PEDESTRIAN AND BICYCLE PERFORMANCE MEASURE RECOMMENDATIONS:

Capturing Our True Progress

SEPTEMBER 2021

Oregon Department of Transportation

ACKNOWLEDGMENTS

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Oregon Department of Transportation

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WHY DOES ODOT NEED NEW PERFORMANCE MEASURES FOR PEOPLE WALKING AND BIKING?

Walking and biking are critical forms of transportation that improve health, sustainability, economic vitality, and overall livability in Oregon. Safe, comfortable walkways and bikeways are crucial for people who use these modes to reach destinations or simply enjoy their communities by foot, mobility device, or bike.

Performance measures promote informed decision-making and make it possible to objectively track concrete progress toward goals. Good measures characterize infrastructure investments, activity, and impacts, narrowing down the target to what will give the clearest picture of progress. Without performance measures, it's difficult to understand how agency decisions are affecting our communities.

The 2016 Oregon Bicycle and Pedestrian Plan identified pedestrian and bicycle performance management as a key ODOT need and initiative, and the 2021-2023 ODOT Strategic Action Plan called out improving access to active and public transportation and reducing our carbon footprint as two key focus areas. ODOT's current metrics focused on people walking and biking do not provide a clear understanding of ODOT's progress for people walking and biking and do not provide enough information to support long term decision-making. This project establishes a set of measures that together will comprehensively track progress and help inform needs and investments for people walking and biking.

How is ODOT Measuring Progress Now?

Today, ODOT uses several main indicators to measure progress toward a safer, more connected statewide pedestrian and bicycle transportation network.

Bikeways and Walkways Key Performance Measure

Today, ODOT has one key performance measure intended specifically to measure progress on its statewide network of walkways and bikeways. This Key Performance Measure (KPM) gauges the percent of urban state highway miles with walkways and bikeways in "fair" or better condition and is reported to the state legislature. The current KPM faces several key challenges that does not allow it to accurately reflect ODOT's progress for walkways and bikeways on the state system including a growing target number of miles for providing walkways and bikeways due to growing urban areas and the lack of recognition for ODOT improved roadways that are then jurisdictionally transfered.

ORS 366.514, "The Bike Bill"

ODOT calculates and reports to the state legislature the total amount and percentage of State Highway Funds spent on pedestrian and bicycle improvements each year. Recipients of State Highway Funds must spend a minimum of 1% of those funds on pedestrian and bicycle infrastructure, and ODOT has been successful in meeting this requirement. The 1% minimum requirement is independent of the requirement to provide bikeways and walkways as part of road construction.

Pedestrian- and Bicycle Fatalities and Serious Injury Crashes

Crashes are well documented through ODOT's Crash Analysis and Reporting (CAR) and Automation Units. Though a useful piece of the puzzle, this data set has some drawbacks as a performance measure. Most bicycle and pedestrian crashes are only documented if there is a major injury or fatality and a motor vehicle is involved, data is not available immediately to be able to tell how recent policies, projects, and programs may affect the number of crashes, and the number of crashes does not indicate crash rate, so more crashes corresponding with a greater number of people walking and biking can appear worse than fewer people walking and biking and the same number of crashes.

Enhancing ODOT's Ability to Track Improvement

ODOT has developed a set of new recommended performance measures that are practical, meaningful in their ability to accurately show system changes over time, and effective in informing strategic decisions. These measures, including two that are recommended to replace the current KPM, work together to produce a clear picture of conditions for people walking and biking in Oregon. Several are identified as future measures that can be applied once data becomes available through creation of a statewide pedestrian and bicycle count program and statewide asset repository and inventory.

Oregon Department of Transportation

HOW DID WE ARRIVE AT THE NEW PERFORMANCE MEASURES?

ODOT staff; MPO and university partners; and pedestrian and bicycle research and data experts worked between February 2020 and September 2021 to identify, evaluate, and implement the desired outcomes and new performance measures. The project team worked closely with stakeholders and partner agencies through interviews and a project technical advisory committee that met six times throughout the project. Reviewers considered both the feasibility of implementing potential performance measures and their potential value to ODOT in painting a clear picture of progress toward a safer, more connected walkway and bikeway network.

February – May 2020
REVIEW OF BEST PRACTICES AND CURRENT ODOT PRACTICES

May – September 2020
EVALUATE DATA AND POTENTIAL MEASURES

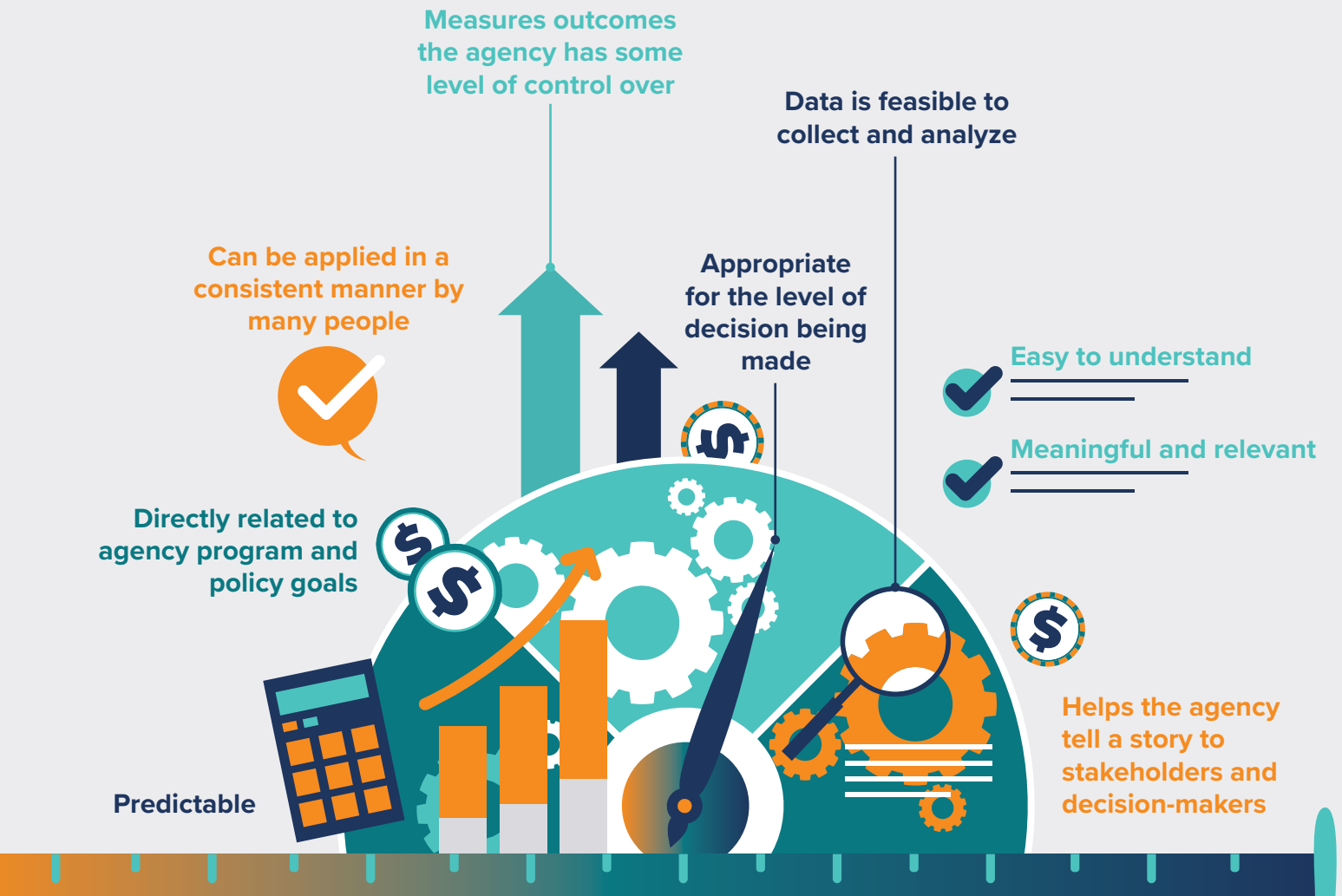
Determine Key Outcomes and Evaluation Criteria

October – January 2020
RECOMMEND PERFORMANCE MEASURES

February – May 2020
METHODOLOGIES AND DATA COLLECTION STRATEGY

May – September 2021
FINAL REPORT AND IMPLEMENTATION FRAMEWORK

What Makes a Good Performance Measure?



DESIRED OUTCOMES

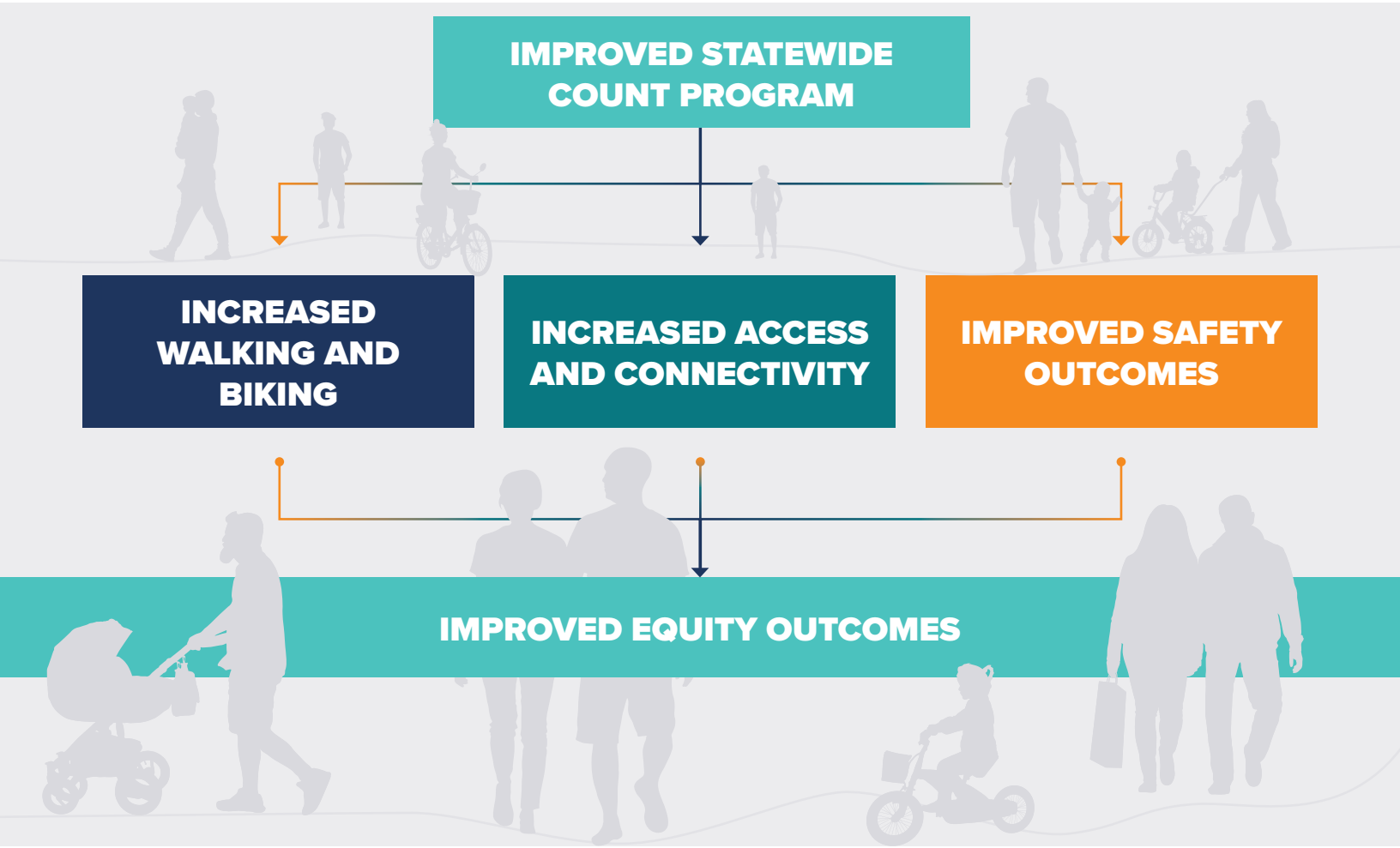
After reviewing agency and industry best practices, the project team and advisory committee established the desired outcomes for walking and biking in Oregon that would become the focus for our performance measures.

Increased walking and biking, especially for marginalized communities, is the primary desired outcome for walking and biking in Oregon. The team pinpointed increased access and improved safety as major components necessary to achieving that goal and established performance measures to support increased walking and biking, increased access, and improved safety.

The team applied an equity lens to each step of the project, including performance measure evaluation, and a statewide pedestrian and bicycle count program was identified as a need to support the measures, though not as a standalone outcome for which individual measures would be established.

The final desired outcomes include:

- **Increased walking and biking**
- **Improved equity outcomes**
- **Increased access and connectivity**
- **Improved safety**
- **Improved pedestrian and bicycle count data**



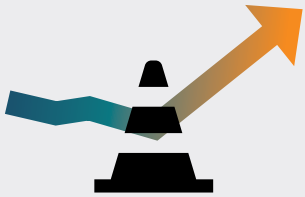
PROPOSED PERFORMANCE MEASURES

These recommended performance measures, supported by the project advisory committee, are designed to work together. Combined, they provide a clear, system-level view of ODOT's efforts to improve the safety and accessibility for people walking and biking across Oregon. For detailed descriptions, methodology, and expanded reporting, data, and responsibilities, see Appendix A.

The recommended performance measures are divided into Near-Term Measures and Future Measures. Near-Term Measures are those with the ability to be implemented immediately, while the future measures require data that is not currently available. Appendix B provides a Non-Motorized Data Management Strategy that outlines the data needs for each measure and steps for obtaining these data.

OUTCOME

INCREASED ACCESS



IMPROVED SAFETY

INCREASED WALKING AND BIKING

NEAR-TERM PERFORMANCE MEASURES

PROPOSED KEY PERFORMANCE MEASURES

Bikeways and walkways: percent of ODOT priority pedestrian and bicycle corridors with walking and bicycling facilities in fair or better condition

Crosswalk spacing: percent of priority pedestrian and bicycle corridors meeting target crossing spacing

Perceived walking safety: percent of people who feel safe walking to meet daily transportation needs

Perceived biking safety: percent of people who feel safe biking to meet daily transportation needs

Mode split: percent of people commuting by modes other than single occupancy vehicle

FUTURE PERFORMANCE MEASURES

***Bikeways and walkways:** percent of statewide pedestrian and bicycle priority areas with low stress walkways and bikeways

***Crosswalk spacing:** percent of statewide priority pedestrian and bicycle areas meeting target crossing spacing

Pedestrian crash rate: number of pedestrian crashes per 100 million pedestrian miles traveled

Bicycle crash rate: number of bicycle crashes per 100 million bicycle miles traveled

Miles Traveled: miles traveled by people walking, biking or driving

** includes roadways not owned by ODOT*

PROPOSED KEY PERFORMANCE MEASURES

Improved Access Measures

PERCENT OF ODOT PRIORITY PEDESTRIAN AND BICYCLE CORRIDORS WITH WALKING AND BICYCLING FACILITIES IN FAIR OR BETTER CONDITION

Less than half of ODOT priority corridors for walking and biking have sidewalks and bikeways in fair or better condition

People need infrastructure such as sidewalks and bicycle facilities to walk and bike safely. This metric tracks ODOT's progress toward providing those critical facilities. Rather than focusing on all ODOT roadways, this measure examines priority corridors across the state to be able to target pedestrian and bicycle funding to the highest need locations that include destinations, transit, and underserved communities. This measure also provides a consistent target for the number of miles of facilities with walking and biking facilities and gives ODOT credit for improving roadways that are jurisdictionally transferred to other agencies.

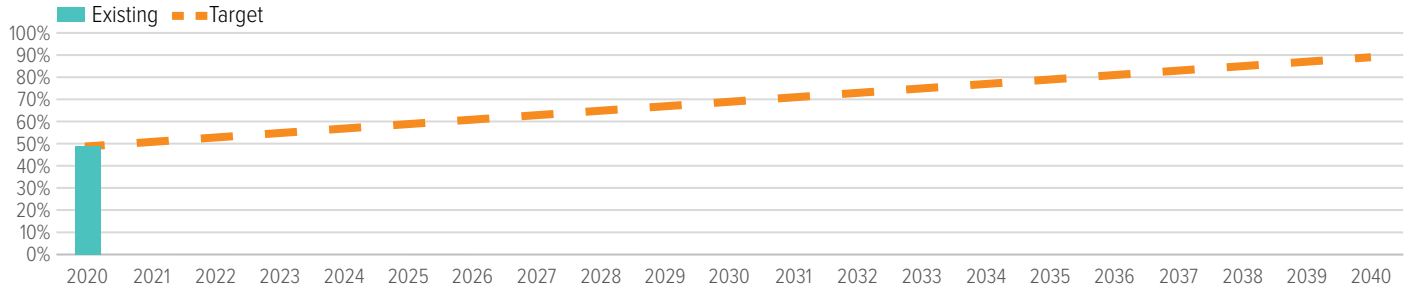
Data Source: GIS

Target: +2% (about 5 roadside miles) per year

Goal: 90% in 20 years

Responsibility: Pedestrian and Bicycle Program Manager

Reporting: Annual (spring)



PERCENT OF PRIORITY PEDESTRIAN AND BICYCLE CORRIDORS MEETING TARGET CROSSING SPACING

Less than half of ODOT priority corridors provide marked crossings every 750 ft

Crossings provide vital access to pedestrians and cyclists, and safe crossings are especially important on highways. This measure uses target crossing spacing from ODOT's Blueprint for Urban Design to track ODOT's progress in providing permeability for people walking and biking in priority locations across ODOT highways and supports connections to local pedestrian walkway and bikeway networks that cross an ODOT roadway..

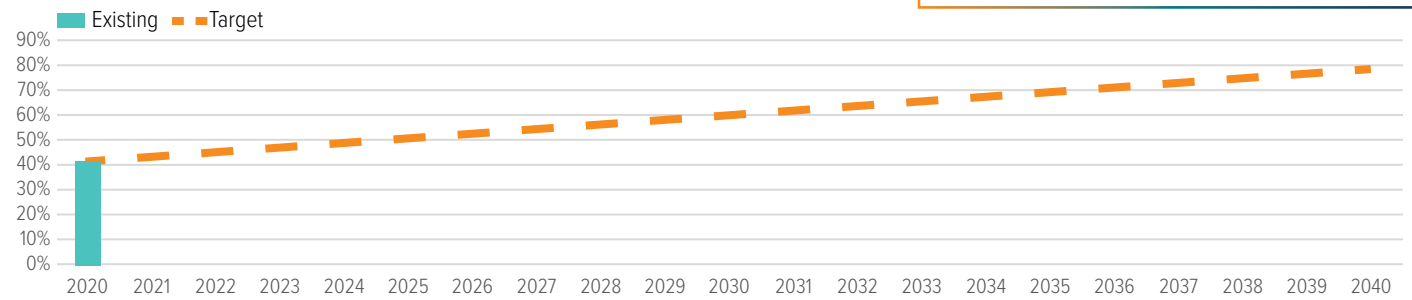
Data Source: GIS

Target: 2% increase per year (approximately 10 crossings)

Goal: 78% in 20 years

Responsibility: Pedestrian and Bicycle Program Manager

Reporting: Annual (spring)



What's Next?

FUTURE MEASURE: PERCENT OF STATEWIDE PEDESTRIAN AND BICYCLE PRIORITY AREAS WITH LOW STRESS WALKWAYS AND BIKEWAYS

Increasing walking and biking access and usage for all Oregonians will require new, improved, and maintained low-stress, or level of traffic stress 1 or 2, facilities in the highest need locations regardless of jurisdiction. Before this measure can go into effect, an inventory of facilities across the state is needed to identify priority areas and calculate this metric. More information on the development of a statewide pedestrian and bicycle asset inventory and repository can be found in Appendix B.

Increased Walking and Biking Utilization

PERCENT OF PEOPLE COMMUTING TO WORK BY MODES OTHER THAN SINGLE OCCUPANCY VEHICLE

Reducing single occupancy vehicle trips is essential to achieve greenhouse gas reduction targets identified in the Statewide Transportation Strategy. Rather than examining walking, biking, taking transit, and other non-single occupancy vehicle (SOV) modes separately, this measure aggregates all non-SOV trips. This view acts to support all of ODOT's programs related to reducing SOV trips. This measure tracks statewide mode splits as well as urban-area mode splits because greater destination density in cities often provides more opportunities for people to travel using non-SOV modes.

Almost 1/3 of all Oregonians use modes other than driving alone to get to work

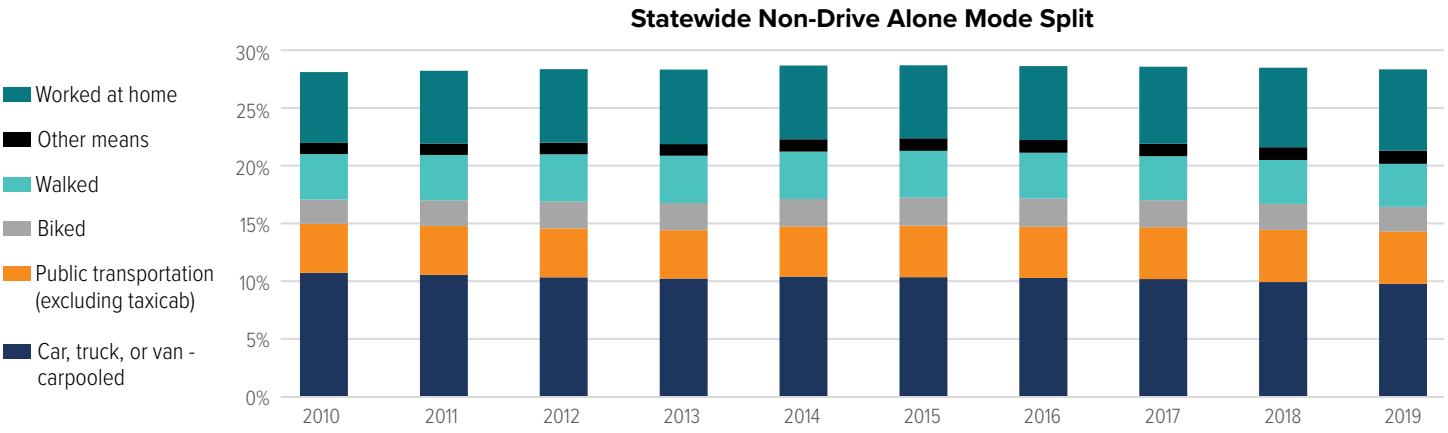
Data Source: American Community Survey (ACS) and Modified Oregon Transportation Needs and Issues Survey (OTNIS)

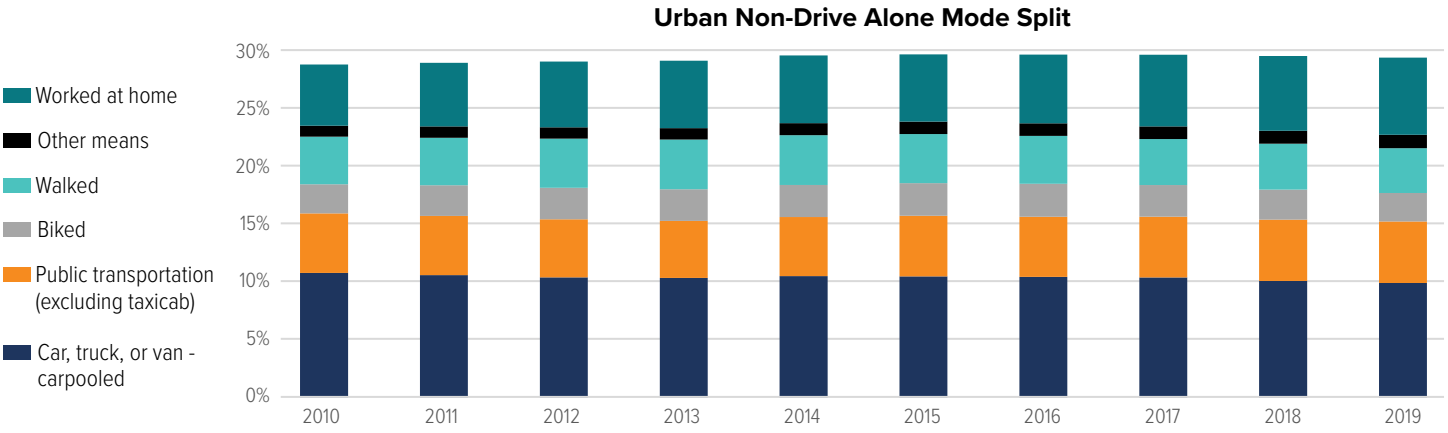
Target: N/A

Goal: N/A

Responsibility: Pedestrian and Bicycle Program Manager

Reporting: ACS: annual, OTNIS: biannual





What's Next?

FUTURE MEASURE: MILES TRAVELED BY PEOPLE WALKING AND BIKING

This measure will require the creation of a pedestrian and bicycle count program to determine the overall miles traveled for pedestrians and cyclists. Over time, data aggregations will reveal trends by walking and biking for each characteristic grouping and help inform other future performance measures. More information on the development of a count program can be found on page 14 or in Appendix B.

Improved Safety Measures

PERCENT OF PEOPLE THAT FEEL SAFE WALKING AND BIKING TO MEET THEIR DAILY TRANSPORTATION NEEDS

If it feels safe to walk and bike, more people are likely to walk or bike instead of drive[1]. This metric directly relates to Policy 1.4 of the Oregon Pedestrian and Bicycle Plan and tracks the percent of people who feel safe walking and biking to meet their daily transportation needs. By evaluating perceived safety, ODOT can better invest in safety infrastructure: walking/biking facilities, adequate illumination, enhanced crossings, traffic calming efforts, and separated high speed and volume vehicle traffic, safety education efforts, facility design as well as operations, maintenance, and speed management projects.

[1] Mekuria, Maaza C., et al. "Low-Stress Bicycling and Network Connectivity." Mineta Transportation Institute, Report 11-19, May 2012, 1005-low-stress-bicycling-network-connectivity.pdf (sjsu.edu). Accessed September 2021.

