include either a pedestrian or bicycle improvement. Dedicating fewer than 10 points would have a minimal impact on scoring and rankings and hinder KYTC's efforts to account for pedestrian/ bicycle improvements in its funding decisions. Under our proposed SHIFT–2024 scoring formula, the 10 points for pedestrian/ bicycle improvements will be made available by reducing the number of points allocated to each of SHIFT's five main components (congestion, safety, benefit-cost ratio, asset management, and economic growth) by 2 points each. Reducing the number of available points for SHIFT's main components keeps available points for the MPO boost and District boost unchanged at 15 points apiece. This gives MPOs and Districts the chance to allocate points to projects in a way that addresses local issues. Table 6.1 summarizes changes in scoring between SHIFT–2022 and SHIFT–2024.

Table 6.1 Comparison of SHIFT–2022 and SHIFT–2024 Scoring Methods

Element	SHIFT–2022 Point Value	SHIFT–2024 Point Value
Main Components • Congestion, safety, benefit-cost ratio, asset management, and economic growth	70	60
MPO Boost	15	15
District Boost	15	15
Pedestrian Improvements	—	5
Bicycle Improvements	—	5

Table 6.2 presents an updated method for scoring existing pedestrian and bicycle facilities, while Table 6.3 lays out how SHIFT–2024 will score proposed pedestrian and bicycle improvements.

Table 6.2 Revised Scores For Existing Pedestrian And Bicycle Facilities

Bicycle Facilities	Pedestrian Facilities	Points
Bicycle lanes in both sides or path is present and in good condition	Sidewalks in both sides are present and in good condition	5
Bicycle lanes in both sides or path is present and in poor condition	Sidewalks in both sides are present and in poor condition	4
Bicycle lanes in both sides or path is present for <75% of project length	Sidewalks in both sides are present for <50-75% of project length	3
Bicycle lane or path is present for <50-75% of project length	Sidewalk is present in one side	2
Sharrows are present	Sidewalks in both sides are present for <50% of project length	1
No facilities	No facilities	0

Table 6.3 Proposed Methods for Scoring Pedestrian and Bicycle Improvements in SHIFT–2024

Bicycle Project	Pedestrian Project	Points
New bicycle multi- or shared-use path, protected bicycle lanes, rail-trail, bicycle signalization	New pedestrian multi- or shared-use path, sidewalk or trail	5
New buffered or separated bicycle lane	Sidewalk improvement (widening, major repair/replacement of discontinuous or poor condition); Trail improvement	4
Improve bicycle facility (create buffer on existing lanes, widen bicycle lanes, pave shoulder, extend bicycle lanes…)	Crossing island, curb extensions, streetscape, adding enhanced crosswalks	3
New bicycle lane (no separation)	Signalization improvements	2
Bicycle amenities (parking, signing, etc.); Sharrows	Wayfinding	1
No project defined	No project defined	0

6.2 Proposed Project Type

In addition to the revised scoring methods, that initial project documentation should incorporate more detailed descriptions of proposed projects. Having more detailed descriptions makes it easier to account for the benefits and costs of facilities, establishes a foundation for systematically evaluating projects, and, if needed, offers a path forward to refine the SHIFT process. Table 6.4 is a proposed list of general project categories.

Table 6.4 Proposed Pedestrian/Bicycle Project Types for SHIFT–2024

• New shared use path (off road)	• Add sharrows
• New shared path (on road)	• Add bike amenities (e.g., parking, signing)
• New bike path (off road)	• New pedestrian trail
• New bike lane (buffered)	• New sidewalk
• New bike lane (separated)	• Improve sidewalk (e.g., add buffer, repair condition/ connectivity, widen, add curb extensions)
• New bike lane (shoulder)	• Add crossing island or streetscape
• Improve bike facility (e.g., add a buffer, widen the lane, pave shoulders, etc.)	• Add signalization for pedestrians
• Add signalization for bikes	• Add pedestrian amenities (e.g., wayfinding, signing)

6.3 Future Work

It will be important to examine how the proposed scoring methods influence SHIFT–2024. Because uncertainties related to project types will be resolved, KYTC and KTC researchers will have the chance to revisit the list of projects in Table 6.4 and determine if it should be modified. Another issue that merits consideration is factoring economic benefits of pedestrian and bicycle facilities into scoring. Researchers have demonstrated these benefits can be significant. Integrating this form of economic analysis into SHIFT could help the Cabinet more exhaustively account for the costs and benefits of proposed projects.

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