1/3 of Oregonians say that they do not have the necessary sidewalks or crossings to walk safely

Data Source: OTNIS

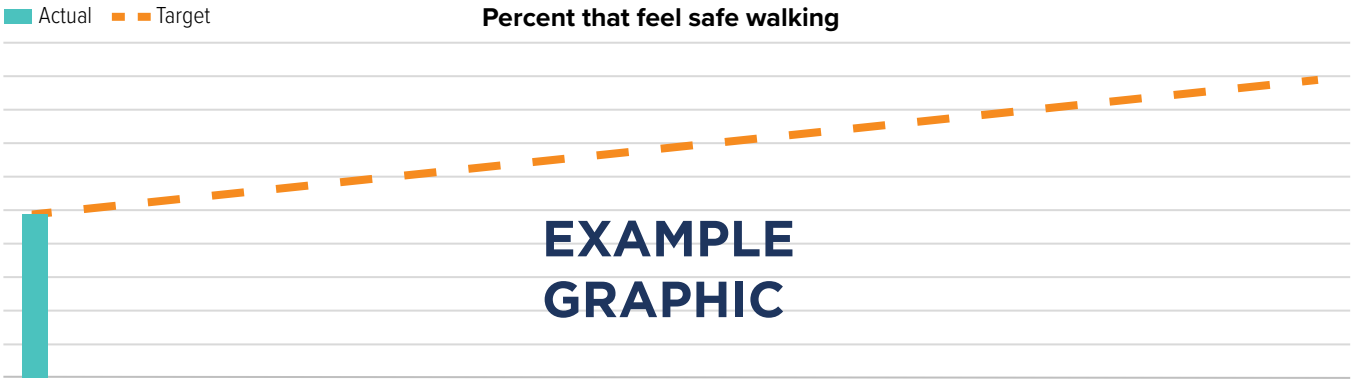
Target: To be determined

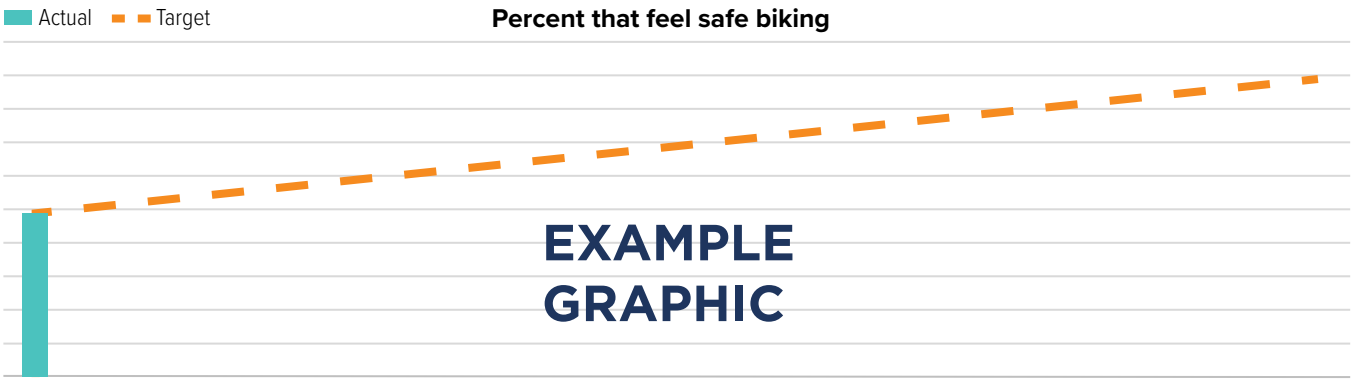
Goal: To be determined

Responsibility: ODOT Statistics and Research Coordinator

Reporting: Biannual

The baseline conditions and targets for perceived safety will be calculated and determined based on data from the 2022 OTNIS survey.





What's Next?

PEDESTRIAN AND BICYCLE CRASHES PER 100 MILLION PEDESTRIAN AND BICYCLE MILES TRAVELED

Crash rates indicate the number of crashes relative to the system's total activity. By tracking crash rates, we can compare safety for each mode. This performance measure will require measuring pedestrian and bicycle miles traveled, which will require comprehensive pedestrian and bicycle counts. Implementing a pedestrian and bicycle traffic count program is the first step in being able to track this measure.

Improved Safety Measures

PEDESTRIAN FATAL AND SERIOUS INJURY CRASHES PER YEAR

BICYCLE FATAL AND SERIOUS INJURY CRASHES PER YEAR

ODOT tracks the number of fatal and serious injury crashes for each mode, including those walking and biking. Performance is reported annually by the Transportation Safety Division in the Oregon Traffic Safety Performance Plan which serves as Oregon's annual application for federal NHTSA Highway Safety grant funds. While the charts below provide a crash target to encourage a reduction in fatal and serious injury crashes, no transportation fatalities are acceptable. Tracking fatal and serious injury crashes aligns with ODOT's focus on safety and provides an understanding of the fatal and serious injury trends over time, but it does not take into account potential changes in volumes. The ultimate safety metric goal, as identified as the future Improved Safety Measure, is to track crash rate. A pedestrian and bicycle count program is necessary to obtain the data to track crash rate.

There are consistently more than 150 people killed or seriously injured while walking in Oregon each year

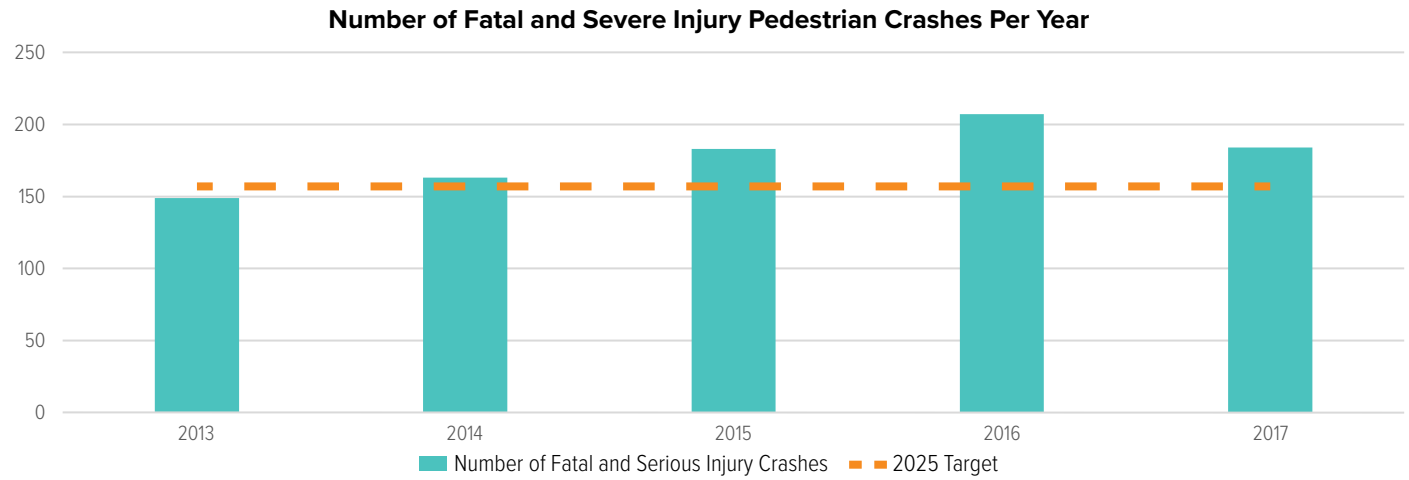
Data Source: ODOT Crash Analysis and Reporting (CARS) data

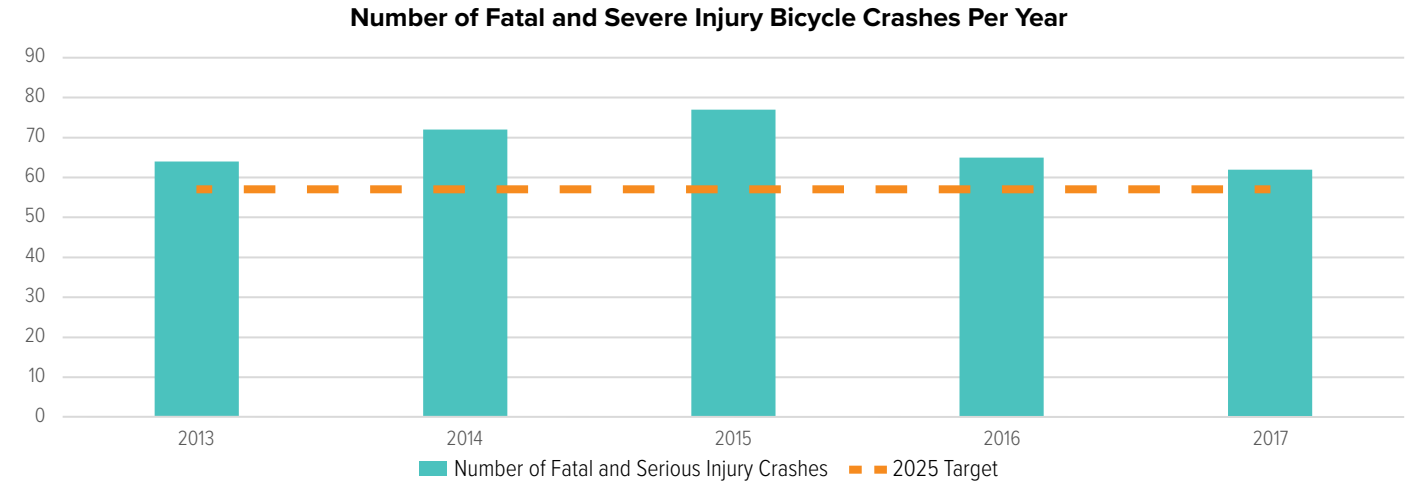
Pedestrian Goal: 157 or less per year by 2025

Bicyclist Goal: 57 or less per year by 2025

Responsibility: Transportation Safety Division

Reporting: Annual





GOOD DATA IS VITAL TO TRACKING OUR INVESTMENTS AND IMPACTS

The future performance measures ODOT identified are meaningful and valuable, and align with desired outcomes, but data are not available today to calculate them.

Two key strategies would correct this problem: creating a statewide pedestrian and bicycle count program, or implementing a systematic plan to collect volumes of people walking and biking, and a statewide repository and inventory, or documentation of, walkways and bikeways covering transportation infrastructure owned by all agencies across the state. The count program will provide volumes necessary for calculating crash rates and understanding how many people are walking and biking across the state. The statewide repository and inventory will provide the documentation of where walkways and bikeways are to allow us to understand what percent of high-need areas serve people walking and biking.

Investing in a comprehensive walkway and bikeway asset inventory and repository and a pedestrian and bicycle count program will not only allow ODOT to track these valuable performance measures but will also help inform other initiatives.

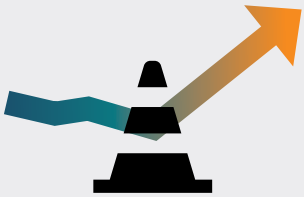
Future Performance Measures

IMPROVED ACCESS

Bikeways and walkways: percent of statewide pedestrian and bicycle priority areas with low-stress pedestrian and bicycle facilities (includes ODOT and non-ODOT systems)

Crosswalk spacing: percent of priority pedestrian and bicycle areas meeting target crossing spacing

Requires statewide pedestrian and bicycle inventory and repository



SAFETY

Bicycle crash rate: number of bicycle crashes per 100 million bicycle miles traveled

Pedestrian crash rate: number of pedestrian crashes per 100 million pedestrian miles traveled

Requires statewide pedestrian and bicycle count program

INCREASED BIKING AND WALKING

Mode split: miles traveled by people walking, biking or driving

Requires statewide pedestrian and bicycle count program

The asset inventory/repository will support

In addition to supporting our future measures, the pedestrian and bicycle asset inventory and repository will support local agencies and ODOT in the following:

- Project prioritization
- Safe Routes to School routing
- First and last mile transit planning
- Trip planning/improved routing recommendations
- Systemic pedestrian and bicycle safety analyses

The count data program will support

In addition to supporting our future measures, the pedestrian and bicycle count program will inform:

- Evaluation of non-motorized trends over time
- Context for pedestrian and bicycle improvements
- Prioritization of improvements
- Evaluation of project impact
- Design decisions
- Systemic crash analyses
- Public health benefits of active transportation
- Reporting for federal regulations and state requirements

Oregon Department of Transportation

Pedestrian and Bicycle Count Program

What ODOT is doing today

There are approximately 91 permanent pedestrian and bicycle counters across Oregon, owned and operated by different agencies. Traffic counts also often collect pedestrian and bicycle counts for short durations. So far, there has not been an initiative to evaluate where, when, and how many counters are needed to provide a comprehensive understanding of pedestrian and bicycle trips across the state.

Bicycle and pedestrian activity is not yet incorporated into existing travel demand models. Existing analysis tools do not allow for an understanding of system use or for measuring the impacts of infrastructure projects.

Looking to the future

The new count program will provide data to model trips and volumes, helping inform volumes on each segment of roadway and overall miles traveled by people walking and biking in Oregon. The count program can then provide input into a model that determines overall miles traveled by people walking and biking in Oregon. Over time, these data will shed light on trends for miles traveled on foot and by bike.

The program will collect counts at representative locations across the state, considering the pedestrian or bicycle facilities available, the land use characteristics, and the roadway characteristics.

The Non-Motorized Data Management Strategy (Appendix B) supplies a framework for pedestrian and bicycle count data collection. This data will ultimately feed into ongoing efforts being conducted by ODOT Research to estimate pedestrian and bicycle travel demand across the state.

General steps for establishing the count program:

1. Identify locations for permanent continuous counters or index sites on ODOT roadways
2. Identify and fill permanent counter factor group, or characteristic, gaps
3. Establish short-duration counters and extrapolate index site count characteristics to estimate annual volumes for the short-duration count locations
4. Work with local agencies to establish counters on the local network
5. Establish a model and use roadway and land use characteristics to data to estimate volumes across the network

Statewide Facility Repository and Inventory

What ODOT is doing today

Although ODOT tracks their assets, tracking biking and walking asset data statewide across all jurisdictions that provide transportation infrastructure is not possible today, as many jurisdictions do not collect walking and biking facility inventories and those that do have different methods of tracking and storing data. The type of data tracked and how frequently it is updated also varies by jurisdiction.

Looking to the future

To prepare for tracking the pedestrian and bicycle performance measures, ODOT will need to decide on a tracking system. This tracking system may use an external source, like Open Streets Map, or may be tracked internally using existing systems like TransInfo, TransGIS, or ArcGIS Online. The method of collecting data from local jurisdictions will depend on the tracking system.

Once initial data are assembled, ODOT will need to work with partners to create a regular, consistent reporting system and determine how often to track the measures. It is unlikely all local jurisdictions will be able to collect and submit updates annually, so the measure may need to be tracked every three to five years instead of annually.

Steps toward creating the repository/inventory

1. Identify the statewide tracking system that will be used to accept and house statewide data from different agencies. This may require creating a statewide Linear Referencing System.
2. Create standard protocol for how facility attributes should be reported by the local agencies that is consistent with the tracking system.
3. Create a system for local agencies to regularly update the attributes of the street network or to submit their progress in the standardized format.
4. Create standards for acceptable facilities to count toward the measure.
5. Identify the priority focus areas for which to measure network completeness.
6. Calculate the baseline performance.
7. Engage local agencies to collect and report inventory regularly. Implementation may be phased to incorporate MPO data first, then expand to other jurisdictions.

The Non-Motorized Data Management Strategy (Appendix B) explores opportunities for statewide data management and storage systems and provides resources for standard data reporting protocols.

Why look at walkways and bikeways ODOT doesn't own?

It is important to establish how facilities owned by cities, counties, and other jurisdictions work together. An ODOT highway may stand between a key community walking and biking route, but without understanding the full network, ODOT will not know to prioritize that segment. Similarly, a safe, accessible city- or county-owned trail may fill a gap in the ODOT network, but without having a full understanding of other jurisdiction's facilities, this segment may seem like a gap in the walking and biking networks.

MORE RESOURCES

Appendix A: Methodology Memorandum

Questions this Appendix Answers:

- What are the details and considerations for each measure?
- What is the detailed methodolgy for calculating each measure?
- What are the targets and who is responsible for calculating each measure?

Appendix B: Non-Motorized Data Management Strategy

Questions this Appendix Answers:

- What are the data needs to support future measures?
- What are the steps necessary for establishing those data?

Appendix A:

Methodology Memorandum

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PEDESTRIAN AND BICYCLE PERFORMANCE MEASURES METHODOLOGY REPORT

Date:	August 31, 2021	Project #: 23021.008
To:	Jessica Horning, Susan Peithman, Josh Roll, and Phil Kase, ODOT	
From:	Susan Wright, PE, Camilla Dartnell, and Bincy Koshy, Kittelson & Associates, Inc.	
Project:	Pedestrian and Bicycle Performance Measures and Data Implementation Framework	
Subject:	Performance Measures Methodology Report	

OVERVIEW

This memorandum serves as a methodology report that will help implement the pedestrian and bicycle Key Performance Measures (KPM) and programmatic performance measures recommended through this planning process for the Oregon Department of Transportation (ODOT). The memorandum first provides the full list of measures, then provides a methodology summary for each near-term measure. This methodology summary includes a description of the measure, data sources, targets, baseline performance, and implementation logistics for each near-term measure. Appendices with the step-by-step methodologies for each KPM supplement the methodologies.

In This Memo:

- Detailed methodologies for near-term measures
- Baseline performance and targets for near-term measures
- General methodologies, data sources, and considerations for future measures

Finally, the document provides the general considerations, methodologies, and data sources for each future measure. The future measures will require significant data collection and resources for future implementation. The Non-Motorized Data Management Strategy, which will follow this memorandum, will identify how to obtain data needed to calculate those measures.

RECOMMENDED PERFORMANCE MEASURES

The near-term and future recommended performance measures are provided in Table 1 and organized by outcome.

Table 1: Recommended Performance Measures

Outcome	Near-Term Performance Measure	Future Performance Measure
Increased Access	***Bikeways and walkways**: percent of ODOT priority pedestrian and bicycle corridors with walking and bicycling facilities in fair or better condition	**Bikeways and walkways:** percent of statewide pedestrian and bicycle priority areas with low stress walkways and bikeways
	***Crosswalk spacing**: percent of priority pedestrian and bicycle corridors meeting target crossing spacing	***Crosswalk spacing**: percent of statewide pedestrian and bicycle priority areas meeting target crossing spacing
Improved Safety	**Perceived walking safety:** percent of people who feel safe walking to meet daily transportation needs	**Pedestrian crash rate**: number of pedestrian crashes per 100 million pedestrian miles traveled
	Perceived biking safety: percent of people who feel safe biking to meet daily transportation needs	**Bicycle crash rate**: number of bicycle crashes per 100 million bicycle miles traveled
Increased Walking and Biking	**Mode split**: percent of people commuting by modes other than single occupancy vehicle	**Miles traveled:** miles traveled by people walking, biking or driving

*Key Performance Measure

EXISTING PERFORMANCE MEASURES

In addition to the current Key Performance Measure, which is recommended to be replaced by the near-term access measures outlined in Table 1, there are several other existing measures focused on pedestrians and bicyclists.

ORS 366.514 Pedestrian and Bicycle Expenditures, "The Bike Bill"

The Oregon Bike Bill (ORS 366.514) established that in any given fiscal year, recipients of state highway funds must spend a minimum of 1% of those funds to provide walkways and bikeways. ODOT's current Strategic Action Plan also specifies that by the end of 2023, ODOT must increase the percentage of agency

funding dedicated to projects and programs that improve equitable access to walking, biking, and transit. To support these initiatives, ODOT must track their spending on walking, biking, and transit related projects and programs. The current methodology for calculating and tracking these items is provided in Attachment C. The current methodology has been audited and approved by the Oregon Department of Justice (DOJ) but could benefit from revisions to better account for the full cost of designing and constructing pedestrian/bicycle improvements and reduce the amount of manual labor needed to generate expenditure estimates. These methodology improvements will be pursued as a separate effort in coordination with ODOT Funding and Program Services and DOJ in the 2021-23 biennium.

ADA Compliance

ODOT's ADA Program tracks and reports on the number of curb ramps, push buttons, and other accessibility improvements on state highways. Per ODOT's settlement agreement with the Association for Oregon Centers for Independent Living (AOCIL), the target date for ODOT to make all curb ramps on the state system ADA compliant is 2032. ADA Program annual reports are available at: https://www.oregon.gov/ODOT/About/Pages/ADA.aspx

FHWA Multimodal Performance Measures

Additionally, there are a number of performance measures required to be reported to Federal Highway Administration (FWHA). Federally required performance measures are defined in rules approved by the United States Department of Transportation (USDOT). The Moving Ahead for Progress in the 21st Century Act (MAP-21) passed in 2012 required state transportation agencies to demonstrate the use of asset management principles and strategies in the statewide transportation planning process. The FAST Act was passed in 2015 and amended provisions for state transportation agencies to incorporate performance goals, measures, and targets into the process of statewide transportation planning, identification of transportation improvements, and project selection.

FHWA performance areas and measures are contained in the Oregon Highway Plan (OHP) Appendix 1 (https://www.oregon.gov/ODOT/Planning/Documents/OHP-Appendix-I-Amendment.pdf). Measures related to active transportation include:

- **Percent non-SOV travel (2- and 4- year average)** – Within Oregon, this measure only applies to the Portland Metro region. The measure is based on American Community Survey Journey to Work dataset. Metro develops the target for this measure and recommended a growth rate of .2% in non single occupancy vehicle mode split per year for the region and as part of the statewide performance target.
- **Total emissions reduction (2-and 4-year cumulative reported emission reductions for all projects funded by CMAQ funds)** – The Oregon Highway Plan addresses FHWA performance management requirements for CMAQ. Total emissions reduction baseline is calculated as the sum of emissions reductions from all projects funded with CMAQ dollars over the period of 2014 through 2017. 4-year target values reflect estimated emissions benefits for projects that are currently programmed in the STIP for 2018- 2021. Two-year target values are set as one-half of

the 4-year target. Baseline data only includes Portland Metro region; however, Salem and Eugene are now also eligible for CMAQ funds.

- **Non-motorized fatalities and serious injuries (5-year average) –** Targets and performance areas addressing safety are contained in the Oregon Transportation Safety Action Plan. Performance is reported annually by Transportation Safety Division in the Oregon Traffic Safety Performance Plan which serves as Oregon's annual application for federal NHTSA Highway Safety grant funds. This document is approved by the Oregon Transportation Safety Committee, endorsed by the Governor's Advisory Committees. These measures were reviewed January 2019 as part of the 2020 planning process. Annual safety performance plans and reports are available at: https://www.oregon.gov/odot/Safety/Pages/Plans-Reports.aspx Near-Term Measures Methodology and Baseline Performance

Kittelson & Associates, Inc. (Kittelson) developed methodology summary sheets for each near-term performance measure. The near-term performance measure sheets provide information that will help calculate the measure. Table 2 summarizes the information contained in the methodology summary sheets for each performance measure.

Table 2. Methodology Summary Sheet Elements

Element	Description
Associated Outcome	Outcome that the measure will support
Overview	Description, challenges, and rationale for the measure
Data Sources and Proposed Data Location	Data necessary for the calculation of measure, data storage software/locations, and sharing mechanisms with other entities
Roles and Responsibility for Calculation	Entity in charge of calculating and reporting the measure
Reporting Frequency (Near-term measures only)	How often the measure should be reported
Methodology	Process of obtaining, analyzing, and calculating data
Baseline Performance Calculation (Near-term measures only)	Calculation of measures under baseline conditions
Short-Term Target (Near-term measures only)	Current targets for the measure
Long-Term Target (Near-term measures only)	Future targets for the measure
Additional Information	Further details and considerations

Near-Term Performance Measures Methodology Summary Sheets

Key Performance Measure: Bikeways and Walkways: Percent of ODOT Priority Pedestrian and Bicycle Corridors with Walking and Bicycling Facilities in Fair or Better Condition

Overview: This is an output measure that will track ODOT's progress in providing walking and biking facilities in priority locations. Providing infrastructure to support walking and biking is necessary to enabling people to use these modes. The agency can directly impact progress through investment decisions and infrastructure improvements, making this an *output* measure. The focus on priority corridors is an improvement to the current Key Performance Measure, which focuses on all ODOT roadways in urban areas, as it more directly tracks investment in meaningful areas like locations near destinations, transit, and with higher concentrations of transportation disadvantaged populations. It also removes challenges associated with the current Key Performance Measure, as increases in urban areas and jurisdictional transfers will not negatively impact the measure result.

Outcome: Increased Access		***Roles and Responsibilities for Calculation***
Data Sources and Proposed Data Location	Priority pedestrian and bicycle corridors in GIS; pedestrian and bicycle facility data in GIS, proposed to be saved to the following folder: \\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM	In the near-term, the ODOT Pedestrian and Bicycle Program and ODOT GIS Unit will retain the priority corridors and GIS toolbox script, and the Public Transportation Network Coordinator (Sarah Hackett) will have responsibility for coordinating the annual reporting. The pedestrian and bicycle facility data should be updated as close to the beginning of the year as feasible and attempt to represent as close to January 1 conditions as possible. The Pedestrian and Bicycle Program Manager will coordinate with ODOT GIS to run the GIS tool to calculate the performance measures. They will then share this information with the liaison to the Continuous Improvement Advisory Committee (Phil Kase) to report as the Key Performance Measure each spring. Moving forward, TransInfo should incorporate the priority corridors as a new data attribute within TransInfo and manipulate the toolbox script as necessary to support annual reporting based directly on the TransInfo database. This transition can occur when TransInfo updates their pedestrian
Reporting Frequency	Annually, as data allows* *ongoing coordination needed with Traffic/Roadway unit to identify methodology and resources for annual updates to ODOT pedestrian and bicycle facility inventories. Current update cycle is 3-5 years.	
Baseline Performance	49% of 256 roadside miles (128 centerline miles) of priority corridors have walking and biking facilities in fair or better condition. Detailed results are provided in Appendix B.	

Short Term Target	Proposed: increase by 2% (approximately 5 roadside miles) each year	and bicycle KPM reporting process, which is anticipated to occur in the next 5 years.
Long-Term Target	Proposed: 90% of facilities in 20 years	

Methodology

1. Review and confirm priority corridors list. ODOT identified the initial list of priority corridors based on the average combined pedestrian and bicycle ATNI scores of tenth mile urban segments on each highway per county. This is the most refined level of detail that can quickly/easily be produced by ATNI data queries at this time. On highways that pass through multiple urban areas in one county, ODOT manually adjusted the mile point extents to clearly focus on the priority urban area(s). Priority corridors may need to be revisited and updated approximately every 10-15 years as land use conditions change and walkway/bikeway networks are built out. An update to the priority corridors may utilize non-infrastructure focused criteria from the most recent Statewide Active Transportation Needs Inventory update. If the priority corridors are updated, the Continuous Improvement Advisory Committee should be notified and the change should be noted in the final KPM report and graphs, as it will affect the performance tracking.
2. Gather all GIS data listed below and save to the following folder: \\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM

Data	Source
Highway Network	TransInfo Program Coordinator (Diana Mann) or ODOT FTP
Priority Corridors	Pedestrian and Bicycle Program Manager (Jessica Horning)
Sidewalks	TransInfo Program Coordinator (Diana Mann) or ODOT FTP
Bicycle Facilities	TransInfo Program Coordinator (Diana Mann) or ODOT FTP

3. Utilize the provided GIS toolbox script to generate an output table with the Key Performance Measure and supporting information. The steps for using the GIS toolbox script for this measure are discussed in detail in Appendix A. The general methodology processed by the GIS toolbox script includes the following steps:

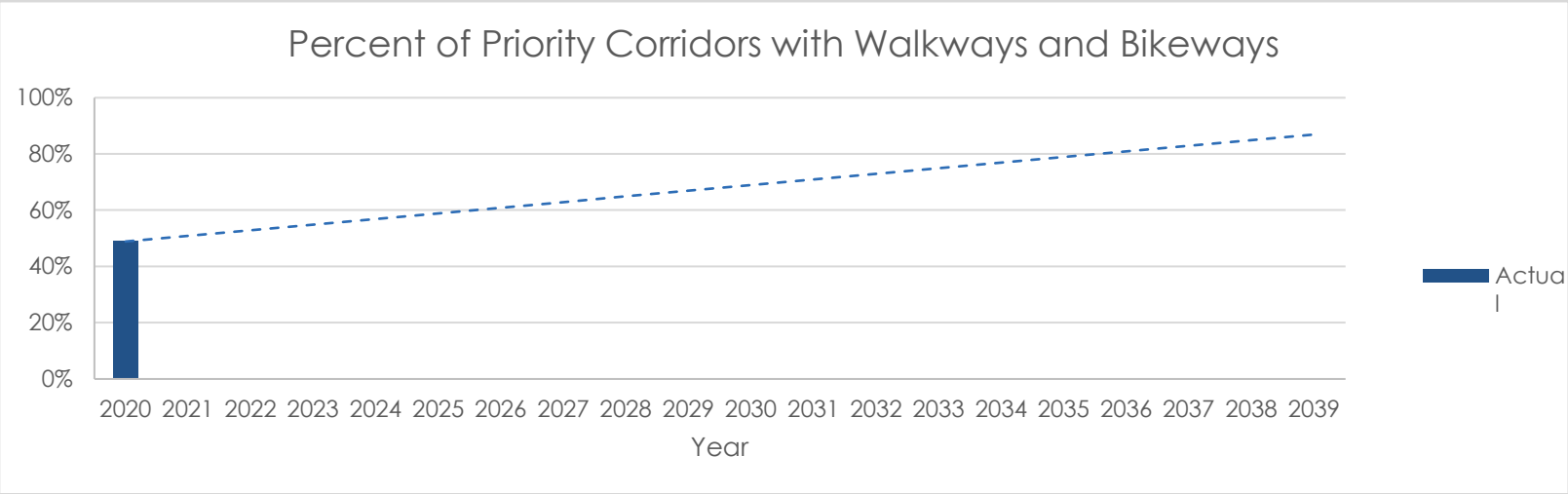
a. Establish spatial correlation between priority corridors and pedestrian and bicycle facilities by the unique linear referencing model (LRM) roadway identifier.
b. Identify pedestrian and bicycle facilities located on the high priority corridors and calculate roadway miles of pedestrian and bicycle facilities in fair or better condition, including bike lane, shared lane, shoulder bikeways, and sidewalk.
c. Summarize interim pedestrian and bicycle facility parameters on each priority corridor including: 1) the total roadside miles that should have pedestrian and bicycle facilities (target miles) 2) the percentage of roadside miles of existing pedestrian facilities, and 3) the percentage of roadside miles of existing bicycle facilities.
d. Calculate the KPM using the equation presented below.

$$\textit{Percent Pedestrian and Bicycle Priority Corridor (BPPC) with Sidewalk and Bike Facilities of Fair or Better} = \frac{(Roadside\ Miles\ with\ Sidewalks\ of\ Fair\ or\ Better\ on\ BPPC + Roadside\ Miles\ with\ Bicycle\ Facilities\ of\ Fair\ or\ Better\ Condition\ BPPC)}{(Target\ Roadside\ BPPC\ Miles\ for\ Sidewalks + Target\ Roadside\ BPPC\ Miles\ for\ Bicycle\ Facilities)}$$

4. Output the calculated measures in an excel table. Evaluate performance for trends, identify reasons for performance changes and strategies to improve performance and estimate amount of funding necessary to meet the targets. Write KPM narrative and submit to Performance Measures Manager (Phil Kase).

Additional Information	- The current measure focuses on whether a bicycle or pedestrian facility in at least fair condition exists. This provides an indication of whether ODOT has made investments for people walking and biking in this location and whether the facility has been maintained in an accessible state of good repair. While providing any facility is important, the measure does not consider who may be comfortable using the facility. Ultimately, this measure should track the percent of priority corridors that provide low stress access. This can be estimated through the level of traffic stress (LTS) rating system. LTS 1 and 2 facilities can be considered low stress and comfortable for most users. ODOT already has bicycle LTS data, but pedestrian LTS is not yet available. - Network reevaluations and jurisdictional transfers have the potential to remove highways from the priority corridors after these facilities have been upgraded to add pedestrian and bicycle facilities, discounting the progress made on these highways. Because roadways will likely need to be in good state of repair before a transfer takes place (or adequate funding has been identified for the local jurisdiction to bring the roadway to a state of good repair after the transfer), a priority corridor that is jurisdictionally transferred will be considered to have complete facilities on the priority corridor system. - Because ODOT will continue to make ped/bike investments on corridors outside of the priority corridors identified for the KPM, the agency should continue to calculate and report on completeness of walking and biking facilities on all urban ODOT highways

Visualization



Key Performance Measure: Crosswalk Spacing: Percent of Priority Pedestrian and Bicycle Corridors Meeting Target Crossing Spacing

Overview: This is an output measure that will track ODOT's progress in providing permeability across ODOT highways for people walking and biking in priority locations. Crossings are critical pieces of infrastructure that provide access to destinations, transit stops, and local walking/biking networks: critically important to improving safety outcomes and prevent highways from acting as barriers to people walking and biking. ODOT can directly impact progress tracked by the measure by improving pedestrian and bicycle crossings. The Blueprint for Urban Design provides target crossing spacing for different urban contexts. Those targets range from 250 ft – 1,500 ft. This measure evaluates the percentage of each priority corridor that is located within 750 ft of a marked crossing, as 750 ft falls within the target spacing for most contexts. Several contexts (traditional downtown/CBD and urban mix) have crossing spacing targets that are more stringent (lower than) 750 ft. The measure does not preclude or discourage closer crossing spacing than 750 ft but does attempt to set a target reasonable for all contexts. Adding this measure as a Key Performance Measure is an improvement to the current Key Performance Measure, as it highlights the importance of enabling safe walking/biking across as well as along state highways.

Outcome: Increased Access		***Roles and Responsibilities for Calculation***
Data Sources and Proposed Data Location	Crossing locations including point and line GIS data summarizing marked crossings with and without adjacent ADA ramps; priority pedestrian and bicycle corridors in GIS; proposed to be saved to the following folder: \\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM.	This measure should be calculated at the same time as the previously summarized KPM, and data location and calculation responsibilities are identical to the Bikeways and Walkways measure. The ODOT Pedestrian and Bicycle Program and ODOT GIS Unit will retain the priority corridors and GIS toolbox script, and the Pedestrian and Bicycle Program Manager (Jessica Horning) will have responsibility for coordinating the annual reporting. The pedestrian and bicycle crossing data should be updated as close to the beginning of the year as feasible and attempt to represent as close to January 1 conditions as possible. The Pedestrian and Bicycle Program Manager will coordinate with ODOT GIS to run the GIS tool to calculate the performance measures. They will then share this information with the liaison to the Continuous Improvement Advisory Committee (Phil Kase) to report as the Key Performance Measure each spring. Moving forward, TransInfo should incorporate the priority corridors and the crossings within TransInfo and manipulate the toolbox script as necessary to support annual
Reporting Frequency	Annually	
Baseline Performance	41.4% of priority corridors meet target crossing spacing of 750 ft. Detailed results are provided in Appendix B.	

Short Term Target	Proposed: 2% increase per year (approximately 10 crossings)	reporting based directly on the TransInfo database. This transition can occur when TransInfo updates their pedestrian and bicycle KPM reporting process, which is anticipated to occur in the next 5 years.
Long-Term Target	Proposed: 78% of facilities in 20 years	

Methodology

1. Gather all GIS data listed below and save to the following folder: \\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM. We recommend calculating the Bikeways and Walkways KPM simultaneously. The highway network and priority corridors should already be compiled for that calculation.

Data	Source
Highway Network	TransInfo Program Coordinator (Diana Mann) or ODOT FTP
Priority Corridors	Pedestrian and Bicycle Program Manager (Jessica Horning)
Marked Crosswalks (Line and Point Files)	Traffic Roadway (Eric Leaming)

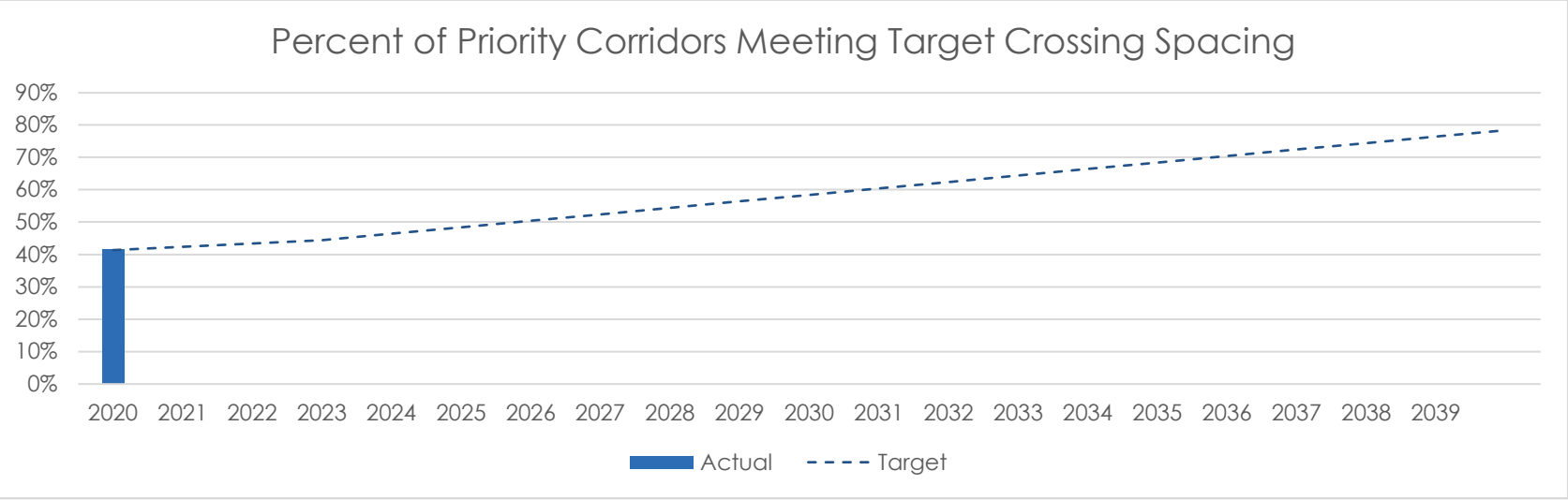
2. The ODOT Pedestrian and bicycle Program and ODOT GIS Program will retain the priority corridors, marked crossings data, and GIS toolbox script. The steps for establishing and using the GIS toolbox script for this measure are discussed in detail in Appendix A. The high-level methodology processed by the GIS toolbox script includes the following steps:
    a. Determine the marked crossings, including crossings with and without ADA ramps, along each high priority corridor and locate marked crossings on the ODOT LRM system.
    b. Create 375-foot buffer area around marked crossings (the buffer distance is a variable that is determined by user through the GIS toolbox). The buffer distance should be half of the target crossing spacing, as two crossings with adjacent 375-ft buffers will have 750-ft spacing between them.
    c. Establish which marked crossings serve the priority corridors by referencing the ODOT LRM keys and milepoints for both data sets.

d. Clip out the priority corridor segments that are covered by the marked crossing buffer area.
e. Calculate the KPM using the equation presented below.

$$\textit{Percent of Priority Pedestrian and Bicycle Corridors Meeting Target Crossing Spacing} = \frac{Centerline\ Miles\ Covered\ by\ Marked\ Crossing\ Buffer\ Area\ on\ BPPC}{Centerline\ BPPC\ Miles}$$

3. Evaluate performance for trends, identify reasons for performance changes and strategies to improve performance and estimate amount of funding necessary to meet the targets. Write KPM narrative and submit to Performance Measures Manager (PK).

Visualization



Perceived Walking and Biking Safety: Percent of People Who Feel Safe Walking and Biking to Meet Daily Transportation Needs

Overview: This is an outcome-focused measure that tracks the percent of people who feel safe walking and biking to meet their daily transportation needs. It also aims to evaluate and understand perceived safety in Oregon to help inform investments or changes would improve perceived safety, including non-infrastructure investments such as educational programs. The measure directly relates to Policy 1.4 of the Oregon Pedestrian and Bicycle Plan, which focuses on improving pedestrians' and bicycle users' perceived safety by supporting personal security. Perceived safety is an important factor when people choose their mode - if it feels safe to walk and bike, more people are likely to choose to walk and bike. ODOT can influence perceptions of safety through multiple agency decisions such as provisions of walking/biking facilities, adequate illumination, enhanced crossings, traffic calming, and separation from high speed and volume vehicle traffic, safety education efforts, facility design, operations, maintenance, and speed management.

Outcome: Increased Access		***Roles and Responsibilities for Calculation***
Data Sources and Proposed Data Location	Oregon Transportation Needs and Issues Survey (OTNIS) data; ODOT Research Section (Tony Knudson)	Several OTNIS questions need to be changed to be able to perform the baseline measure calculation. A Public Transportation/Active Transportation representative will need to coordinate these changes, and in October Tony Knudson will work with Susan Peithman to decide who that representative should be. The output of the first OTNIS survey with these changes will provide the baseline performance. In the future the ODOT Statistics and Research Coordinator (Tony Knudson) will be responsible for storing and summarizing the data through the typical OTNIS summary. The Pedestrian and Bicycle Program Manager (Jessica Horning) will be responsible for coordinating the tracking of
Reporting Frequency	Every OTNIS cycle, generally biannually	
Baseline Performance	The FY 2007-2021 OTNIS exclude people who indicate that they don't walk or bike. The surveys also do not provide insight into what makes participants feel unsafe or what influences their perception of safety. Due to these challenges, a baseline calculation could not be developed. The next round of surveys should take the above-described factors into considerations and will provide the data for the baseline calculation.	
Short Term Target	To be determined after baseline performance is calculated. The short-term target should be determined using the following equation:	

	Short-Term Target = (Long-Term Target - Baseline Calculation)/Number of Years	the measure after the OTNIS results are summarized every two years.
Long-Term Target	To be determined after baseline performance is established	

Methodology

1. Modify the OTNIS to include additional questions directly related to perceived safety of walking and biking by recommending language/wording for the OTNIS questions and answer choices for all people, not just those who classify themselves as pedestrians and bicyclists.
2. Following are recommended additional questions:
    a. How safe do you feel walking or using a mobility device (wheelchair, walker, etc.) in your community?
        i. Very Safe
        ii. Somewhat safe
        iii. Not very safe
        iv. Not at all safe
        v. N/A: Do not walk or use mobility device

    b. How safe do you feel riding a bicycle in your community?

        i. Very Safe
        ii. Somewhat safe
        iii. Not very safe
        iv. Not at all safe
        v. N/A: Do not ride bicycles

    c. What do you perceive as the top three biggest influences on your safety while walking in your community?
        i. Poor or no lighting
        ii. Motor vehicle traffic speeds
        iii. Poor or no sidewalks or pathways (cracks, narrow sidewalks, poles/signs blocking sidewalk)
        iv. Street harassment and discrimination (non-infrastructure issues)
        v. Conflicts with other non-motorized users (bikes/scooters on sidewalks)
        vi. Accessibility issues (challenges for the blind)
        vii. Proximity of sidewalks to traffic
        viii. Potential crime
        ix. Poor or no crossings

x. Other (describe: _____)

d. What do you perceive as the single biggest influence on your safety while biking in your community?

i. Poor or no lighting
ii. Motor vehicle traffic speeds
iii. Poor or no bicycle lanes or pathways (cracks, not enough clear space)
iv. Presence of large personal vehicle, freight vehicle
v. Street harassment and discrimination (non-infrastructure issues)
vi. Conflicts with other non-motorized users
vii. Accessibility issues (challenges for the blind)
viii. Mixed-use conflicts (bikes/scooters on sidewalks)
ix. Proximity of bike lanes to traffic
x. Biking near traffic
xi. Potential crime and perceived crime
xii. Dangerous crossings
xiii. Other (describe: _____)

3. Collect responses and assess survey data using graphs and charts. The percent of respondents that indicate they feel "very safe" and "somewhat safe" should be compared to all respondents other than those that indicate an "NA" answer to calculate the perceived safety.
4. Identify common influences on safety and potential actions to address

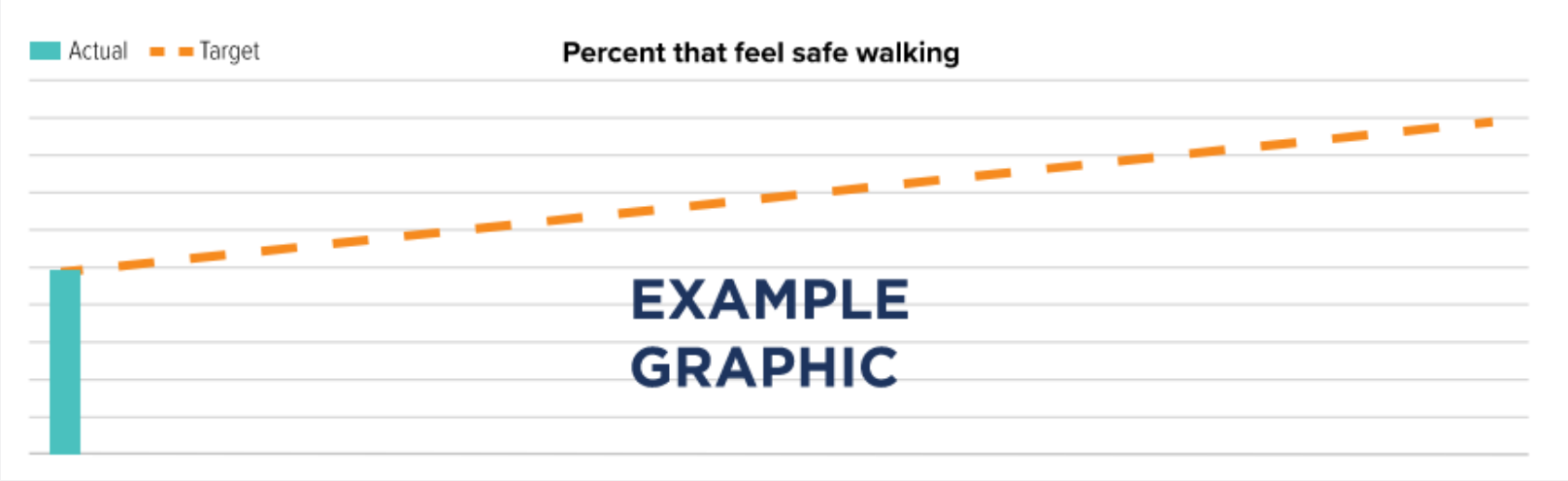
Track perceived safety over the years when OTNIS survey takes place to determine trends/improvement of perceived safety.

Additional Information	The measure will utilize the OTNIS, which is conducted to assess perceptions about the transportation system, determine how the system is used, and identify transportation-related concerns. The OTNIS is conducted by mail and web. Surveys may reach or have responses from some groups over others, potentially misrepresenting the full state. Reaching out to transportation-disadvantaged communities by carrying out additional outreach to these groups will be necessary to get a comprehensive, representative survey dataset. The questions related to perceived safety for walking and biking in the past Oregon Transportation Needs and Issues Surveys do not capture how safe people feel walking and biking if they indicate that they do not walk and/or bike on the system. Thus, it does not provide an indication of perceived safety for all people. Additionally, the survey also does not provide insight into what makes participants feel unsafe or what influences their perception of safety. Currently, the survey targets 350 responses for each ODOT region of the state. ODOT Region 1 contains the greatest overall population and the greatest population of minorities. The current method of sampling can cause underrepresentation of minority populations in the OTNIS responses.

To capture perceived safety of all people, including transportation-disadvantaged communities at a representative rate, the team recommends that those conducting the OTNIS change the target sample sizes from 350 per region to be representative of the relative population of each region. The percent of target responses for minority populations should also be at least that of their overall representation in that region. If there have historically been lower response rates from minority populations, the team recommends sampling based on the anticipated response rates for each population. Minority populations including Asian, American Indian and Alaskan Native, Black, LatinX, Native Hawaiian and other Pacific Islander and other ethnicities and races make up about 20% of Oregon's total population and 25% of ODOT Region 1's total population.

According to OTNIS results 2019, around 64% of all people indicated that they have necessary sidewalks/crossings to walk safely and around 48% indicated that the sidewalks are free of obstructions and adequate for disabled individuals. Around 45% of respondents indicated that there are necessary bike lanes and signage to bike safely. The question formatting does not provide options about varying degrees of safety and thus it can only be assumed that it roughly translates to an average of 64% feeling "very safe" or "somewhat safe" to walk while around 45% of people feel "very safe" or "somewhat safe" to bike.

Example Visualization: to be updated when data is available



Mode Split: Percent of People Commuting by Modes Other Than Single Occupancy Vehicle

Overview:	This measure tracks the desired outcome of many initiatives: reducing the percentage of people who drive alone, and is therefore an outcome-based measure. Reducing single occupancy vehicle trips is essential to achieve GHG reduction targets identified in the Statewide Transportation Strategy and to supporting other ODOT policy goals. This measure will focus on all non-single occupancy vehicles (SOV) modes in aggregate rather than walking and biking as standalone modes to reflect the shared goal of decreasing SOV, which is also relevant to multiple ODOT programs. ODOT can therefore impact performance by making it easier, safer, and more convenient to take modes other than driving alone, including by providing comfortable, direct facilities for people walking and biking. This measure tracks mode split statewide as well as specifically in urban areas, as there may be greater opportunity for people to travel using modes other than single occupancy vehicle when there is a greater density of destinations.

Outcome: Increased Walking and Biking		***Roles and Responsibility for Calculation***
Data Sources and Proposed Data Storage	The American Community Survey (ACS) is a nationwide annual survey that tracks commute mode split. Although there is a desire to track the mode split for all trips, not just commute trips, data is not readily available for this purpose. Ultimately, the team recommends modifying the OTNIS survey to obtain regular data on mode split for all trips. OTNIS data should be maintained and stored by ODOT's research section.	The Pedestrian and Bicycle Program Manager (Jessica Horning) will be responsible for delegating the measure calculation, which may be performed by an intern or the Transportation Planning and Analysis Unit.
Reporting Frequency	ACS data will be used in the near-term as it is readily available. As ACS data is available for every year and the sample size is large, this measure will be calculated and reported annually through ACS 1-year estimates. OTNIS data is proposed to be used in the long-term to calculate this measure and will be summarized with the other OTNIS data in the regular report by Tony Knudson. The measure will be tracked bi-annually, as the OTNIS is conducted every two years.	
Targets	Not Applicable: Statewide mode split targets are not being established by this effort.	

Methodology

1. On data.census.gov, open table S0802: Means of Transportation to Work By Selected Characteristics.
2. Select the ACS 5-year estimate subject table for the most recent year of data.
3. In *Geography*, select *Show Summary Levels,* then select *Oregon- Urban Areas.*
4. Download the data table.
5. Collect responses and assess survey data using graphs and charts. The percent of respondents that indicate their trips are "drive alone" trips should be compared to all respondents to calculate percent of commuting-trips to work by modes other than single occupancy vehicle.

$$\text{Percent of commuting-trips to work by modes other than single occupancy vehicle} = \frac{\text{All responses} - \text{Number of respondents that indicate they "drive alone"}}{\text{Total number of respondents}}$$

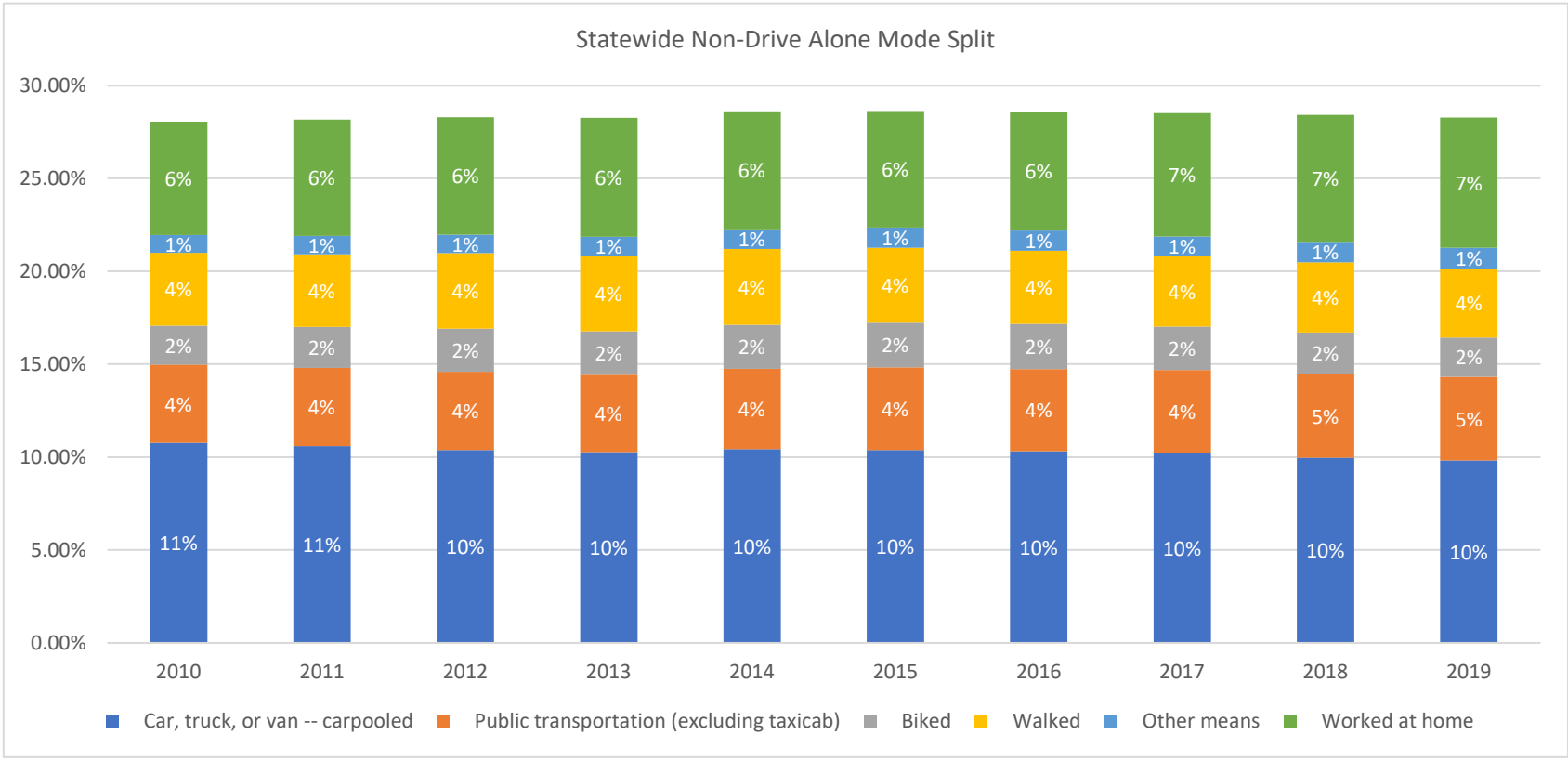
6. Modify the OTNIS to gain insight about non-commute trips. Add the following question and answer choices, then

In a typical week, indicate the number of times that you used each mode to meet your daily transportation needs.

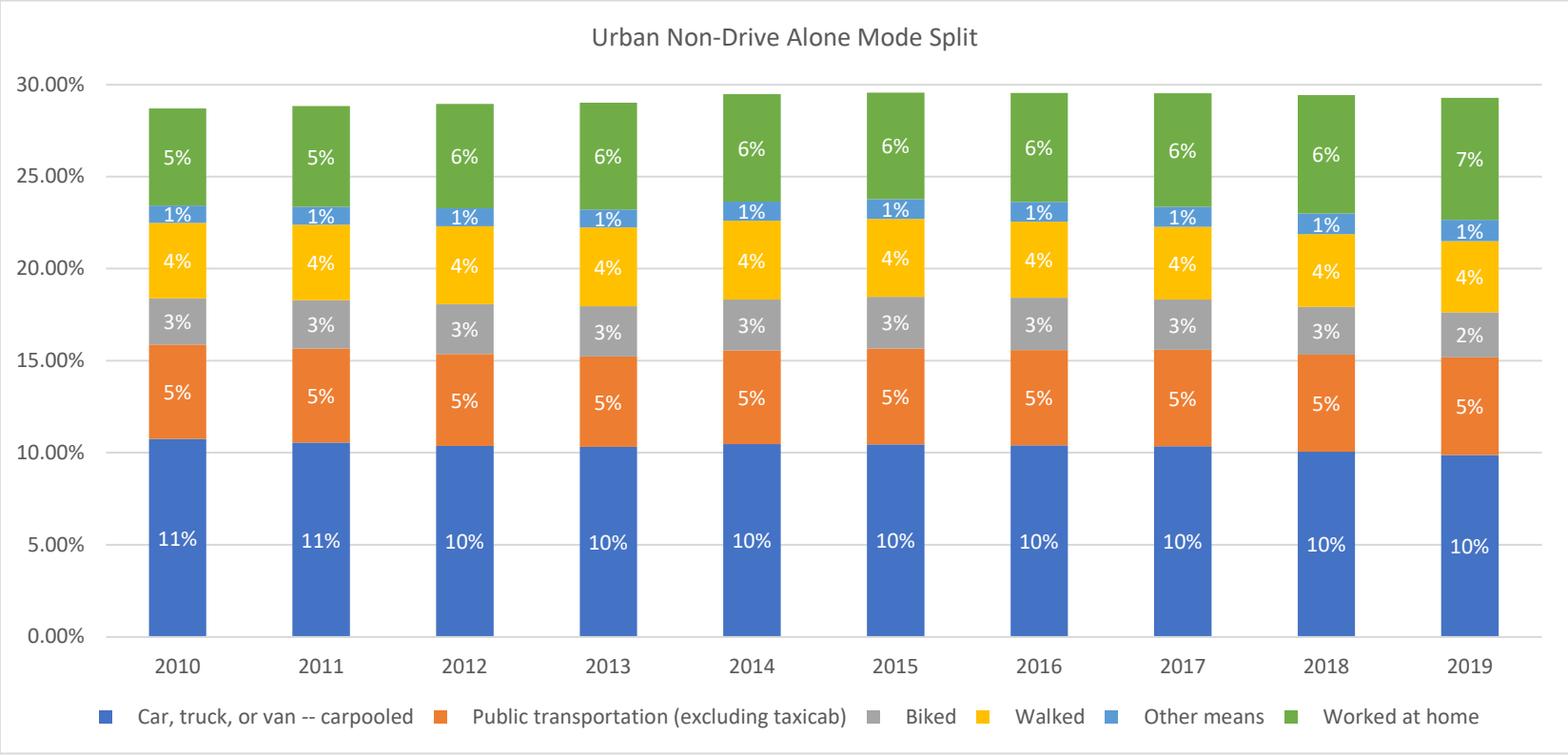
   a. Driving alone in your personal vehicle _____
   b. Driving with others in your household_____
   c. Sharing a ride with people not from your household (example: carpool or vanpool): _____
   d. Using a ride hailing app or carsharing service, such as Uber or Lyft, Flex car, Zipcar, Car2Go, etc.)
   e. Taking transit or a bus other than a school bus _____
   f. Walking for non-recreational purposes such as to work, school, shopping, errands, etc._____
   g. Biking for non-recreational purposes such as to work, school, shopping, errands, etc._____
   h. Scooters/ other non-SOV modes _____
   i. Other _____
7. Track mode split by trip purpose over the years when OTNIS survey takes place to determine trends/improvement of mode split.

Baseline Performance

1. ACS (5-Year Estimates) data trends indicate that statewide, 28.28% of Oregonians commuted to work using modes other than driving alone in 2019.



2. ACS (5-Year Estimates) data trends indicate that in urban areas, 29.29% of Oregonians commuted to work using modes other than driving alone in 2019.



Additional Information	Although 1-year estimates are available for the general statewide mode splits, they are not available for the Urban Areas specific data. Tracking 5-year estimates may take longer to portray trends over time but have less error, which is important when reporting small percentages. Tracking mode split only for work-related trips is problematic due to work trips only representing about 20% of all trips and prioritizing trips made only by certain segments of the population. It is desirable to begin tracking mode split for all trips through the OTNIS as soon as possible to support ODOT's Social Equity initiatives. Identifying the percentage of people who use non-auto modes "often" or "occassionally" may be preferable to identifying the percentage of people who use non-auto modes as their primary mode of transportation in order to help socially normalize these modes.

FUTURE MEASURES METHODOLOGY

Future performance measures were identified by the project team, stakeholders, and the Technical Advisory Committee as meaningful, valuable, and in alignment with the identified desired outcomes, but data are not available to calculate these measures currently. The future performance measure methodology summary sheets are designed to provide a general overview of potential data sources, description of the measure, and high-level methodology. The Non-Motorized Data Management Strategy, which will follow this memorandum, will identify how to obtain data needed to calculate those measures. The future measures include the following:

- **Bikeways and walkways**: percent of statewide pedestrian and bicycle priority areas with pedestrian and bicycle facilities (includes ODOT and non-ODOT systems)
- **Crosswalk spacing**: percent of statewide priority pedestrian and bicycle areas meeting target crossing spacing (includes ODOT and non-ODOT systems)
- **Miles traveled**: miles traveled by people walking, biking or driving
- **Bicycle crash rate**: number of bicycle crashes per 100 million bicycle miles traveled
- **Pedestrian crash rate**: number of pedestrian crashes per 100 million pedestrian miles traveled

Bikeways and Walkways: Percent of Statewide Pedestrian and Bicycle Priority Areas with Low Stress Walkways and Bikeways & **Crosswalk Spacing*:*** Percent of Statewide Priority Pedestrian and Bicycle Areas Meeting Target Crossing Spacing

Outcome: Increased Access

Overview:	Although ODOT has the most direct control over walking and biking access along and across state highways, achieving the desired end outcomes of increasing walking and biking access and usage for all Oregonians will require facilities for people walking and biking on roads regardless of jurisdiction. This measure will identify high priority areas for walking and biking facilities and track the percent of those roadways with walking and biking facilities as an output measure. Tracking data statewide is not possible at this time, as many jurisdictions do not collect walking and biking facility inventories and each jurisdiction that does collect this information has different methods of tracking and storing data. The type of data tracked and frequency with which that data is updated may also vary by jurisdiction. To prepare for tracking this measure, ODOT will need to decide a tracking system. This tracking system may utilize an external source, like Open Streets Map, or may be tracked internally using existing systems like TransInfo, TransGIS, or ArcGIS Online. The method of collecting data from local jurisdictions will be dependent on the tracking system. Once initial data is assembled, ODOT will need to work with partners to create a system of regular, consistent reporting, and determine how often to track the measure. Initially, it is unlikely that all local jurisdictions will be able to collect and submit their updates annually, so the measure may need to be tracked every 3-5 years instead of on an annual basis.

High-Level Methodology

The steps for establishing this measure will require creating the systems to support the measure. Those steps include the following:

1. Establish base network and referencing system
2. Determine data needs and formatting
3. Establish priority facilities
4. Inventory facilities/receive data from local agencies
5. Apply data to the base network
6. Evaluate level of traffic stress
7. Update data on a regular basis

Next Steps

The Non-Motorized Data Management Strategy will explore opportunities for statewide data management and storage systems and provide resources for standard data reporting protocols.

Miles Traveled: Miles Traveled by People Walking and Biking

Outcome: Increased Walking and Biking

Overview:	This outcome-based measure will track the miles traveled by walking and biking. This measure will rely on the creation of a pedestrian and bicycle count program, which will provide an input into a model to determine the overall miles traveled for people walking and biking. Over time, aggregations of the data will show the trends for miles traveled by walking and biking for each characteristic grouping.

High-Level Methodology

1. This measure is based on the successful implementation of a count program to collect pedestrian and bicycle volumes across the state.
2. Collect counts in representative locations across the state, considering the pedestrian or bicycle facilities available, the land use characteristics, and the roadway characteristics.
3. Create a model, which may be based on the data fusion work being done by Josh Roll in ODOT Research, to estimate volumes on each facility based on the characteristics of the facility in comparison to the characteristics of each location for which counts are available.
4. Use location-based services data to estimate the trip length for each trip, and apply to the counts to determine overall estimated pedestrian and bicycle miles traveled.

Next Steps

The Non-Motorized Data Management Strategy will provide a framework for pedestrian and bicycle count data collection. This data will ultimately feed into ongoing efforts being conducted by ODOT Research to estimate pedestrian and bicycle demand across the state.

Crash Rate: Number of Bicycle Crashes per 100 Million Bicycle Miles Traveled and Number of Pedestrian Crashes per 100 Million Pedestrian Miles Traveled

Outcome: Increased Safety

Overview:	Crash rates provide an indication of the number of crashes in relation to the total amount of activity on the system. Tracking crash rates allows for determination of relative safety for each individual mode and as a comparison across modes. This performance measure is dependent upon the successful implementation of a pedestrian and bicycle traffic monitoring program and development of measures pedestrian miles traveled and bicycle miles traveled. This measure will be applied to all state highways.

High-Level Methodology

This measure will take the pedestrian and bicycle miles traveled from the previously outlined measure as a basis for pedestrian and bicycle exposure. Crash data can then be compared with estimated pedestrian and bicycle miles traveled for each segment to determine the segment crash rate.

Next Steps and Additional Information

The Non-Motorized Data Management Strategy will come up with a framework for pedestrian and bicycle traffic monitoring including a likely structure of a traffic count data collection program. This data will ultimately feed into ongoing efforts being conducted by ODOT Research and other national efforts to estimate pedestrian and bicycle travel activity demand across the state.

This measure would be improved by changes to the bicycle and pedestrian crash reporting systems to better capture all crashes.

SUMMARY AND NEXT STEPS

Implementing the methodologies outlined within this report will allow ODOT to have a comprehensive understanding of what is happening across the ODOT highway network for those walking and biking by implementing the near-term measures. There are several key steps to take to implement these measures and support the existing measures fully including the following:

- For the existing Pedestrian and Bicycle Expenditures ("Bike Bill 1% Reporting"), ODOT should revise the methodology to better account for the full cost of designing and constructing pedestrian/bicycle improvements and reduce the amount of manual labor needed to generate expenditure estimates. These methodology improvements will be pursued as a separate effort in coordination with ODOT Funding and Program Services and DOJ in the 2021-23 biennium.
- For the Key Performance Measures:
    - Ongoing coordination is needed with the Traffic/Roadway unit to identify methodology and resources for annual updates to ODOT pedestrian and bicycle facility inventories , as the current update cycle is 3-5 years.
    - TransInfo should incorporate the priority corridors as a new data attribute within TransInfo and manipulate the toolbox script as necessary to support annual reporting based directly on the TransInfo database.
    - ODOT should develop a pedestrian LTS methodology and incorporate pedestrian and bicycle LTS into the toolbox scripts to be able to track the percent of statewide pedestrian and bicycle priority areas with low stress facilities.
- To support the improved safety and increased walking and biking measures, several OTNIS questions need to be changed. In October 2021, Tony Knudson should reach out to Susan Peithman to decide which Public Transportation/Active Transportation representative will should coordinate those changes. The recommended changes are documented in this memorandum.

While this document and the above bullets focus on the implementation of the near-term measures, the Non-Motorized Data Management Strategy provides recommendations to support the implementation of the future measures.

Attachment A: Near-Term Pedestrian and Bicycle Access Key Performance Measures Methodology

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NEAR-TERM BICYCLE/PEDESTRIAN ACCESS KEY PERFORMANCE MEASURES DETAILED METHODOLOGIES

Date:	September 10, 2021	Project #: 23021.008
To:	Jessica Horning, Susan Peithman, Josh Roll, and Phil Kase, ODOT	
From:	Susan Wright, PE, Camilla Dartnell, and Bincy Koshy, Kittelson & Associates, Inc.	
Project:	Pedestrian and Bicycle Performance Measures and Data Implementation Framework	
Subject:	Performance Measures Methodology Report Appendix A: Detailed KPM Methodologies	

This appendix provides the detailed methodology for calculating and reporting the near-term bicycle/pedestrian access key performance measures (KPMs) using provided toolboxes and scripts. The methodology is outlined through four primary steps, to be completed in order:

Until the pedestrian and bicycle priority corridor designations are added to TransInfo, it is assumed that ODOT's GIS Unit will run these calculations and share the final spreadsheet output with the Pedestrian and Bicycle Program Manager. When the priority corridors are added to TransInfo, the TransInfo Unit can add the Key Performance Measure into their regular reporting process by updating their script to take the same steps as those in these toolboxes, explained below. This four-step process will be completed every year as part of the state's annual KPM reporting.

All data is assumed to be provided through TransGIS, from the TransInfo group, and/or from the Pedestrian and Bicycle Program.

1 SET UP TASKS PRIOR TO CALCULATING AND REPORTING BICYCLE/PEDESTRIAN ACCESS KEY PERFORMANCE MEASURES

To be able to run the calculation and report toolboxes, the following steps must be completed first.

1.1 REQUEST THE LATEST INPUT DATA FROM TRANSINFO

Input shapefile data from ODOT's inventory database must include:

- hwynet.shp: this data displays statewide highway network that includes all state-owned highways, connections and frontage roads.
- bicycle_facilities.shp: this data identifies locations of bike facilities in Oregon, which was taken from the Integrated Transportation Information System.
- sidewalks.shp: this data identifies locations of sidewalks.
- marked_crosswalks_line.shp: this data is a polyline dataset that identifies locations of marked crossings by connecting the ADA crossings. marked_crosswalks_point.shp: this data is a point dataset that identifies locations of marked crosswalks.

1.2 VERIFY ARCGIS VERSION AND SAVE SITE PACKAGES TO ARCGIS FOLDER LOCATION

The toolboxes must be run on a computer running on the Windows system with ArcMap 10.5 or higher. Before running the calculation toolboxes, please copy the following files or folders to C:\Python27***ArcGIS10.x***\Lib\site-packages. [1]

- ex_xmlfile
- et_xmlfile-1.0.1.dist-info
- jdcal-1.4.1.dist-info
- openpyxl
- openpyxl-2.6.4.dist-info
- jdcal.py
- jdcal.pyc

[1] The folder path depends on the ArcMap version on the computer. If the toolboxes will be run with ArcMap 10.5, the folder path will be C:\Python27\ArcGIS10.5\Lib\site-packages. Site-packages is the target directory of manually built Python packages as well as the location where Python installs its modules.

1.3 VERIFY THE PRIORITY CORRIDOR DATA IS UP-TO-DATE

Before running the calculation toolboxes, verify that the GIS Unit has the latest pedestrian and bicycle priority corridor data.

Until the pedestrian and bicycle priority corridor designations are added to TransGIS, ODOT's Pedestrian and Bicycle Program will maintain the pedestrian and bicycle priority corridor data. The priority corridor designations will not need to be updated frequently, but if the pedestrian and bicycle priority corridor data has been updated, request the latest shapefile from the Pedestrian and bicycle Program.

1.4 VERIFY THE TARGET MARKED CROSSING SPACING

Before running the marked crossing key performance measure calculation toolbox, verify the target marked crossing spacing with the Pedestrian and bicycle Program manager. This will eliminate the potential need to rerun the toolbox output if an incorrect value is used as an input.

1.5 SAVE DATA, TOOLBOX, SITE PACKAGES,SCRIPT FILES AND TEMPLATE FILE TO A KNOWN FOLDER LOCATION

This folder will become the hub for all tasks to complete the annual report. Suggested working directory: \\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM\YYYY. Files that will be utilized during the clean-up, calculation, and reporting steps include:

- Toolkit (**ODOT_Bike_Ped_KPMs.tbx**) with the toolbox files:
  - 1 Clean-up Priority Corridor
  - 2 Calculate Bikeway Walkway KPM
  - 3 Calculate Marked Crossing Spacing KPM
  - 4 Report
- Script files:
  - Cleanup_Priority_Corridor.py
  - BikewayWalkway.py
  - CrossingFreq.py
  - Excel_report_gemeratopm.py
- Site packages:
  - ex_xmlfile
  - et_xmlfile-1.0.1.dist-info
  - jdcal-1.4.1.dist-info
  - openpyxl
  - openpyxl-2.6.4.dist-info
  - jdcal.py
  - jdcal.pyc

- Input shapefiles:
    - prioritycorridors.shp
    - hwynet.shp
    - bicycle_facilities.shp
    - sidewalks.shp
    - marked_crosswalks_line.shp
    - marked_crosswalks_point.shp
- Input Excel template file:
    - Template.xlsx

1.6 CREATE AN "INPUT" GEODATABASE AND SAVE INPUT SHAPEFILES INTO GEODATABASE

Within the root folder, create an "input" geodatabase file that houses the input shapefiles listed above. It will help verify that all necessary elements are provided and up-to-date. It will also provide efficiency when selecting files, feature classes, and fields when running the toolboxes.

1.7 CREATE AN "OUTPUT" GEODATABASE

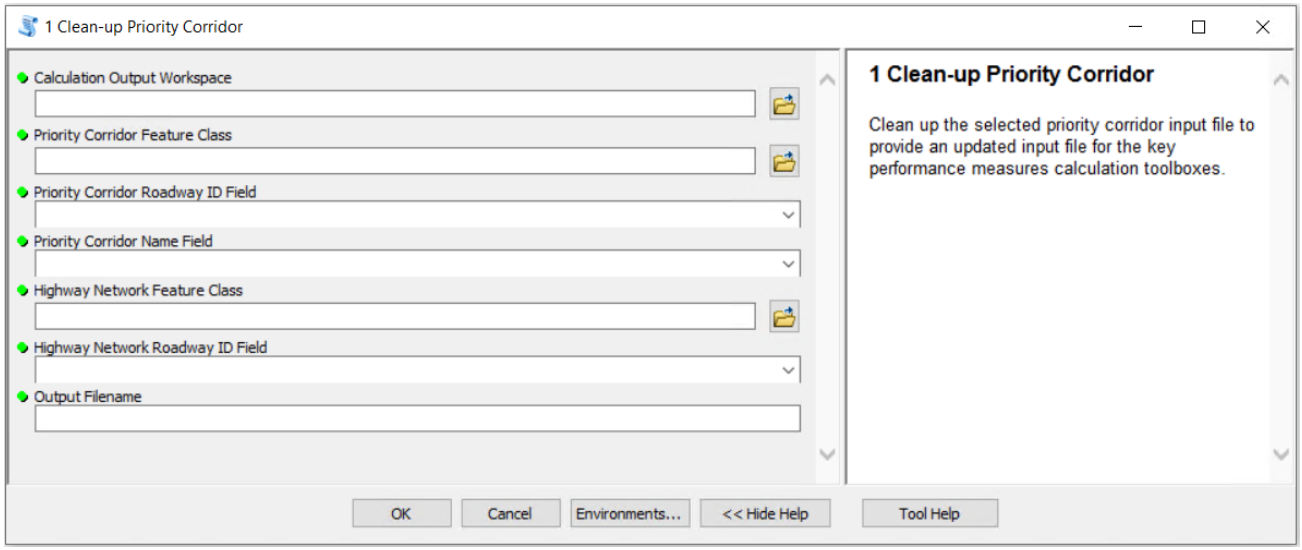
Within the root folder, create an "output" geodatabase file that will be populated from the clean-up and calculation toolboxes (1 Clean-up Priority Corridor, 2 Calculate Bikeway Walkway KPM, and 3 Calculate Marked Crossing Spacing KPM). All the output feature classes from step 1 to 3 will be stored in the "output" geodatabase. This geodatabase will then become the input for the toolbox reporting step (4 Report). Create a new "output" geodatabase each year that the KPM report is run through the GIS Unit to store and organize the output. Copy the "Template.xlsx" to the desired location for final output in Excel format.

1.8 RUN THE PRIORITY CORRIDOR CLEAN-UP TOOLBOX

1.8.1 Open "1 Clean-up Priority Corridor"

In the ArcGIS Catalog, navigate to the ODOT_Bike_Ped_KPMs.tbx toolkit and expand the list of toolboxes. Double-click on "1 Clean-up Priority Corridor". The dialogue box will look like the clip shown below.

Figure 1. Priority Corridor Clean-up Toolbox Dialogue Box



1.8.2 Fill in the elements of the toolbox

Further descriptions of the toolbox elements are provided below or can be seen on the right-hand side of the toolbox dialogue box.

Table 1. Priority Corridor Clean-up Toolbox Elements

Toolbox Element	Current Input / Recommended Naming Convention	Description
Calculation Output Workspace	Toolbox_Run_Output_MMDDYYYY.gdb*	Point the toolbox to the geodatabase file where all output from the clean-up and calculation toolboxes (1 Clean-up Priority Corridor, 2 Calculate Bikeway Walkway KPM, and 3 Calculate Marked Crossing Spacing KPM) will be saved. This geodatabase will then become the input for the reporting toolbox (4 Report).
Priority Corridor Feature Class	prioritycorridors_07012021	Point the toolbox to the priority corridor feature class within the input geodatabase. Only polyline feature classes are able to be selected. The priority corridors generated through the Pedestrian and Bicycle Performance Measures and Data Implementation Framework project will have the date 07012021, and the priority corridors are not anticipated to be updated often. If they are updated, the date associated with the file may be different than that listed here.
Priority Corridor Roadway ID Field	LRM	Select the field from the priority corridor feature class that is used for the LRM key. Only string fields are able to be selected.
Priority Corridor Roadway Name Field	PriorCorrN	Select the field from the priority corridor feature class that is used for the priority corridor name. Only string fields are able to be selected.
Highway Network Feature Class	hwynet	Point the toolbox to the highway network feature class within the input geodatabase. Only polyline feature classes are able to be selected.
Highway Network Roadway ID Field	LRM_KEY	Select the field from the highway network feature class that is used for the LRM key. Only string fields are able to be selected.
Output Filename	clean_prior_corr_MMDDYYYY*	Provide the output filename for the cleaned-up priority corridor shapefile, which will used in the calculation and report toolboxes.

* Recommended Naming Convention

1.8.3 Run the "Clean-up Priority Corridor" toolbox

The "01 Clean-up Priority Corridor" toolbox cleans up the selected priority corridor input file to provide an updated input file for the key performance measures calculation toolboxes. It should take less than one minute for the toolbox to run. After this, you are able to move on to the KPM calculation toolboxes using the new output shapefile.

2 CALCULATE THE BIKEWAY AND WALKWAY KEY PERFORMANCE MEASURE

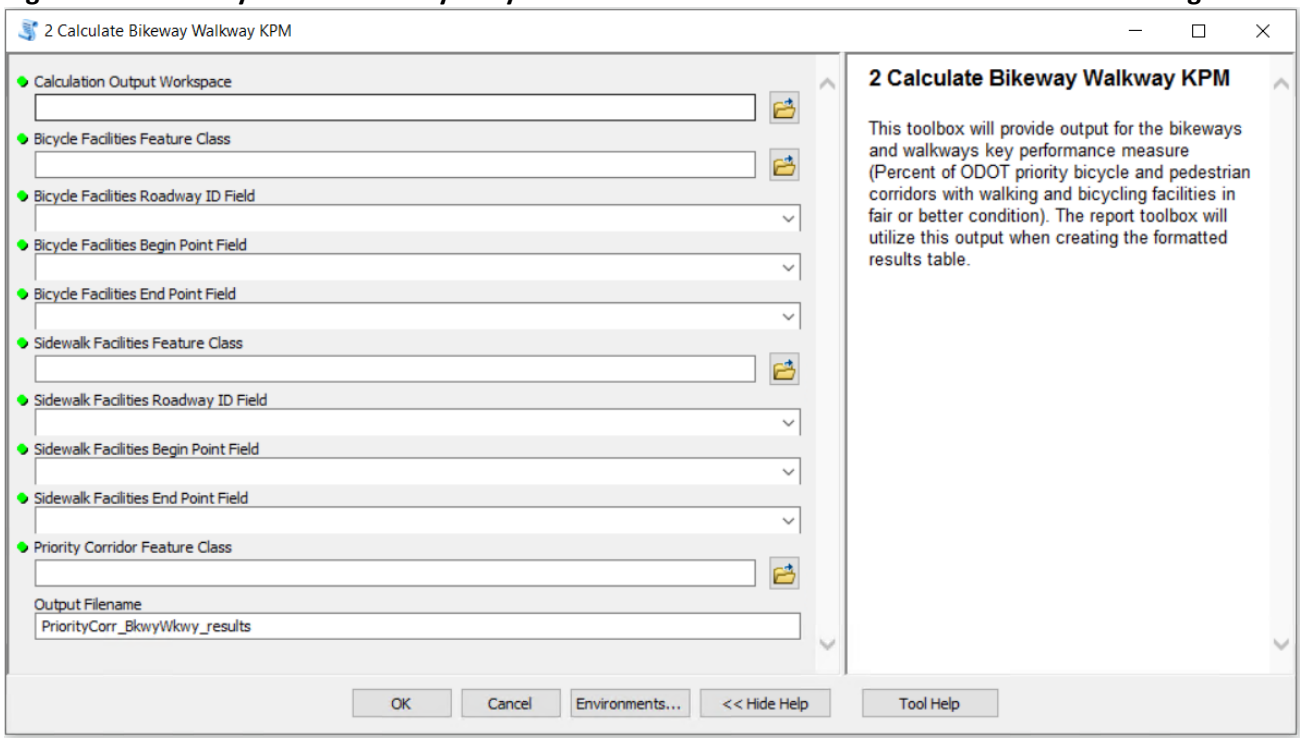
Percent of ODOT priority pedestrian and bicycle corridors with walking and bicycling facilities in fair or better condition

2.1 RUN THE BIKEWAY AND WALKWAY KEY PERFORMANCE MEASURE CALCULATION TOOLBOX

2.1.1 Open "2 Calculate Bikeway Walkway KPM"

In the ArcGIS Catalog, navigate to the ODOT_Bike_Ped_KPMs.tbx toolkit and expand the list of toolboxes. Double-click on "2 Calculate Bikeway Walkway KPM". The dialogue box will look like the clip shown below.

Figure 2. Bikeway and Walkway Key Performance Measure Calculation Toolbox Dialogue Box



2.1.2 Fill in the elements of the toolbox

Further descriptions of the toolbox elements are provided below or can be seen on the right-hand side of the toolbox dialogue box.

Table 2. Bikeway and Walkway Key Performance Measure Calculation Toolbox Elements

Toolbox Element	Current Input / Recommended Naming Convention	Description
Calculation Output Workspace	Toolbox_Run_Output_MMDDYYYY.gdb*	Point the toolbox to the geodatabase file where all output from the clean-up and calculation toolboxes (1 Clean-up Priority Corridor, 2 Calculate Bikeway Walkway KPM, and 3 Calculate Marked Crossing Spacing KPM) will be saved. This geodatabase will then become the input for the reporting toolbox (4 Report).
Bicycle Facilities Feature Class	bicycle_facilities	Point the toolbox to the bicycle facilities feature class within the input geodatabase. Only polyline feature classes are able to be selected.
Bicycle Facilities Roadway ID Field	LRM_KEY	Select the field from the bicycle facilities feature class that is used for the LRM key. Only string fields are able to be selected.
Bicycle Facilities Begin Point Field	BEGMP	Select the field from the bicycle facilities feature class that represents the begin mile point.
Bicycle Facilities End Point Field	ENDMP	Select the field from the bicycle facilities feature class that represents the end mile point.
Sidewalk Facilities Feature Class	Sidewalks	Point the toolbox to the sidewalk facilities feature class within the input geodatabase. Only polyline feature classes are able to be selected.
Sidewalk Facilities Roadway ID Field	LRM_KEY	Select the field from the sidewalk facilities feature class that is used for the LRM key. Only string fields are able to be selected.
Sidewalk Facilities Begin Point Field	BEGMP	Select the field from the sidewalk facilities feature class that represents the begin mile point.
Sidewalk Facilities End Point Field	ENDMP	Select the field from the sidewalk facilities feature class that represents the end mile point.
Priority Corridor Feature Class	clean_prior_corr_MMDDYYYY*	Point the toolbox to the priority corridor feature class within the output geodatabase. This should be the clean_prior_corr_MMDDYYYY output file from the first toolbox step. Only polyline feature classes are able to be selected.
Output Filename	PriorityCorr_BkwyWkwy_results_MMDDYYYY*	Provide filename for the output shapefile, which will be used in the report toolbox.

* Recommended Naming Convention

2.1.3 Run the toolbox

It will take approximately 20 minutes for the toolbox to run. The output shapefile will be used to run the report toolbox.

2.2 CALCULATION METHODOLOGY

1) Dissolve the priority corridors (PCs) by linear referencing model (LRM) to generate a clean table to loop through.
2) Loop through PC list by LRM identifier to establish spatial correlation between PCs and pedestrian and bicycle facilities by the unique LRM roadway identifier.
3) Identify BK and PD facilities located on the PCs and calculate roadway miles of facilities in fair or better condition by category, including bike lane, shared lane, shoulder bikeways, sidewalk, and shared use paths.
4) Summarize interim BK and PD facility parameters on each PC including:
    a. Target Roadside Miles of Walking Facilities
    b. Total Existing Roadside Walking Facility Miles of Fair or Better
    c. Target Roadside Miles of Bicycling Facilities
    d. Total Existing Roadside Bicycling Facility Miles of Fair or Better
    e. Target Roadside Miles of Walking and Bicycling Facilities
    f. Existing Roadside Miles with Walking and Bicycling Facilities of Fair or Better
5) Calculate the KPM

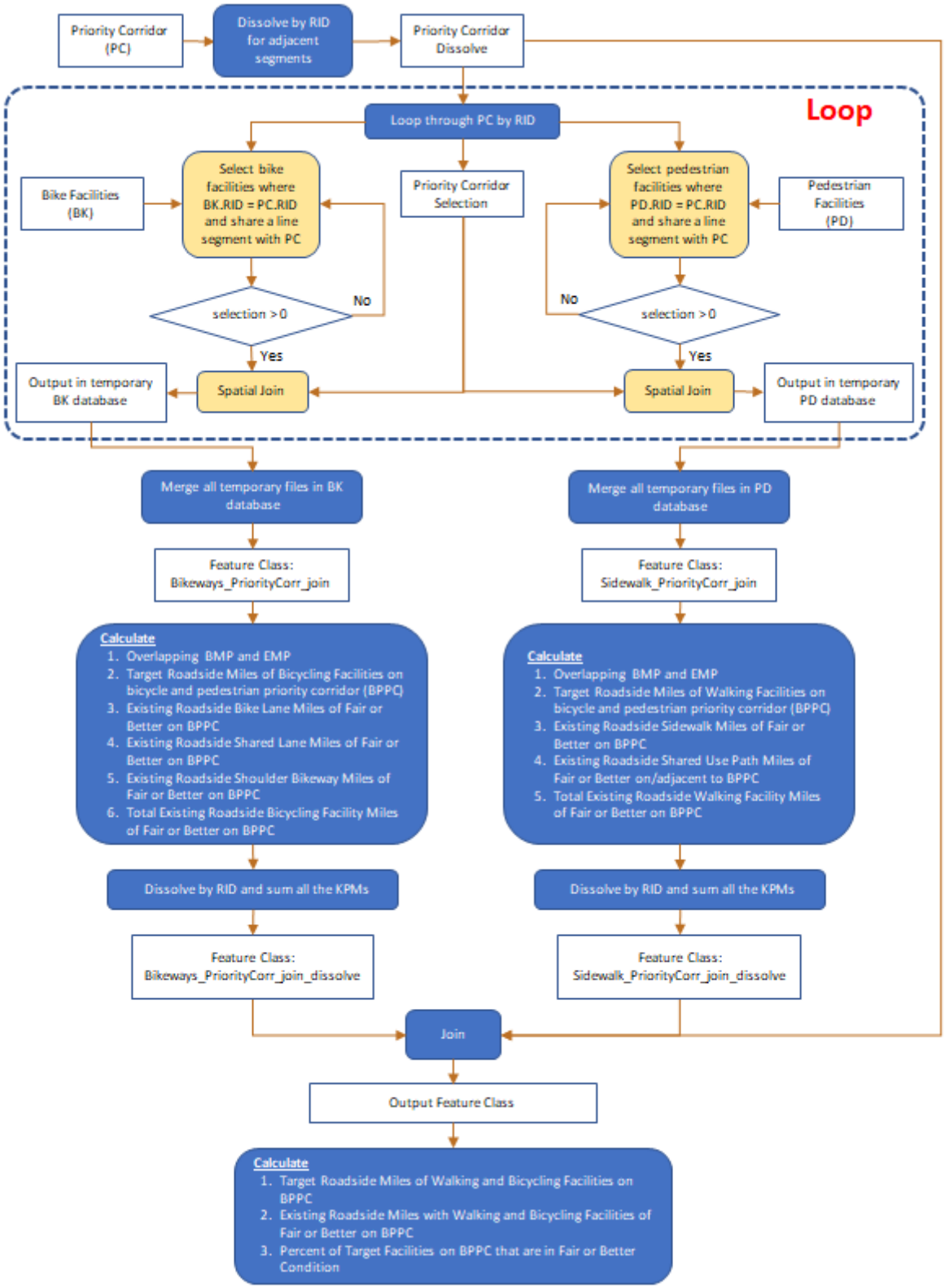
$$\text{Percent of Target Facilities on Pedestrian and bicycle Priority Corridor (BPPC) that are in Fair or Better Condition} = \frac{\text{Roadside miles of walking and biking facilities in fair or better condition on BPPC}}{\text{Target Roadside Miles of Walking and Bicycling Facilities on BPPC}}$$

Parameters shown in the KPM report by PC:

- Target Roadside Miles of Walking and Bicycling Facilities on BPPC = roadside miles of walking facilities that should have facilities + roadside miles of bicycling facilities that should have facilities. Whether or not a segment should have a facility is define in the sidewalks and bikeways datasets as having a need indication of *Y*, representing *Yes.* Most segments are included in this target. Special cases, like divided highways, will indicate that a facility is not needed. In the case of divided highways, bicycle facilities are indicated to not be needed on the inside of each divided highway, as providing facilities on one side of each divided highway segment allows for continuous bikeways in each direction.
- Existing Roadside Miles with Walking and Bicycling Facilities of Fair or Better on BPPC = roadside miles of walking facilities in fair or better condition + roadside bicycling facilities miles of fair of better condition.
- Percent of Target Facilities on BPPC that are in Fair or Better Condition = (Roadside miles of walking facilities in fair or better condition + Roadside bicycling facilities miles of fair of better condition) / (roadside miles of walking facilities needed + roadside miles of bicycling facilities needed).
- Target Roadside Miles of Walking Facilities on BPPC: roadside miles of walking facilities that should have facilities (have a need indication of *Y)*.

- Existing Roadside Sidewalk Miles of Fair or Better on BPPC: roadside miles priority corridors that should have walking facilities (have a need indication of *Y)*.
- Existing Roadside Shared Use Path Miles of Fair or Better on/adjacent to BPPC: the roadside miles where shared use paths in fair or better condition.
- Total Existing Roadside Walking Facility Miles of Fair or Better on BPPC = roadside sidewalk miles of fair or better condition + roadside shared use paths miles of fair of better condition.
- Target Roadside Miles of Bicycling Facilities on BPPC: roadside miles priority corridors that should have bicycle facilities (have a need indication of *Y)*.
- Existing Roadside Bike Lane Miles of Fair or Better on BPPC: the roadside miles where bike lanes in fair or better condition.
- Existing Roadside Shared Lane Miles of Fair or Better on BPPC: the roadside miles where shared lane bikeways in fair or better condition.
- Existing Roadside Shoulder Bikeway Miles of Fair or Better on BPPC: the roadside miles where shoulder bikeways in fair or better condition.
- Total Existing Roadside Bicycling Facility Miles of Fair or Better on BPPC = roadside with bike lane miles of fair or better condition + roadside shared lane miles of fair of better condition + roadside shoulder bikeways miles of fair of better condition.

Figure 3. Bikeway and Walkway Key Performance Measure Calculation Flowchart



3 CALCULATE THE MARKED CROSSING SPACING KEY PERFORMANCE MEASURE

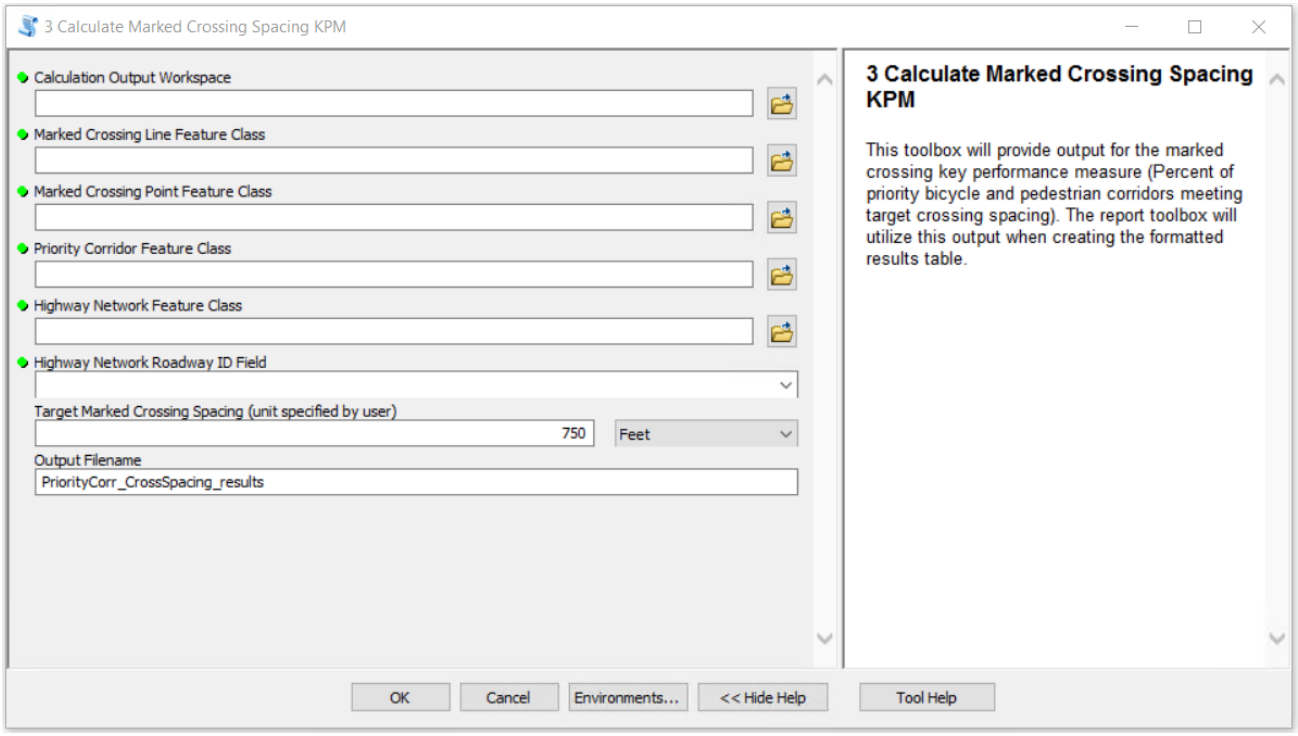
Percent of priority pedestrian and bicycle corridors meeting target crossing spacing

3.1 RUN THE MARKED CROSSING SPACING KEY PERFORMANCE MEASURE CALCULATION TOOLBOX

3.1.1 Open "3 Calculate Marked Crossing Spacing KPM"

In the ArcGIS Catalog, navigate to the ODOT_Bike_Ped_KPMs.tbx toolkit and expand the list of toolboxes. Double-click on "3 Calculate Marked Crossing Spacing KPM". The dialogue box will look like the clip shown below.

Figure 4. Marked Crossing Spacing Key Performance Measure Calculation Toolbox Dialogue Box



3.1.2 Fill in the elements of the toolbox

Further descriptions of the toolbox elements are provided below or can be seen on the right-hand side of the toolbox dialogue box.

Table 3. Marked Crossing Spacing Key Performance Measure Calculation Toolbox Elements

Toolbox Element	Current Input / Recommended Naming Convention	Description
Calculation Output Workspace	Toolbox_Run_Output_MMDDYYYY.gdb	Point the toolbox to the geodatabase file where all output from the clean-up and calculation toolboxes (1 Clean-up Priority Corridor, 2 Calculate Bikeway Walkway KPM, and 3 Calculate Marked Crossing Spacing KPM) will be saved. This geodatabase will then become the input for the reporting toolbox (4 Report).
Marked Crossing Line Feature Class	marked_crosswalks_line	The data for marked crossings is provided from ODOT in two files: one with line data and one with point data. For this element, point the toolbox to the marked crossing feature class within the input geodatabase that contains line data. Only line feature classes are able to be selected.
Marked Crossing Point Feature Class	marked_crosswalks_point	The data for marked crossings is provided from ODOT in two files: one with line data and one with point data. For this element, point the toolbox to the marked crossing feature class within the input geodatabase that contains point data. Only point feature classes are able to be selected.
Priority Corridor Feature Class	clean_prior_corr_MMDDYYYY	Point the toolbox to the priority corridor feature class within the output geodatabase. This should be the output file from the first toolbox step. Only polyline feature classes are able to be selected.
Highway Network Feature Class	hwynet	Point the toolbox to the highway network feature class within the input geodatabase. Only polyline feature classes are able to be selected.
Highway Network Roadway ID Field	LRM_KEY	Select the field from the highway network feature class that is used for the LRM key. Only string fields are able to be selected.
Target Marked Crossing Spacing (unit specified by user)	375 feet	Provide half of the target marked crossing spacing for the calculation output. The user must define both the unit and number for half of the target spacing. Verify the target spacing with the Pedestrian and bicycle Program manager prior to running the toolbox.
Output Filename	PriorityCorr_CrossSpacing_results_MMDDYYYY	Provide filename for the output shapefile, which will be used in the report toolbox.

* Recommended Naming Convention

3.1.3 Run the toolbox

It will take approximately 20 minutes for the toolbox to run. The output shapefile will be used to run the report toolbox.

3.2 CALCULATION METHODOLOGY

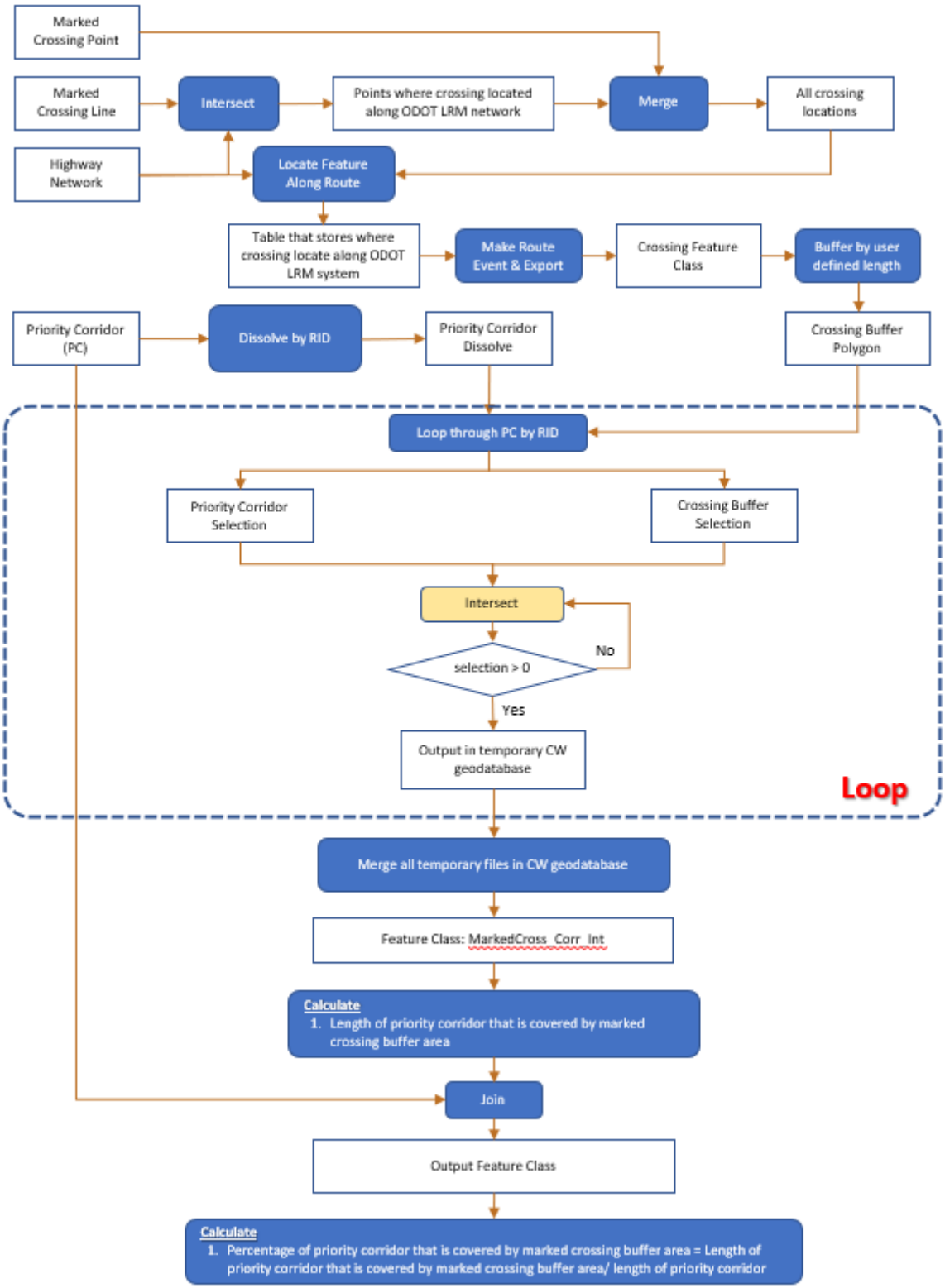
1) Establish the marked crossing line data locations using their intersection with the highway network. Merge the newly establish points for the marked crossing line data with the marked crossing point data.
2) Locate the marked crossings on the priority corridors (PCs) LRM system.
3) Create buffer areas around the marked crossing locations based on the user-identified target spacing.
4) Dissolve the PCs by roadway identification (RID) to generate a clean table to loop through.
5) Loop through PC list and establish spatial correlation between priority corridors and the marked crossings buffer area that has the same roadway identifier on ODOT LRM system.
6) Clip out the PC segments that are within the marked crossing buffer area.
7) Calculate the length of each PC that is covered by the marked crossing buffer area.
8) Summarize the length and calculate the percentage of each PC that is covered by the marked crossing buffer area. The marking crossing spacing KPM calculation:

$$\text{Percent of priority pedestrian and bicycle corridor meeting target crossing spacing} = \frac{\text{Center Lane Miles Covered by Marked Crossing Buffer Area on PC}}{\text{Center Lane PC Miles}}$$

Parameters shown in the KPM report by PC:

- Centerline BPPC miles meeting target marked crossing spacing: length of each PC that is covered by the marked crossing buffer area.
- Percent BPPC meeting target marked crossing spacing = percentage of each PC that is covered by the marked crossing buffer area.

Figure 5. Marked Crossing Key Performance Measure Calculation Flowchart



4 CREATE REPORT

Create a formatted excel spreadsheet that is ready to print the final bicycle/pedestrian access KPM report.

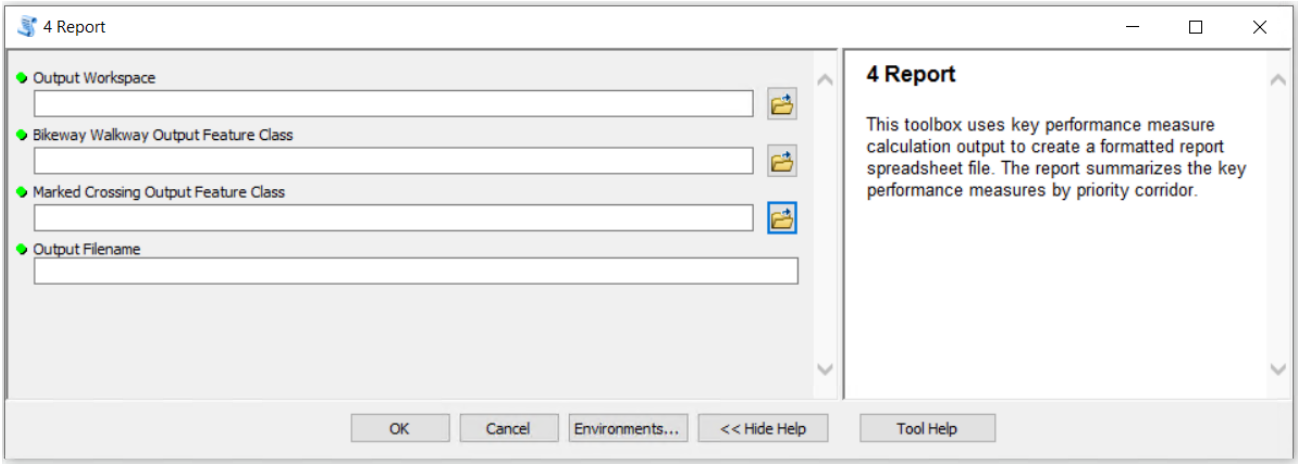
4.1 RUN THE REPORT TOOLBOX

In the ArcGIS Catalog, navigate to the ODOT_Bike_Ped_KPMs.tbx toolkit and expand the list of toolboxes.

4.1.1 Double-click on "4 Report"

The dialogue box will look like the clip shown below.

Figure 6. Report Toolbox Dialogue Box



4.1.2 Fill in the elements of the toolbox

Further descriptions of the toolbox elements are provided below or can be seen on the right-hand side of the toolbox dialogue box.

Table 4. Toolbox Element Descriptions

Toolbox Element	Current Input / Recommended Naming Convention	Description
Calculation Output Workspace	\\s6000e\6610shar\Bike_Ped\PM_Data_Implementation\KPM\YYYY*	Point the toolbox to a folder where the "Template.xlsx" is saved. The final output in Excel format will be saved to the same folder.
Bikeway Walkway Output Feature Class	PriorityCorr_BkwyWkwy_results_MMDDYYYY*	Point the toolbox to the bikeway walkway output feature class within the output geodatabase. Only polyline feature classes are able to be selected.
Marked Crossing Output Feature Class	PriorityCorr_CrossSpacing_results_MMDDYYYY*	Point the toolbox to the marked crossing output feature class within the output geodatabase. Only polyline feature classes are able to be selected.
Output Filename	Report_MMDDYYYY*	Provide the output filename for the formatted report spreadsheet file that summarizes the key performance measures.

* Recommended Naming Convention

4.1.3 Run the toolbox

It will take less than one minute for the toolbox to run. The output spreadsheet file will be shared with the Pedestrian and bicycle Program manager.

The spreadsheet is formatted so that the bikeway and walkway KPM report will print on 11x17 sheets and the marking crossing report will print on 8.5x11 sheets.

Attachment B: Key Performance Measures Detailed Results

Attachment C: Oregon Bike Bill (ORS 366.514) Methodology

ENCUMBRANCE PROCEDURE
Working Draft July 2021

This memo describes the process for determining the encumbered charges that count towards the ORS 366.514 required minimum 1% to be spent on bicycle and pedestrian facilities.

- Step 1: Determine which bid items and projects contribute to the 1% Report. Create a new folder in the directory **Z:\Bike_Ped\1% Expenditure Spreadsheets.** Name the folder "**FYXX working files**", where XX is the two-digit fiscal year.
- If there has been any change to the standard specifications or to the bid items since the last fiscal year, obtain a new list of bid items and determine which items count toward bicycle and pedestrian infrastructure, If the bid items have not changed, copy the bid item list from the previous year
- Send an email to a Trans*Port cost estimator (Mike Lippsmeyer in 2021), requesting a list of bike-ped bid items from the fiscal year you are working on. If no changes to the bid item list need to be made, this report is generated quickly and you will receive an email with an excel file listing all the bid items. For the purpose of this procedure document, we will refer to this list as **the bid items let list.** The bid items let list will not contain every project that was let in the previous fiscal year, only those projects with elements that are expected to contribute to the 1% report ("bike-ped items"). Things that should be on the bid let list:

○ Contract Number ○ Key Number ○ Notice to Proceed date ○ (if requesting multiple fiscal years) ○ Line number ○ Item number	○ Unit Price ○ Quantity ○ Extended Amount ○ Project Description 1 ○ Project Description 2 ○ Item Long Description 1

- For data, you are requesting the following "iqsupdes" containing any of the following (you can add/remove as necessary):

○ 'SHARROW' ○ 'PATTERNED' ○ 'COLORED' ○ '%MULTI%USE%' ○ '%PATH%' ○ 'PICNIC' ○ 'BOLLARD' ○ 'BUS' ○ 'DOMES' ○ 'BALUSTER' ○ 'ISLAND' ○ 'PAVER'	○ 'BICY' ○ '%TRAFFIC%SIGNAL%' ○ 'PEDEST' ○ '%FLASHING%BEACON%' ○ '%LOOP%DETECTOR%' ○ '%CONCRETE%DRIVE%' ○ 'BENCH' ○ '%HAND%RAIL%' ○ '%ORNAMENTAL%RAIL%' ○ 'STAIR' ○ 'BIKE' ○ 'WALK'

- Copy the list of projects from the fiscal year you are working on into a new Excel Tab. For the purpose of this procedure document, we will refer to this list as **Calc Sheet**.

Step 2: Obtain plan sets. The purpose of obtaining plan sets is to determine if there are 100% active transportation projects.

- Electronic copies of contracts and plans are available in the file \\bd7800a\OPER\ContractElectronicFiles
- A complete listing of projects let by fiscal year can be found on the Internet at https://www.oregon.gov/odot/Business/Procurement/Pages/BT.aspx https://www.oregon.gov/odot/Business/Procurement/Pages/Archive.aspx Copy the list of projects from the fiscal year you are working on into a new Excel Tab. For the purpose of this procedure document, we will refer to this list as **the projects let list**.

Step 3: Prepare the encumbrance workbook.

- Create an Excel workbook with title: **FYXX encumbrances.xls**, where XX is the fiscal year. Create four spreadsheet tabs in the workbook: (1) Bid Items Let List, (2) Calculations, (3) Projects Summary, (4) Funding Splits.
- Bid Items Let List – this is the spreadsheet described in step 1. Paste the spreadsheet into this new file and format it to make calculations easy. For example: highlight rows of bid item information, rotating colors between projects with different contract numbers, combine text so that bid item descriptions appear in one column instead of three.
- Calculations – Copy or link relevant fields from the bid items let list into this spreadsheet tab. (contract number, key number, project name, bid item description, bid item cost.) Add additional columns for calculations. See previous year's column headings. There will be the same number of rows in this spreadsheet as in the bid items let list (until additional bid items are added per step 4). The column "Cost for 1% Rpt" will begin blank and will be filled in step 4. The remaining columns will have descriptions of the bid item and why it contributes or does not contribute to the 1% requirement.
- Projects Summary – Create this sheet in step 5.
- Funding Splits – Create this sheet in step 7.

Step 4: Determine encumberable expenses.

- Enter the proportionate cost of each bid item that contributes to the 1% requirement in the "Cost for 1% Rpt" column of the calculations sheet. In general, most of the encumberable charges will come from sidewalks, traffic signals and stand-alone bicycle and pedestrian projects. Shoulders that are part of a regular highway improvement project do not count, unless we requested widening above what was originally planned. The following list outlines the proportion of bid item cost that contributes to the 1% requirement.

1. **Structures:** The bid items let list does not include structures. Bridges and retaining walls contribute only when pedestrian facilities accompany them. If the project includes bridges or similar structures, add the total structure to the list of bid items in the calculations sheet. Only include structures when it is new or if bridge rehabilitation modifications affect the footpath or bicycle pathway.

    a. **Bridges**: If under-deck for sidewalk is not included in the bid item list, calculate the proportion of the structure taken up by sidewalks. Identify the structure(s) in the bid tab and add all the items that go into the structure to get a total cost for each structure (do not include bridge rail items or roadway surfacing specific items like "membrane waterproofing"); Multiply the cost of the total structure by the total sidewalk width and divide by the overall structure width. Enter this under the "cost for 1% rpt" column in the calculation sheet If under-deck for sidewalk is included in the bid item list, use 100% of this bid item and any others that are included in the bridge portion of bid tab instead of the width to total width calculation described above under the "cost for 1% rpt" column in the calculation sheet

    b. **Retaining Walls**: For retaining walls, with sidewalks above or beneath them, try to determine what the height of the retaining wall would have been without sidewalks. Take the difference in the actual wall height and the assumed height needed without sidewalks, and divide it by the actual wall height to determine the percentage of that retaining wall's cost to enter in the spreadsheet. If you determine that no wall would have been needed if no sidewalks were built, enter the entire cost of the wall under the "cost for 1% rpt" column in the calculation sheet. When there are more than one structure on a project, create extra rows below the top row and use the top row to sum the costs of all the structures. If a project reconstructs a roadway that already had sidewalks (and no retaining wall) in order to widen the road, and the new sidewalks require a retaining wall, the retaining wall shall not contribute to the 1%.

2. **Shared-use paths:** Use 100% of the cost of a separated shared-use path, including base material and surfacing. If retaining structures, bridges or any other features are required to build the path, include 100% of their cost as well. Enter the total path cost under the "cost for 1% rpt" column in the calculation sheet.

3. **Driveways:** Use 50% of the driveway cost. Enter the entire driveway costs in the "cost for 1% rpt" column in the calculation sheet.

4. **Sidewalks:** Use 100% of the sidewalk cost. Enter the entire sidewalk and sidewalk ramp costs under the "cost for 1% rpt" column in the calculation sheet.

5. **Removal of Walks/Driveways/Signals/etc:** Removal costs do not contribute to 1%.

6. **Crosswalk Closure Barricades:** These do not contribute to encumbrances. ORS 366.514 requires provision of footpaths [and bicycle trails]. Closure Barricades remove otherwise existing footpaths.

7. **Concrete Islands:** Use 100% of the concrete island cost **or** the portion of concrete islands that are for pedestrian crossing. If a crossing island is landscaped or composed of a material that is not ADA accessible (cobblestone, etc), use 50% of cost. Use 50% of "right turn channelization" islands. Enter the cost under the "cost for 1% rpt" column in the calculation sheet

8. **Pedestrian Rail:** A pedestrian rail mounted on concrete barrier accounts for 2/7 of the cost per foot of the barrier/rail. Take that fraction of the pedestrian rail costs if the barrier would have been there regardless of pedestrians. If the barrier is put up for pedestrians only, count 100% under the "cost for 1% rpt" column in the calculation sheet.

9. **Traffic Signal Installation:** Use 10% of traffic signal costs if there are pedestrian heads and pushbuttons included. However, if there are closed crosswalks, use 10% multiplied by the "ratio of the number of legs with crosswalks to the total legs of the intersection" under the "cost for 1% rpt" column in the calculation sheet.
10. **Traffic Signal Modifications:** Determine what is being modified. If changes do not modify the signal for pedestrians or bicyclists (i.e. pushbuttons, pedestals, wiring for ped phases, etc) it does not contribute to the 1%. If modifications are comprehensive use 10% of the modification cost times the ratio of open crossing legs. If modifications are only or mostly for pedestrians or bicyclists (i.e. APS upgrade), include the cost as _____??
11. **Loop Detector Installation:** Use the portion of lanes with bike loops, not the number of loops. (e. g. 7 lanes of new loops, 2 are bike lanes, 5 are vehicle lanes – 2/7 of cost under the "cost for 1% rpt" column in the calculation sheet. If no bike lanes exist, none of it contributes to 1%.

12. **Stand-alone bicycle and/or pedestrian projects**: If a project is entirely intended for bicycles and/or pedestrian, the whole project bid shall contribute to the expenditures. The bid items let list will not include project charges (mobilization, excavation, etc). Ignore the items included in the bid items let list; if a project is a stand-alone bicycle and/or pedestrian project, take the total cost of the project instead of the list of bike-ped bid items in the project. Enter the entire project cost under the "Cost for 1% Rpt" column in the calculation sheet. For stand-alone projects, the cost of any right-of-way purchased should also be included. Add the R/W costs in the calculation sheet. Note: the bike-ped work type does not mean that it is a stand-alone project.
13. **Street Furniture**
14.

Step 5: Prepare summary sheet

- At this point, you are ready to use the summary sheet. Copy or link relevant fields from the bid items let list or the calculations sheet (contract number, key number, project name). List each project on a single row. (The summary sheet will have fewer rows than the bid items let list and calculations sheet.) Use previous year's summary sheet to add additional column headings. Many of these columns require information from the STIP.
- Link to the STIP Database website. Obtain information for the following columns: the "BID LET DATE", "PROJECT TYPE" and funding distribution ("FED %", "ST. %" and "LOCAL %"). The project type helps to determine the funding "CATEGORY". Make a determination whether the project is modernization, preservation or bike/ped.
- Sum the "Cost for 1% Rpt" column for each project in the calculations sheet and place in the "BIKE/PED BID ITEMS" column in the summary worksheet. The column "BIKE/PED NET TOTAL" is the amount of "BIKE/PED BID ITEMS" in excess of "SWIP, etc EXPENDED" (the "SWIP, etc EXPENDED" column will be explained in step 6.) Make sure the remaining columns are set up to automatically calculate the state, local and federal dollars spent on modernization, preservation and bike-ped projects. This is done by using the referencing the "CATEGORY" column (i.e. If you enter "Modern" in the "CATEGORY" column – the project charges will show up in the "MODERNIZ. PROJECTS" columns).

Step 6: Separate out Grant. SWIP and QuickFix projects

Some projects that are listed in the summary sheet are Grant, SWIP or QuickFix projects that were done by ODOT. Since money from these funding programs also include projects that were not bid by ODOT, these expenses are tallied separately in step 8. However, the amount of SWIP, Grant, or QuickFix money in a project may not equal the entire portion of money that contributes to the 1% requirement. Therefore, the SWIP, Grant or QuickFix money is removed from the net bike/ped items after the contributing bike-ped items are tallied.

Open the **Bicycle and Pedestrian Program Funding Tracker** database. Determine which projects had SWIP funding by comparing the **SWIP Projects Active** table to the list of projects in the summary table. Enter the dollar amount from the "Allocation" column in the SWIP Projects Active table into the "SWIP, etc EXPENDED" column in the summary sheet. Determine which projects in the summary table have QuickFix funding by comparing the **Quick Fixes** table to the list of projects in the summary table. Enter the dollar amount from the "$ Budgeted" column in the Quick Fixes table into the "SWIP, etc EXPENDED" column in the summary sheet. If any grant projects are listed among projects in the summary sheet, enter the dollar amount from the "State Share (Max $)" column in the **Grants** table in the summary sheet. The "BIKE/PED NET TOTALS" column should show remaining funds that contribute to the 1% requirement only if the amount in the "BIKE/PED BID ITEMS" column is greater than the amount in the "SWIP, etc EXPENDED"; otherwise, the net total is zero.

Step 7: Determine Funding Splits

The summary sheet calculates the state, local and federal share for each project and lists that funding separately in the applicable column. Sum each column at the bottom of the summary sheet. For easier comparison, copy the summed columns into the "Funding Splits" tab in the "FYXX encumbrances.xls" workbook and calculate totals. This sheet can also be used to summarize the SWIP, QuickFix and Grant funds.

Step 8: Prepare 1% Report

Create a new file in the G:\Reports (Program Reports)\1% Report\1% Expenditure Spreadsheets directory by copying the **Bike-Ped FY XX 1% Expenditure Report.xls** from the previous fiscal year and naming it after the fiscal year that you are working on. Copy the "FY 20XX" tab and clear all the non-calculated numeric fields.

Obtain the value for "Highway Fund" by requesting a summary of the state's revenue for the fiscal year from the Revenue & Expenditures Accounting Manager (). Enter this amount and any bond (i.e. OTIA) amounts at the top of the page. Make sure the total is calculated the right.

Obtain the value for "Administration, equipment, misc" expenditures from Denise Billings or John Maher. A summary report was created in 2009 that should expedite this process.

Enter state, local and federal dollar amounts from step 7 into the actual expenditures table: enter modernization projects in the row labeled: "Hwy Construction Projects that include Bikeways and Walkways" includes modernization projects; enter bike/ped projects in the row labeled: "Stand Alone Bike/Ped Projects (Enhancement, HES, etc.)"; enter preservation projects in the row labeled: "Preservation Projects".

Enter programmed amounts for SWIP, Grants and QuickFix in the rows: "SWIP (Sidewalks with Preservation)", "Bike/Ped Grant Projects" and "Quick Fix". Programmed amounts can be found in the **Bicycle and Pedestrian Program Funding Tracker** database, **Statewide Buckets** table and "Originally Loaded Amount" column. The remaining numeric fields should be complete, as they are calculated amounts. Open the "1% History" tab and add a row with values from the tab that you created.

The "FY 20XX" tab can be duplicated again and renamed "FY 20XX (actuals)" with actual amounts for SWIP, QuickFix and Grants rather than programmed amounts. Expenditure reports for SWIP, QuickFix and Grant moneys are prepared monthly (by John Maher in 2009) and titled beginning with MAH24881. They are saved in the directory: G:\Funding Programs\Geneva Financial Reports. Open a report dated after the end of the fiscal year (i.e. July's report). The column "FYXX AMT EXP'D" has five summaries: "QuickFix", "Grants", "SWIP", "QuickFix+SWIP" and "BIKE&PEDESTRIAN". Determine the funding source by comparing the EA information to the Bicycle and Pedestrian Program Funding Tracker database. Consolidate the 5 summaries into 3 (QuickFix, Grants, SWIP) by adding the individual rows to one of the 3 funds. Enter these summary totals into the respective columns in the "FY 20XX actuals" tab of the Bike-Ped FY XX 1% Expenditure Report.xls

Appendix B:

Non-Motorized Data Management Strategy

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Non-Motorized Data Management Strategy

Date:	September 13, 2021	Project #: 23021.008
To:	Jessica Horning, Susan Peithman, Josh Roll, and Phil Kase, ODOT	
From:	Susan Wright, PE, Camilla Dartnell, and Molly McCormick, Kittelson & Associates, Inc.	
Project:	Pedestrian and Bicycle Performance Measures and Data Implementation Framework	
Subject:	Non-Motorized Data Management Strategy	

OVERVIEW

Through the Pedestrian and Bicycle Performance Measures and Data Implementation Framework project process, the project team and stakeholders identified a number of measures that would be valuable for the Oregon Department of Transportation (ODOT) to track, but for which data is not available. These measures are considered to be *future measures,* as they will need to be implemented in the future when data is available. This memorandum provides an overview of those measures then describes the two main initiatives necessary to make that data available: a statewide pedestrian and bicycle facilities asset inventory and repository and a pedestrian and bicycle count program. Table 1 describes the future performance measures and the corresponding data needs.

Table 1: Future Performance Measures and their Corresponding Data Need

Outcome	Future Performance Measure	Data Need
Access	**Bikeways and walkways:** percent of statewide pedestrian and bicycle priority areas with low stress walkways and bikeways	Statewide pedestrian and bicycle asset inventory and repository
	Crosswalk spacing: percent of statewide bicycle and pedestrian priority areas meeting target crossing spacing	
Safety	**Pedestrian crash rate**: number of pedestrian crashes per 100 million pedestrian miles traveled	Pedestrian and bicycle count program
	Bicycle crash rate: number of bicycle crashes per 100 million bicycle miles traveled	

Utilization	**Miles traveled:** miles traveled by people walking, biking or driving	Pedestrian and bicycle count program

STATEWIDE PEDESTRIAN AND BICYCLE ASSET INVENTORY AND REPOSITORY

There are many considerations when someone is deciding which mode to take to a destination. Key considerations for walking and biking include whether the route feels comfortable and whether the destination is in reasonable walking or biking distance. People do not typically consider whether ODOT or a local agency owns and maintains a facility into consideration when making trip decisions. The absence of a jurisdictionally blind inventory of walking and biking facilities in Oregon is, therefore, a major obstacle to being able to understand and inform people's trip-making decisions.

The future access measures, *bikeways and walkways: percent of statewide pedestrian and bicycle priority areas with low stress walkways and bikeways* and *crosswalk spacing: percent of statewide bicycle and pedestrian priority areas meeting target crossing spacing,* addresses this challenge. By focusing on priority areas, ODOT is focusing on the locations that provide the most access to destinations and priority populations, regardless of who owns the roadways. The focus on low-stress facilities addresses the level of comfort that people walking and biking will feel on those facilities. Low stress facilities are defined as facilities with a Level of Traffic Stress 1 or 2.

Both future access related measures are reliant on understanding where infrastructure exists through the development of a statewide system for tracking pedestrian and bicycle assets. This system will also support other ODOT initiatives, which are further explored in the *Program Objectives and Uses* of this document.

To support the understanding of the options available for a statewide pedestrian and bicycle asset inventory and repository, the team conducted interviews and reviewed relevant literature. The key documents, provided below, most informed the approach outlined in this section and may be relevant as the inventory and repository are developed.

- FHWA's Developing National Bicycle Facility Inventory Data
- Minnesota Facility Standards
- OpenStreetMap Wiki (https://wiki.openstreetmap.org/wiki/Main_Page) (accessed April 2021)
- ODOT's Bike-Pedestrian Data Collection Guide (2020)

Program Objectives and Uses

In addition to supporting the development of the future access measures, there are a number of other initiatives to which a statewide pedestrian and bicycle facility inventory and repository would contribute. Those initiatives include but are not limited to the following:

- Planning and project prioritization
- Safe Routes to School routing

- First and last mile transit planning
- Trip planning/improved routing recommendations
- Systemic pedestrian and bicycle safety analyses

In addition to these ODOT initiatives, this inventory and repository is anticipated to support other state, local, and national efforts. The Oregon Department of Land Conservation and Development (DLCD) is undergoing a process to identify and track performance measures that will support the State's greenhouse gas emission reduction goals. This ODOT project team is coordinating closely with the DLCD initiative and using this project's outcomes to help inform the measures pertaining to active transportation.

The National Bikeway Network (NBN) is a Federal Highway Administration (FHWA) initiative to create a national dataset for bikeway data to ultimately inform metrics around safety, volumes, and the extent of bicycle facilities nationally. The NBN is anticipated to be an online platform to which agencies can add data by uploading shapefiles of network data that use a common data format. The NBN is in a beta-testing phase and not yet available for use by agencies or the public. This ODOT project considered the data templates created for the NBN when producing the data recommendations for this asset inventory and repository. Although the NBN may be an option as a future bicycle data repository, the NBN does not include pedestrian data, may not be made available for public use, and is not anticipated to be routeable, therefore not meeting many of the desires for a statewide asset inventory and repository. When the NBN is fully functional, ODOT can upload their data (either statewide or just for ODOT facilities) to the NBN to contribute to the national database.

Process

Creation of a statewide inventory and repository will require several main steps. First, ODOT will need to determine the data needs and the format for the data. Next, ODOT will need to establish the base network for which they will apply the assets. Existing facility data will then need to be applied to the base network. To evaluate Level of Traffic Stress (LTS) for biking and walking, ODOT will need to run the script developed by ODOT's Transportation Planning and Analysis Unit (TPAU) to assess the LTS for each segment. ODOT should consider developing a simplified pedestrian LTS methodology and/or default assumed values for some data elements included in pedestrian and bicycle LTS to reduce the data collection burden on local jurisdictions. Finally, ODOT will need a system for receiving data from local agencies or inventorying local roadways and updating the data from local agencies on a regular basis. Each of these steps is covered in more detail in the following sections.

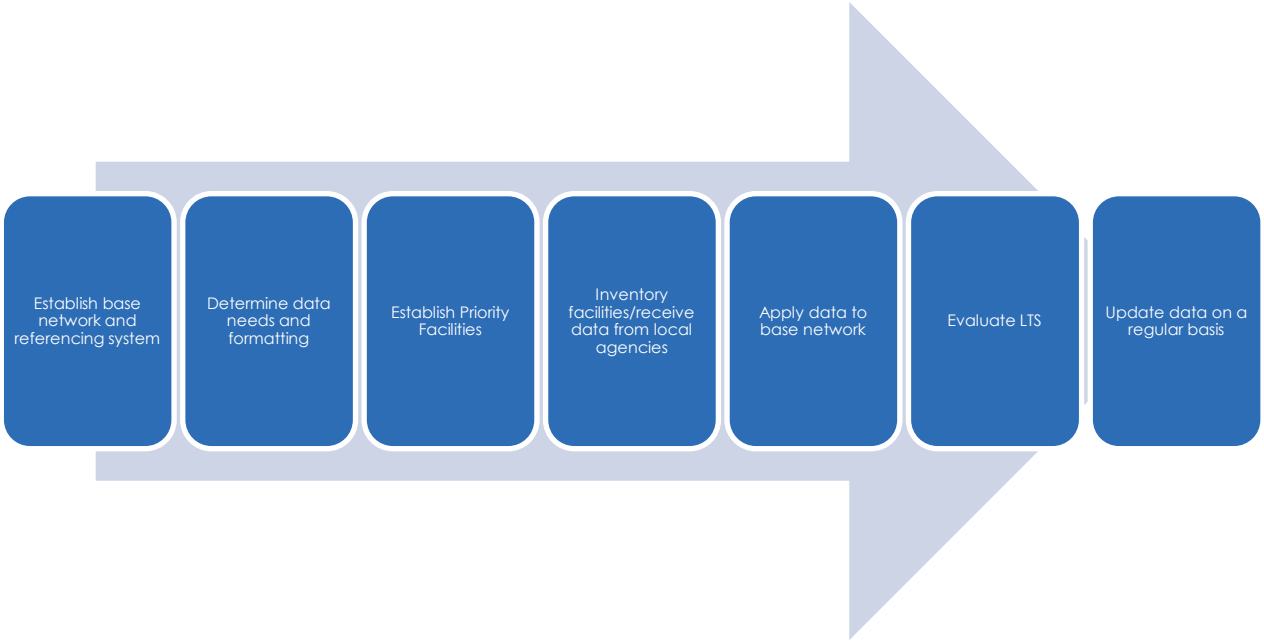


Exhibit 1: Access Measure Implementation Steps

Establish Base Network and Referencing System

First, it is necessary to establish a base network to which assets can be associated. Although it is not necessary for the calculation of these performance measures, the base network should be routeable enough to provide a general understanding of how volumes are distributed at intersections to be able to support other analysis initiatives. There are several key base network options to be considered. ODOT is in the process of adding all non-state roads to their authoritative linear referencing system (LRS), which would provide a master base network for which statewide data can be applied. Alternatively, OpenStreetMap (OSM) provides a global, non-proprietary referencing system that hosts opensource data on its routeable network. This section provides the benefits and challenges to using each potential network.

Statewide Linear Referencing System

Although there are currently geolocated statewide roadway datasets like the All Road Network of Linear Referenced Data (ARNOLD) and Topically Integrated Geographic Encoding and Referencing (TIGER) datasets, these may not be routable and are crude, often not differentiating between forest roads and general-purpose roads. The formation of a statewide linear referencing system would provide a semi-routeable network that can be used to reference the location of assets along the roadways.

This statewide linear referencing system is expected to be complete by March 2022, and the effort is being led by Jennifer Campbell, the Highway Performance Monitoring System (HPMS)Coordinator within the ODOT RICS Unit. Once they create the system, base data will reside in the TransInfo database and asset data can be linked. The group is expecting to add HPMS data and anticipate other datasets will follow as they are available.

This LRS can be used as a referencing system for walking and biking assets across the state in the same format that those assets are currently stored and shared for ODOT highways. There are many considerations for whether this LRS is the best base network for statewide data. Those considerations are provided below as advantages and disadvantages.

Benefits

The key benefit or advantage to using the statewide LRS centerline is the use of common linework with other ODOT data and asset data across the state if data is added to the LRS as it is anticipated. Having pedestrian and bicycle assets readily available to use on the same base network will create the opportunity to access the data during multimodal analyses and will allow those accessing other asset data to consider pedestrian and bicycle related assets or data in their own analyses. Other benefits to using the statewide LRS centerline include:

- Easy integration of current tools and resources, including the Bike-Pedestrian Data Collection Guide and the current Key Performance Measure tool, because the data format will mimic the existing ODOT system. Additionally, staff that are already familiar with utilizing pedestrian and bicycle asset data using the current systems will be able to also utilize the statewide data without learning a new system.
- The potential for piggybacking off other data collection and integration efforts. HPMS data is likely to be added to the statewide LRS in the near-term (2022). If ODOT is investing resources into determining a process for collecting or receiving that data and adding it to the LRS centerline, the same process can likely be utilized to add pedestrian and bicycle data to the base network.
- Internal data control for adding assets to the centerline. While open sourcing data from the public can provide efficiency benefits, it can also create significant data control challenges and make tracking changes in data quality in comparison to changes in actual system infrastructure difficult. Having a more controlled data source to understand the amount of the system for which data is not available is key to tracking the performance of the system.

Challenges

There are some key challenges to using the LRS centerline to support assets. Using the LRS centerline may continue the use of a data system that presents challenges or can be cumbersome for applying or analyzing bicycle and pedestrian asset data. The current LRS has gaps at intersections or access points that impact the performance measures. The current update cycle for pedestrian and bicycle inventories is five years, as there is limited staff capacity to perform updates. Once the inventories are complete, it can be a significant period of time before those inventories are added to TransInfo due also to limited staff capacity.

OpenStreetMap (OSM)

OSM is a routeable worldwide map with a network based on defined relationships between intersections and their connecting segments. Much of the OSM roadway network in the US was first based on the

Topologically Integrated Geographic Encoding and Referencing system (TIGER) data produced by the US Census Bureau. The network and characteristics or attributes of the network are updated by crowdsourced volunteer OSM editors, and it serves many OSM layers including CyclOSM, Cycle Map, and Transport Map, each of which has a different set of attributes associated with it. As the OSM network and data improve, it is being used on a more widespread basis, including by organizations like TriMet, Streetlight Data, Gaia GPS, Strava, Facebook, Apple, and Amazon. These organizations may also have initiatives to improve the data.

There are two potential ways that OSM can be used to track pedestrian and bicycle assets in Oregon. ODOT can edit OSM to reflect their biking and walking facilities and recommend that local jurisdictions do the same, then compare the OSM network over time, or ODOT can download the current OSM network to use the existing data as a starting point, then receive data from local jurisdictions and reconcile that data with the OSM network.

Benefits

The benefits and challenges of OSM vary based on how it will be used. If OSM is used to host all pedestrian and bicycle asset data and local agencies are encouraged to update OSM to reflect their pedestrian and bicycle assets, the major benefit of OSM is the lack of a need for an in-house system for receiving, compiling, and storing the data. Those processes may be resource intensive for ODOT to undertake, so utilizing the OSM platform can take advantage of the free tool to reduce the resources necessary for ODOT to commit to this initiative.

Jurisdictions with limited capacity to manage and reconcile their data onto OSM can still publish their data and ask the OSM community to integrate it into the system. This requires much less effort but relies on volunteer help, which is not guaranteed. Otherwise, jurisdictions can conflate the data to align their network geometry with the OSM network and match the original attributes into the OSM data format (data tags). This process can be done through a purposefully written script. SharedStreets is a non-profit that provides opensource scripts to help with this integration. After the automated integration, manual review and conflation of the data will be necessary to ensure quality.

If the OSM network is to be downloaded and used as a starting point for adding data, that data can be reconciled onto the LRS centerline, then data added or augmented by receiving data from local jurisdictions.

Challenges

The key challenges with using this process include the requirement for local jurisdictions to update OSM, which may not be feasible or a priority for many agencies, and the inconsistency of data quality and input due to the crowdsourced nature of the system and the inability to understand whether data is unavailable or whether assets do not exist, making it difficult to track progress over time. Finally, the attributes included in the OSM system will not comprehensively support the measure, as many elements,

including facility condition, facility types, and buffer presence, is not included as OSM attributes currently.

Future Decision Points or Actions:

ODOT will need to decide which base network and referencing system they will use to track pedestrian and bicycle assets statewide.

Data Needs and Format

This section identifies the data necessary for calculating the performance measure across the state. These data will also be valuable in supporting other initiatives. Many of the data needs are driven by the need for the data to support the level of traffic stress analyses. The exact format for the data will be based on the base network and system of collection and reporting, so the data needs detailed below provide only the general type of data needed.

OSM's data format includes pedestrian and bicycle asset attributes that can be assigned through a tagging system. The full attribute list can be found here: https://wiki.openstreetmap.org/wiki/Map_features#Primary_features. The attributes do not currently include condition of the pedestrian and bicycle facilities, but the data can still be used to track the presence of each facility type. Attributes not currently tracked in OSM can be added by writing in free-form tags.

ODOT's data format includes more of the pedestrian and bicycle asset attributes necessary for calculating the measures than OSM. The detailed metadata can be found here: https://geoportalprod-ordot.msappproxy.net/geoportal/catalog/main/home.page. Details about how to categorize many of these attributes can be found in the ODOT Bike-Pedestrian Data Collection Guide.

After the base network and referencing system are established, it is recommended for ODOT to create a comprehensive data standard that aligns with the selected system. The following data should be included:

- **Segment data**
  - Roadside
  - Begin milepoint
  - End Milepoint
  - Speed limit (use 85th percentile speed if available)
  - Number of lanes per direction
  - Parking presence
  - Parking type
  - Parking lane width (assume 8 feet if present but width data is not available)
- **Pedestrian facility data**
  - Pedestrian facility need
  - Pedestrian facility condition

  - Pedestrian facility width
  - Sidewalk buffer presence
  - Sidewalk buffer width (assume 4 feet if present but width data is not available)
  - Sidewalk buffer type
- **Bicycle facility data**
  - Bicycle facility need
  - Bicycle facility type
  - Bicycle facility width (assume 6 feet if present but width data is not available)
  - Bicycle lane buffer presence
  - Bicycle lane buffer width (assume 3 feet if present but width data is not available)
  - Bicycle facility condition
- **Crossing data**
  - LRM key/ID of roadway crossed
  - Location/milepoint

Many jurisdictions will not have the resources to collect and provide all of the previously listed data. MPO partners are more likely to have the data available or have the means to collect or estimate the data. For this reason, the team recommends that ODOT use a tiered system for receiving data from local jurisdictions. ODOT should first work with MPO partners to implement this system and track the performance measures in MPO areas. From there, ODOT can expand to other cities and urban areas. ODOT should recommend that during Transportation System Planning efforts, local jurisdictions perform level of traffic stress analyses on their roadways. That will allow the measure to be more easily tracked in these areas. For areas that do not have the data available, parallel research efforts at ODOT and beyond are working toward more automated data collection. ODOT is launching an initiative to test the abilities of LIDAR and artificial intelligence systems to automate asset inventorying. If this initiative is successful and funding can be secured, ODOT may be able to expand their data collection efforts to locally owned facilities as well, after inventorying ODOT facilities.

Future Decision Points or Actions:

After deciding on the base network system, ODOT will need to:

- Create a formal data standard and data collection and submittal guide to provide to local jurisdictions and create consistency in the data provided by various jurisdictions. This will need to occur after the base network system is chosen. Those creating the data standard should also coordinate with the Oregon Bicycle and Pedestrian Advisory Committee (OBPAC), the Association of Oregon Counties, and the League of Oregon Cities to determine existing local asset data availability and format.
- Determine which data is already included in the ODOT Ped/Bike Data Collection Guide and current asset metadata to reflect the new data. If new data needs to be added, which may be necessary to support the pedestrian LTS data, those two sources should be updated accordingly.

Establish Priority Areas

The future access measures will focus on the low stress walking and biking facilities and crossings within priority areas. ODOT will need to define these "priority areas", then can target those for initial data requests. These priority areas can be established a number of ways. They can be specific corridors that are identified by local agencies as being part of their priority networks, ODOT can create a methodology for establishing the priority areas at a more statewide level, or a combination of these methodologies can be applied. Many of the criteria used for the ODOT Active Transportation Needs Inventory and applied to determine the near-term ODOT priority corridors can be applied statewide without requiring additional data from the local agencies. Priority areas identified for ODOT performance measures should coordinate with DLCD's "Climate Friendly areas" and other priority area designations used for statewide performance measurement.

Future Decision Points or Actions:

- Establish and implement the methodology for priority areas

Inventory, Receive, and Apply Data to Base Network

After determining the base network to which the data will be associated, establishing the data needs, and creating the priority areas, ODOT should set up a system for receiving data. The system for receiving data will be dependent upon the system that ODOT decides upon for the base network and data hosting platform. If OSM is to be used for hosting the data, local jurisdictions are encouraged to add their assets to OSM. Regardless of the network, local jurisdictions should be encouraged to provide their data.

If ODOT decides to host the data, either on the ODOT LRS network or by downloading the OSM network, there will need to be a system for taking asset data with associated attributes and reconciling that data onto the network. The level of effort for reconciling the data onto the appropriate network can be significant and will vary for each jurisdiction's data depending on the format of their data and the alignment with the chosen network. The two main options for data reconciliation include:

- Option 1: have local jurisdictions compare their network to the statewide network and if the geometries do not align, integrate their data onto the statewide network and share that data with ODOT
- Option 2: have local jurisdictions share their data with ODOT, who then compares the local network to the statewide network and if the geometries do not align, integrates the data onto the statewide network

The resources required from ODOT will be greater for the second option, if ODOT is receiving data that has not yet been integrated or conflated to their network.

Jurisdictions with fewer resources are likely to have less developed pedestrian and bicycle facility data and fewer resources for providing or integrating that data. It is recommended that this process of receiving, hosting, and analyzing the pedestrian and bicycle data is implemented in a step-wise process,

first coordinating and receiving data from MPOs or major cities which are more likely to have the data available, then working with medium-sized cities, and finally all other jurisdictions. It is anticipated that pedestrian and bicycle asset data at the MPO level may be required for other statewide initiatives such as Climate Action Plan measures and to support ongoing performance measures work through the Department of Land Conservation and Development. This creates a higher likelihood that the data will be available at these levels and creates a higher need for ongoing interagency coordination.

Another option for receiving data from jurisdictions that do not have quality data is for ODOT to perform data collection. This is not currently feasible for ODOT to do; however, ongoing research and pilots into the use of machine learning systems for the use of data collection may make this feasible to implement in the future if additional staff resources are identified to manage these processes and/or cost sharing approaches are developed with state and local partners. ODOT has a research project focused on using LIDAR data currently collected by ODOT to develop asset inventories beginning next year. Third party services may also be able to automate asset inventories using satellite imagery or other data, but before committing to a third party system, ODOT should make sure accuracy of the data is high.

Evaluate Level of Traffic Stress

Once the data has been received and is applied to the base network, ODOT can calculate the LTS for each segment. ODOT's Transportation Planning and Analysis Unit established a script that automates the process for calculating bicycle LTS on ODOT facilities. This script can likely be applied with minor changes to local jurisdiction roadways, too. Although it is not currently under development, a similar script for pedestrian LTS is likely to be developed in the near future. This will then be able to be applied statewide as well. The length of total roadways within the priority areas should then be compared to the number of miles of roadways within the priority areas that are LTS 1 or 2.

Future Decision Points or Actions:

- Apply the current LTS methodologies to the data to calculate the LTS for each roadway segment.
- Consider developing a simplified level of traffic stress methodology or create assumed values to make it more feasible to apply statewide.

Update Data

After a baseline pedestrian and bicycle statewide asset inventory is established, it will be necessary to update the data as the system changes to track progress over time. The data will be updated differently depending on the final selected system for hosting the data. If OSM is utilized, jurisdictions should be encouraged to make direct changes to the OSM system over time as improvements are made. If ODOT hosts the data, ArcGIS Online or other similar viewing platforms can be set up for local jurisdictions to manually edit the data on the network. Jurisdictions could also provide an updated data set if the edits are significant. If the ODOT network is different than the local jurisdiction network, it will require integration onto the ODOT network again.

Initially, data updates should be targeted for approximately every 4-5 years. This timescale is consistent with DLCD's anticipated reporting requirement and balances regular performance tracking with realistic expectations around data update.

Resources

Creating the statewide pedestrian and bicycle asset inventory and repository will require significant effort, and maintaining the data will require ongoing coordination with each jurisdiction. Based on the 36 counties and approximately 100 cities with a population of 5,000 or greater, there will be approximately 136 jurisdictions with which to coordinate. Initial start-up, including receiving and reconciling data onto a base network is likely to take 2 full-time equivalents (FTE) the first year. This assumes an average of approximately 30 hours per jurisdiction. Beyond that, coordination and maintenance over time after the initial start-up phase is likely to take 1 FTE per year, based on an estimate of coordinating for 15 hours with each jurisdiction. This estimate assumes that ODOT is receiving all data from the local jurisdictions, not performing data collection themselves. This estimate may change over time depending on the system chosen and available technologies for collecting and reporting data.

Additional Considerations and Coordination

There are a number of related initiatives underway within the ODOT and other agencies within the State of Oregon that may affect the statewide asset inventory and repository.

Cy Smith is the Oregon Geospatial Information Officer and is leading an effort toward articulating and implementing a data strategy that includes a central web portal for publication of data and an enterprise data inventory: GEOHub. GEOHub, will provide capabilities for partners to share data, applications, and tools and to collaborate more effectively on common initiatives. This initiative is likely to use the statewide LRS as the backbone of the roadway network. If implemented, this system would likely address Steps 1-5 of the process outlined above and may be used to host the pedestrian and bicycle asset data. If this does move forward, the list of recommended data presented in the *Determine Data Needs and Formatting* section should be included in the data within GEOHub. Jennifer Campbell is a representative for that initiative and should provide continuity between the GEOHub initiative and this pedestrian and bicycle asset inventory and repository plan.

Additionally, Peter Schuytema within the Transportation Planning and Analysis Unit is exploring an initiative to create a shareable statewide ArcGIS online based system that would allow agency partners to edit link level information, including level of traffic stress data or the supporting data. If this can be used and applied successfully statewide, this initiative may also address Steps 1-5 of the process outlined above and could be used to host the pedestrian and bicycle asset data without any or much additional effort by the Public Transportation Unit. Because these two initiatives can so dramatically impact the need for the Public Transportation Unit to create a statewide pedestrian and bicycle inventory and repository, Peter and Jennifer should inform the Pedestrian and Bicycle Program Manager, Jessica Horning, of progress as the initiatives progress.

Additional considerations throughout the implementation of this process include:

- Responsibility for hosting the data. If the GEOHub initiative successfully creates a location for data sharing and storage, ODOT will not need to separately host the data even if the LRS is the selected base network. If the GEOHub initiative does not address the need for a pedestrian and bicycle asset inventory and repository and OSM is not the selected base network, the data should be added to TransInfo
- How and whether to include intersections in the statewide dataset. It is not necessary for the calculation of the future access measures but could be useful for other initiatives, including the application of pedestrian push button data to volume estimation which would support the future safety and utilization measures.
- How and whether to include off-street facilities and paths that don't follow a centerline.

NON-MOTORIZED COUNT PROGRAM

Developing a non-motorized count program is key to establishing several long-term performance measures, including *number of bicycle crashes per 100 million bicycle miles traveled, number of pedestrian crashes per 100 million pedestrian miles traveled,* and *number of people walking and biking*. The count program will also support other programs and initiatives internal to ODOT, from project identification to design and delivery.

An official non-motorized count program should utilize the efforts ODOT has already made to collect pedestrian and bicycle counts in the past, while formalizing a future process for identifying count locations, validating and storing data, conducting performance measurement, and sharing validated data with partners and stakeholders.

A literature review was conducted at the beginning of the project to help support this effort; the following documents informed the approach outlined below. As staff and funding become available to establish the non-motorized count program and the next level of implementation is determined (i.e. decisions on technology types, exact placement of counters, etc.), these resources may continue to bring additional value.

- 2016 Traffic Monitoring Guide by Federal Highway Administration
- NCHRP Report 797: Guidebook on Bicycle and Pedestrian Data Collection
- Orange County Transportation Authority (OCTA) Active Transportation Count Program (January 2019)
- Colorado Department of Transportation (CDOT) Non-Motorized Monitoring Program Evaluation and Implementation Plan (October 2016)
- Michigan Department of Transportation (MDOT) Non-motorized Data Collection and Monitoring Program Guide and Implementation Plan (February 2019)

Program Objectives and Uses

Although the need for establishing a non-motorized count program is driven by the pedestrian and bicycle performance measures, the program will support multiple purposes. ODOT staff and partner agencies created the following list of program objectives and uses:

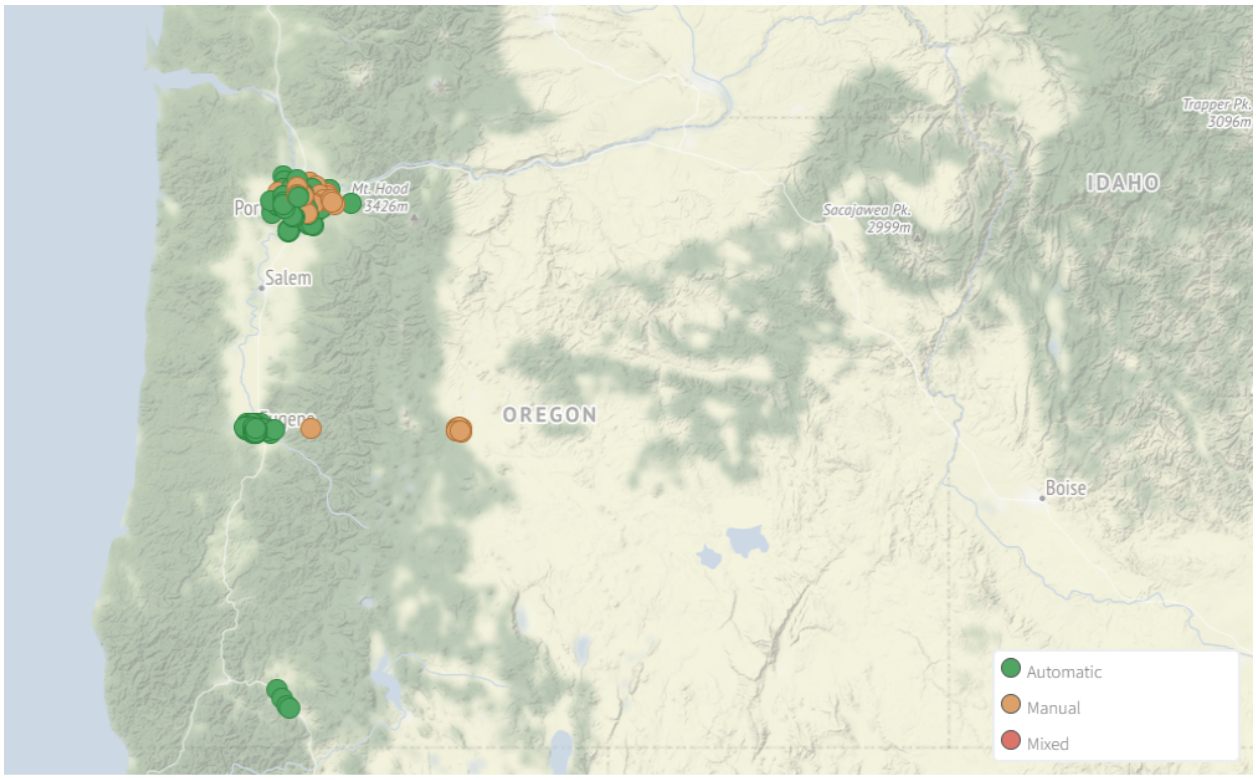
- Track performance measures: estimate pedestrian and bicycle miles traveled per roadway and inform crash rate exposure
- Assess non-motorized trends over time
- Provide context and make a case for pedestrian and bicycle improvements
- Inform funding decisions
- Prioritize improvements
- Determine impact of projects (before and after counts)
- Inform design decisions
- Provide input to Highway Safety Manual (HSM) methods for systemic crash analyses
- Provide data for understanding public health benefits of active transportation
- Reporting for federal regulations (Congestion Mitigation and Air Quality Improvement Program [CMAQ], future climate regulations, etc.)
- Reporting for state requirements (Department of Land Conservation and Development [DLCD], key performance measures, etc.)

The vision for the count program is to establish both continuous and short-duration count stations throughout the state, covering ODOT and non-ODOT facilities. However, the set-up and maintenance needs to meet this statewide goal will require significant staff time and equipment. Similar to the approach to reaching the future access measures vision, it is recommended to establish the count program in phases. Each phase will include manageable tasks that grow the program over time.

Existing Statewide Non-Motorized Counts

The BikePed Portal is a non-motorized count archive hosted by Portland State University (PSU) since 2015. The National Institute for Transportation and Communities (NITC) developed the archive through a pooled fund grant. The image below is a screen capture of the Oregon count locations provided through the site. This is not an exhaustive list of non-motorized counts in the state, but it does highlight agencies that are already sharing and compiling counts and a potential format or tool for aggregating them statewide.

Figure 1: Oregon Non-motorized Count Locations Archived via the BikePed Portal



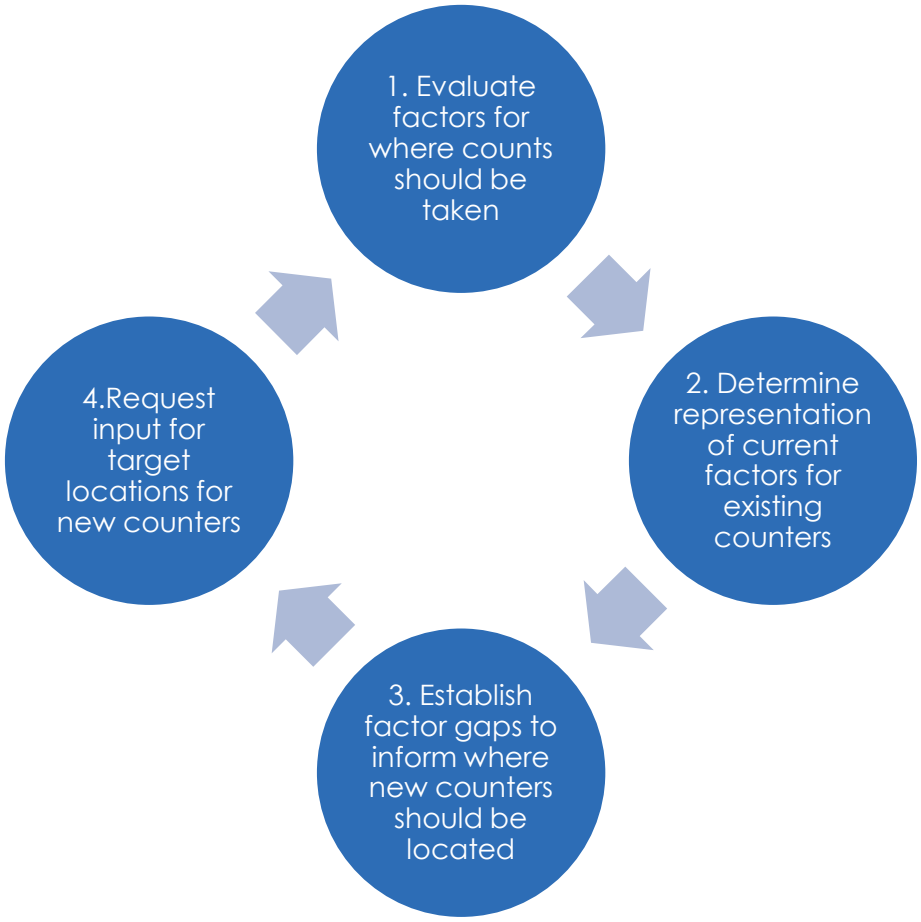
Source: http://bikeped.trec.pdx.edu/

As shown, there are non-motorized counts provided for four metropolitan areas: Bend, Portland, Eugene, and Medford. The Oregon jurisdictions linked to the counts include ODOT, Metro, Clackamas County, Jackson County, Lane Council of Governments, Bend MPO, City of Bend, City of Portland, and Tualatin Hills Park and Recreation District. There are over 250 Oregon counts sites shown through the BikePed Portal, including both automatic counts and manual counts. ODOT is listed as a partner agency and owns several permanent counters across the state, managed by different groups within ODOT. Although this example shows a potential format to share pedestrian and bicycle counter data, it is not representative of all non-motorized counts in the state and is specifically missing most of ODOT's permanent count data which is currently being integrated into the MS2 database.

Factors for Selecting Count Locations

When determining the locations for continuous and short-duration counter sites, there are many factors that could be used to provide a set that is representative to the study area. Factors may change over time or additional factors may become more relevant over time. A cyclic process, as shown in Figure 2 , is needed to refine and expand count locations over time as ODOT's priorities change and as non-motorized count program practices and technologies evolve.

Figure 2: Count Location Selection Process



When determining the number of sites for continuous and short-duration count locations, the current practices point to having 2-3 index sites (continuous counts) and 3-4 temporary locations per factor group. It is important to note that pedestrians and bicyclists travel differently and therefore not every index site or count locations will be applicable to both modes. Key limitations and considerations when selecting count sites are listed below:

- The current existing technologies make it difficult to count in mixed traffic locations. Additional effort will be needed to design the counter placements at these locations.
- Determining the exact configuration for pedestrian and bicyclist counters is complex and unique for each mode. They do not have restricted entry and exit points, and therefore during the site selection process, the likely movements of each mode should be considered.
    - Pedestrian travel is often more complex and unconstrained than bicycle travel. Many transportation agencies have focused their nonmotorized count programs on bicycle travel more than pedestrian travel due to the difficulty of estimating travel at a region or state level. Technology limitations also create challenges for counting pedestrians in multimodal or busy environments.
- ODOT is interested in all anticipated transportation facilities for non-motorized users. There are some facility types that are not within the scope of the work ODOT is interested in. For

example, mountain bike trails or trails within parks that are not connected to other facilities are used for recreational purposes outside of the transportation uses that ODOT is looking to measure and understand.

Number of Count Sites

Through review of current practices and non-motorized count programs, a set of primary and secondary site factors are recommended as ODOT selects index sites and then counter locations. The primary factor groups will determine the first group of counter locations, which will be expanded to cover the secondary factor during count program implementation. Table 2 highlights the primary site factor types recommended to select the initial list of locations.

Table 2: Primary Site Factors for Consideration

Primary Index Site Factors		
ODOT Region	**Non-motorized Travel Pattern**	**Land Use Type**
Region 1: Portland Metro Region 2: Willamette Valley and North Coast Region 3: Southwestern Oregon Region 4: Central Oregon Region 5: Eastern Oregon	Commuter Recreational Mixed	Rural Urban Gateway Urban Urban Low Volume

Based on the list of primary index site factors shown in the table, there are up to 45 primary factor groups that could be formed. For each factor group, there will need to be at least two to three index sites,. The pedestrian and bicycle count locations may be the same; however, counters will be needed to count and differentiate between the two modes, often resulting in multiple counters per location. This results in a primary set of between 90 and 135 permanent index sites statewide.

Long-term Number of Count Sites

As the program expands, another site factor that is recommended for pedestrian and bicycle travel coverage is LTS. LTS can be an important factor in pedestrian and bicycle facility usage, as more people are likely to feel comfortable using lower stress facilities. Although many count programs are developed considering facility type, LTS is more likely to be correlated with volumes. LTS provides a factor that can help balance usage expectations and could therefore be useful when creating factor groups that determine index sites. Although ODOT has bicycle LTS calculated for all their roadways, pedestrian LTS is not yet available. In addition, there is not a database of LTS designations for all roadways available at this time. With this in mind, it is recommended to start with the three factors provided above for the short-term selection of count sites as the program is initiated. When the program has matured and there is interest in expanding, LTS can be introduced into the factor groups.

Potential Future Probe Data Fusion

The site factors recommended for the factor groups were selected because they will allow for coverage of both geography and pedestrian/bicycle travel patterns, but there are additional characteristics of each count site that should be tracked when counters are implemented. These are characteristics that will be useful when incorporating probe data but that should not necessarily impact count location decisions. When probe data is collected in highly multimodal areas, it can be difficult to determine the mode of travel. With that in mind, probe data providers like Streetlight are exploring methodologies to use characteristics about facility type and adjacent transit service to better separate modal data in those areas. ODOT can set up the program for incorporating probe data in the future by tracking these additional characteristics that provide better modal representations.

Suggested characteristics to track include:

- Non-motorized facility type(s)
- Non-motorized facility location with respect to the roadway (on roadway, adjacent to roadway, or separate right of way)
- Adjacent to transit service (bus, rail, streetcar, etc)

This information should be included along with counter and technology type as attribute data recorded for each counter.

In addition to providing characteristic data to a probe data provider in the future as part of a contract, ODOT may decide to also share subsets of actual count data to help calibrate their volumes. In the long-term, a better calibrated methodology will allow the provider to give ODOT better data moving forward.

Permanent Continuous Counters (Index Sites)

Continuous counters at index sites provide information about temporal trends for a specific factor group. This data will then be used to extrapolate bicycle and pedestrian traffic at short duration count sites to estimate pedestrian and bicycle miles traveled per roadway and inform crash rate exposure for key performance measure tracking. With continuous counts, the fluctuations in non-motorized traffic based on day of week, time of year, weather conditions, and other local events can be reviewed and estimated.

When identifying index sites, the following should be considered:

- Sites should be located at network pinch points or areas where it is likely that all users are taking a similar path to be captured by the counter.
- The technology for collecting continuous counts have limitations, as described in the next sections. For example, counters are typically more accurate in locations without motor vehicles. Some counters are limited to the path width they can cover or require a post for mounting.
- Counts should be collected on a level grade where bicyclists are not going above the average speed and where pedestrians are walking and not congregating.

- Many non-motorized count programs (i.e. OCTA, CDOT) recommend establishing index sites at locations where the volume of pedestrians and bicyclists at the site is at least 100 per day, with higher volumes preferred. Sufficient volume data is needed to make meaningful conclusions about trends. Because one outcome of ODOT's non-motorized count program will be to estimate pedestrian and bicycle miles traveled, lower use facilities will still be of interest. ODOT will need to determine if counter equipment should be deployed on these lower use facilities or if a methodology for simulated counts may work for the KPM estimates. The research group has explored a methodology for simulated counts in zero traffic likely areas that could be a starting point.
- Maintenance considerations (e.g. posts that can get knocked over or burned, travel time to site for maintenance, validation, manual data downloads, etc.)

It is important to note that research around extrapolating pedestrian and bicycle counts based on counter data is ongoing. Local travel patterns may differ widely across Oregon and weather events, as short as an hour or two, can greatly impact a person's decision to roll or walk on a given day.

Short-Duration Counters

Regular short duration counts can augment our understanding of the spatial distribution of bicycle and pedestrian travel and volumes and trends can be compared to permanent counters. The counts can be used to inform the bicycle and pedestrian flow map and help estimate volumes across the network. A widespread understanding of bicycle and pedestrian travel can inform everything from high injury crash risk, public health impacts and economic impact studies to traffic signal operations.

Short duration counts are used in tandem with the continuous counters to inform change over time and the spatial distribution of bicycling and walking. These foundational data types can be combined with other data sources such as socio demographics, roadway characteristics, and GPS-trace data from smart phone apps to estimate bicycle and pedestrian volumes throughout a network.

For ODOT's non-motorized count program, short duration counts will be extrapolated using the permanent continuous counts at index sites. The Pedestrian and Bicycle Program will then be able to estimate pedestrian and bicycle miles traveled per roadway and inform crash rate exposure for key performance measure tracking.

Potential Technologies and Considerations

As noted earlier, pedestrian travel is more complex and unconstrained than bicycle travel. Because of this, there are more potential technologies for collecting bicycle counts. For locations where only collecting bicycle counts, the most common technologies include inductive loops, piezoelectric sensors, and pneumatic tubes with equipment costs ranging from approximately $1,000 to $6,000 per location plus installation costs. These counter types can be purchased off the shelf from vendors, and vendors can often help with identifying which equipment will work at specific sites. Professional engineers will be required to perform or oversee design work that occurs within the right of way.

- **Inductive loops** – electrical wire installed under the pavement surface that can detect bicyclists when they pass over the loops. For bicycle counts, inductive loops should be placed in a bicycle facility such as a bike lane or paved path. Although inductive loops can be placed on top of the pavement for a temporary installation, they are most often embedded in the pavement for a permanent installation. A permanent installation includes sawcutting. Inductive loops are recommended for permanent counter locations.
- **Piezoelectric sensors** – sensors that are installed as two strips under the pavement surface, collecting bicycle speed and direction of travel. They are embedded in the pavement, requiring sawcutting.
- **Pneumatic tubes** – rubber tubes that are pulled across a bicycle facility, counting when a bicycle changes the air pressure as it rides over the tubes. Because they are not embedded into the pavement, pneumatic tubes are very portable and are recommended for short duration counts.

When considering both pedestrian and bicycle counts at a location, potential technologies include image recognition software, manual counts from video, and passive infrared counters with equipment costs ranging from approximately $1,000 to $6,000 per location.

- **Image recognition software** – a software that is becoming available from some signal detection vendors that detects non-motorized users through video or thermal camera images. This technology is most accurate when bicyclists and pedestrians and motor vehicles are in separate areas (i.e. pedestrians on a sidewalk, cyclists in a bike lane, and vehicles in a travel lane). When the modes are mixed, the count accuracy is reduced.
- **Manual counts from video** – video reduction where bicycles and pedestrians are counted, which can also include other characteristics about users such as helmet use, wrong-way riding, and sidewalk riding. Short duration manual counts can be an easy add-on to already planned vehicle counts, but become less cost-efficient the longer the counts are collected due to the cost of labor to reduce. Machine learning video counters are also in circulation but as newer technologies, the accuracy may not currently be competitive to manual video reduction.
- **Passive infrared counters** – mobile units that count all heat sources. Although they are the most common technology for counting pedestrians, count accuracy is reduced in higher activity settings where pedestrian, bicyclists, and even buildings or vehicles may be counted if they are giving off heat. With this in mind, passive infrared counters are recommended in pedestrian-only settings or in combination with a bicycle counting technology.

Less common or emerging technologies for non-motorized counts include radio beams, thermal, laser scanners, pressure and acoustic pads, magnetometers, and fiberoptic pressure sensors. It will be important to continue to monitor the progress for these technologies to understand if they are better suited for ODOT's program as implementation moves forward.

Other potential data sources that do not require specific pedestrian/bicycle counters include pushbutton actuations and probe data. ODOT is already aware of these potential data sources and plans to conduct research around applications for a future non-motorized count program. ODOT is likely to start pushbutton actuation research in summer 2021. Because of the challenges associated with pedestrian

count technologies and the scalability of a pedestrian pushbutton count program, we recommend pedestrian push button based counts serving as the main source of pedestrian counts and augmenting those with permanent and temporary pedestrian counts in appropriate sites. ODOT TSM and ITS are working together on getting traffic count data estimated from traffic signal controllers into MS2, but count data from traffic controllers have wildly varying levels of accuracy and usefulness depending on each intersection's detection layout. Bicycle data from traffic signal controllers is especially problematic for the following reasons:

- Detectors are set up primarily to detect presence of a user, not necessarily to discreetly parse individual users. Therefore, counts from detectors are often not going to be as accurate as other counting methods.
- Bicycles are served across a wider range of "facility types" from protected facilities to shared lanes, some of which do not have detection available.
- Cyclists may also use other facilities like a sidewalk or the travel lane when crossing at an intersection, leading to undercounting.

Resources

A number of resources and resource types will be needed to initiate, grow, and then maintain a non-motorized count program. The sections below describe estimated needs and key considerations to move forward.

Permanent Counter Equipment Needs

The main equipment needs to initialize a non-motorized count program are the permanent counters. Depending on the equipment selected, each counter may also need a power source, junction box, and/or modem for data transmission. Based on the initial 45 factor groups, ODOT should work toward installing 90 - 135 permanent bicycle or joint bicycle and pedestrian counters. If locations are selected where pedestrian and bicycle counter technology can be used in tandem (such as passive infrared and inductive loops), the total index sites could be reduced. The 90 – 125 permanent counters may include existing equipment owned and operated by ODOT and local agencies. In the near-term, staff leading the program will need to conduct a location-based needs assessment to understand how many additional permanent counters need to be purchased to cover the 45 factor groups. Next steps for conducting the needs assessment are discussed in the implementation section. For cost estimating purposes, it was assumed that ODOT would be building its permanent index site counter fleet from scratch for 113 locations although it is likely that there will some sites throughout that state that already have usable permanent counters for index sites. Because of this, it is recommended that ODOT initiate the program with 15 index sites on state facilities first. This will allow the staff to establish procedures and protocols for permanent counter installation, while completing a parallel effort to review existing permanent counters already in the state.

Equipment costs will differ depending on the counter technology, modes being counted, and location complexity. The following costs are based on battery-operated Eco-counter installations occurring in the Boston area between 2019 and 2021. These counter installations were funded by Massachusetts Department of Transportation and therefore do not include federal regulatory standards that may impact costs.

- Joint pedestrian and bicycle counter on trails (equipment only): $4,000
- Joint pedestrian and bicycle counter on a roadway (equipment only): $8,000
- Bicycle-only counter on a roadway (equipment only): $5,000
- Contractor installation for one permanent site including night work, traffic management, and testing (in addition to equipment cost): $6,000

For purposes of estimating an equipment cost range, the following unit costs were assumed:

- Bicycle-only counter and installation: $11,000
- Joint pedestrian and bicycle counter and installation: $14,000

Pedestrian-only counters were not included, as pushbutton counts are anticipated to provide the basis of the pedestrian counts in the state. If only bicycle count locations are installed (assuming 113 locations), equipment and installation costs are estimated to be approximately $1,243,000. If only joint count locations are installed (assuming 113 locations), equipment and installation costs are estimated to be approximately $1,582,000. It is assumed that a combination of these two scenarios will be most likely when installing counters across the state, with a cost ranging between these two estimates. In addition to this initial investment for the permanent index site counters, there are ongoing equipment costs related to replacing the equipment, data transmission, counter transportation, and storage. Transportation and storage are estimated at 10% of the total counter costs. The following are annual cost estimates related to these needs, totaling $193,200 to $230,500 per year once the program has been fully established with 113 index site locations:

- Counter replacement costs (every 10 years) – $124,300 to $158,200 per year
- Battery replacement costs ($200 every 2 years) – $11,300 per year
- Data transmission costs ($400 per location per year) - $45,200 per year
- Counter transportation (vans) and storage - $12,400 to 15,800 per year (10% of counter costs)

Manual data transmission is also an option for each counter but it is assumed that the cost of having an employee travel to each site, download the data, then upload the data into a shared format would cost approximately the same or more each year. Automatic data transmission also allows for current data to be accessed and the data to be monitored to

Short-Duration Counter Equipment Needs

Establishing a short-duration counter fleet is important for eventually estimating statewide pedestrian and bicycle miles traveled, but it is recommended as a secondary focus after establishing permanent index site counters. This is because the short-duration count data needs the permanent count data for extrapolation. When ODOT is ready to invest in short-term counter equipment, the currently used technologies cost between $1,000 and $6,000 per location, including pneumatic tubes, passive infrared counters, manual counts from video, and image recognition software. Because they are not permanently installed, it is assumed that ODOT staff will be used for the temporary installations instead of external construction labor costs.

Ideally, there will be five to seven short-duration counts per factor group or 225 to 315 counts with the 45 identified factor groups. Because the counts will be used to support the annual key performance measure tracking, it is assumed that 225 to 315 short-term locations will be counted each year. For cost estimating purposed, the counters are assumed to reside at each location for two months, resulting in a short-duration counter fleet of 38 to 53 counters. If 45 short-term counters are assumed, the equipment costs are estimated to be approximately $270,000. In addition to this initial investment for the short-duration counters, there are ongoing equipment costs related to replacing the equipment. If a life cycle of 5 years is assumed, the annual replacement costs are estimated to be $54,000.

- Counter replacement costs (every 5 years) – $270,000 per year
- Battery replacement costs ($200 every 2 years) – $4,500 per year
- Counter transportation (vans) and storage - $27,000 per year (10% of counter costs)

Battery replacement costs may or may not be needed depending on the technology selected.

For efficiency's sake, the short-term counters can be deployed when TSM field technicians are performing their annual coverage counts. Although ODOT will want to strategically locate these short-term counters to cover the factor groups, initial placement does not need to be as strategic because any counts will help to cover some factor groups.

Staff and Resource Needs

In addition to equipment and installation resources, staff resources will be needed to coordinate the installations and maintenance, develop installation diagrams, and validate the data. As the non-motorized count program begins, the necessary staff resources will depend on the number of counters that are deployed. As the program then grows, ODOT should explore shared responsibility of the program tasks across different divisions and units. For example, the Colorado Department of Transportation shares responsibility between their Transportation Development, Bicycle and Pedestrian Program, and Traffic Analysis Unit.

Program Element Tasks	Estimated Staff Resource Needs	Other Considerations
Internal Program Initiation (One-time Need)		
Determine roles and responsibilities of ODOT staff across departments. Select preferred technologies and establish a contract with vendor(s). Select 3 index site locations per region to install a first phase of permanent counters on state facilities. Establish standard details and specifications language for permanent counter installations. Coordinate with local agencies to determine interest in participating in a statewide program. Review existing ODOT and non-ODOT permanent counters for factor group representation. Complete needs assessment for new permanent index site counters after implement phase and existing counters. Establish a system for adding short duration counts to the count database.	10 hours per week for two years **This is equivalent to approximately 0.25 FTEs per year. ***	Additional outreach to agencies that have their own non-motorized count programs is recommended to support these tasks.
Develop Installation Diagrams (One-time Need)		
Conduct a site visit and develop installation diagrams and traffic management plans.	25 hours per site If 113 separate count sites are installed, this will include approximately 2,825 hours of resource time, spaced over approximately 3 years. **This is equivalent to approximately 0.5 FTEs per year.** *	The hour estimate is based on an anticipated need for a combination of high-level installation diagrams and design-level plans, depending on the site. Determine technology first. It will determine a lot of the components needed and influence placement and installation needs. Includes a site visit to determine the technology and best locations. If need a junction box, try to avoid placement within a bicycle facility. Although the installation diagrams can be simple, they will likely require traffic management plans. Additional resource time may be needed to develop traffic management plans if the location is adjacent or within a traveled roadway (i.e. restrict access to adjacent facilities 200 feet upstream and downstream of the site during installation).
Installation (One-time Need)		
Coordinate the contractor and be on-site during installation. Acquire permits as needed.	8 hours per site If 113 separate count sites are installed, this will include approximately 900 hours of resource time, spaced over approximately 3 years. **This is equivalent to approximately 0.15 FTEs per year. ***	It is recommended to conduct installation at night or non-peak periods for the facility's use. It is recommended to have a project team member on-site for installation to verify placement and that the counter is functioning before the contractor leaves. Coordination with a contractor will be streamlined if the contractor is identified before creating the installation diagrams or if using the same contractor for all similar technology sites. If the permitting process will occur through a separate agency or separate unit within ODOT, permitting may be the biggest time component of the installation process.
On-going Program Management		
Coordinate staff and units to complete on-going tasks. Establish a process for determining if permanent counters should	10 hours per week	Potential units to support the program include the Pedestrian and Bicycle Program, TPAU, Traffic Monitoring, TSM, ITS, and Research. ODOT will need to

be included in upcoming projects. Determine where/when/how to install permanent counters as part of projects. Coordinate with TPAU to combine with other data sources, to include in models, and to estimate traffic flows. Review count data from index sites and short-term counts to verify they are good locations and the best way to configure the equipment. Identify new count locations as needed. Coordinate with ODOT project teams to identify when/where/how counters should be installed with projects. Work with local partner agencies to verify program use and any updates to permanent counters.	**This is equivalent to approximately 0.25 FTEs per year.**	determine which analyses will utilize the data in addition to the annual key performance measure tracking. Many uses will likely be ad hoc, but if some analyses will be recurring, the FTE estimate may need to be adjusted.
On-going Permanent Counter Maintenance		
Visit sites to replace batteries, take care of vandalism or animal impacts, verify it is functioning, and perform minor maintenance. Replacement of counter equipment. Permanent counter life cycle assumed to be 10 years.	Up to 14 hours per year per counter and 8 hours every 10 years per counter If 113 separate count sites are installed and have a life span of 10 years, this will include approximately 1690 hours per year. **This is equivalent to approximately 0.80 FTEs per year.**	As with other assets, maintenance needs will fluctuate greatly between locations. Distance to the count sites will also impact resource needs. Develop local maintenance agreements, as necessary.
On-going Short-Duration Counter Management		
Move short-term counter equipment from one count location to the next, including data downloads. Work with local partner agencies to determine if they have acceptable short-term counts to add to the program. Add short duration counts to the count database.	6 hours per count location If 270 short-duration counts are assumed per year, this will include approximately 1620 hours per year. **This is equivalent to approximately 0.78 FTEs per year.**	ODOT may decide to invest in mobile short-duration counters earlier in the project initiation phase to support selection of index sites.
On-going Data Quality Control and Validation		
Upload data to MS2 database. Check that data is being received for each location. Conduct the quality control protocols to validate counts from each location. Troubleshoot if there are issues.	6 hours per year per counter If 113 separate count sites are installed, this will include approximately 900 hours per year. **This is equivalent to approximately 0.45 FTEs initially. *** When 45 short duration counts are added, this will require an additional .1 FTEs. Thus, in total this is anticipated to take **.55 FTEs after short duration counts are added.** This is assumed to occur after the first 3-year start-up phase.	Simply checking if things are running smoothly will take a small amount of time, but troubleshooting and scrubbing data will require the majority of this time.

Notes: * Included in initially programed FTE estimate.

As the program is initiated, 2.5 dedicated FTEs are estimate to be needed for the first three years. If the program does expand to cover the full state and short duration counters are added, 2.38 dedicated FTEs are estimated to be needed to support the program to oversee and coordinate counters and perform basic data validation annually after the initial start-up phase. After the count program is implemented, the amount of resources needed will likely not drop significantly, as the counters will need to be

maintained and replaced on an on-going basis. As LTS is incorporated into the factor groups, it is also likely that the new count sites will need to be added to account for the new information.

This estimate per year is focused on the installation and maintenance of permanent counters and does not include volume expansion. This estimate aligns with what the team found to be true in speaking to similar agencies with count programs during interviews. WashDOT has approximately 1 FTE focused on maintenance and overseeing counter implementation (including development of installation plans), for approximately 65 sites total. They do not use outside contractors but instead have about 1 additional FTE focused solely on counter construction in the field. They also have resources dedicated to data processing and analysis beyond what is outlined above, for the purpose of applying the counts.

The team identified several considerations for minimizing new effort and maximizing current efforts:

- From the literature review from the Orange County Transportation Authority (OCTA) active transportation count program, one lesson learned is to partner with a university to reduce agency program development effort. As discussed earlier, TREC at PSU is one example of a university collaboration around non-motorized counts that is already in place and used both by agencies in Oregon and across the country. WashDOT partnered with TREC to help make decisions about counter locations and count methodologies and technologies.
- Stay engaged with ongoing vehicle count efforts through collaboration with the ODOT Transportation Systems Monitoring Unit and IT staff. When ODOT is collecting short-duration counts for a project or through another program, non-motorized counts can often be added for minimal additional cost to already occurring vehicle counts. This should be added to those counts taken in-house as well as those performed by contractors. In addition, permanent counters may be able to be installed during previously planned construction activities, minimizing the amount of time and resources required for developing traffic management plans site plans and performing construction.
- When using equipment that requires an external power source, determine the exact location based on ability to tie into an existing power source.

Data Storage

ODOT recently acquired the MS2 software and is migrating it to be the traffic counting database of record. MS2 is currently setup to house vehicle count data from ATRs and other sources within the short-term counting program such as turning movement counts. ODOT TSM has not decided how this data would be published or shared within MS2, since they will be of different use and quality from counts collected for HPMS reporting.

As ODOT further explores MS2, the non-motorized count program will import counts into the MS2 system through coordination with the Traffic Monitoring unit. A consultant is currently working on migrating legacy pedestrian and bicycle count data into the MS2 non-motorized module, conducting quality control review of the data, and developing MS2 non-motorized data protocols for ODOT.

After collecting, validating, and storing the data, ODOT may wish to share this information with partner agencies, project teams, or the public. Depending on the protocols that can be set and security processes, utilizing MS2's Nonmotorized Database System is a convenient option. Michigan DOT plans to utilize this database to provide access to local agency users by establishing varying permissions through the web interface and would be a good resource to verify access usage, licensing, and lessons learned. Two other databases already in place that ODOT could coordinate with are the BikePed archive as described above or PORTAL, also through PSU. Another option is to create a custom data-sharing platform. For example, Central Lane MPO utilizes Tableau and could be a resource for ODOT if wishing to have an agency-specific platform.

Implementation and Next Steps

Recommended next steps are sorted below into near-term, mid-term, and long-term action items. These include future studies or research necessary or valuable in implementing the non-motorized count program and supporting the long-term performance measures.

Future Decision Points

As ODOT moves forward with the non-motorized count program, several unknown elements and major decision points will need to be explored. The decision points have been identified as part of established an action plan:

- Determine the scope of the count program and related key performance measures and analyses. For safety analyses for example, ODOT will be most interested in the network where vehicles might also interface with the non-motorized users. However, urban path systems where the activity on the off-street path is related to the activity on the street segments will be important to consider for some aggregate or system-level safety analyses. Rural paths are worth accounting for in statewide public health analyses. ODOT will need to establish guidance about count program priorities determining if some network segments are not worthwhile to count, such as mountain bike trails in rural areas.
- Determine which existing ODOT permanent counts sites can be utilized or updated to fill an index site need. There are 92 existing count stations being migrated into MS2 currently. In addition, there may be current ATR locations where bike loops can be added to address an index site need.
- Come up with a strategy to coordinate, support, and maintain the existing 92 count sites.
- Verify the site selection factors established above are supported by the involved ODOT units. For example, travel pattern information requires a count or other proxy measure to determine. ODOT may conduct analysis comparing land use characteristics and travel patterns as an appropriate proxy measure.
- Determine the preferred power source and data transmission option for permanent counter locations. The cost estimates above assume battery-operation and virtual data transmissions, but ODOT has some existing counter locations where equipment was

hardwired to a power source and data is manually downloaded to reduce ongoing and recurring costs.

- Determine the preferred process for testing permanent count locations. One option is to review counts previously collected at a location. Another option is to establish a library of short-duration count equipment to be deployed to test potential permanent count sites. ODOT may decide to use a combination of options as well.
- Determine the process and protocols for integrating data already being collected by local agencies like Bend, CLMPO, Washington County, and others. This is especially important for the short duration counts. Known options include ODOT's authoritative system: MS2's Nonmotorized Database System, the BikePed Portland, PORTAL, or a custom data-sharing platform through Tableau.
- Determine the maintenance responsibility and protocols, including ongoing electrical and/or battery costs and communications costs. ODOT District crews generally requires a maintenance IGA with locals.

Near-term – Initiate Index Site Installations on State Facilities and Conduct Research (Years 1 to 3)

- Focus on implementation and analysis of the count program on ODOT facilities first.
- Establish responsibilities across ODOT divisions and units, including communication processes when passing tasks off to another group.
- Initialize an installation of a first phase of permanent counters to gain understanding of the process and create procedures for the design and installation tasks. It is recommended to start with 15 locations, three per region, to allow for a full needs assessment and review of existing counters that may fulfill factor group needs.
- Conduct a full needs assessment for the index site locations. The 90 – 125 permanent counters may include existing equipment owned and operated by ODOT and local agencies. In the near-term, staff leading the program will need to conduct a location-based needs assessment to understand how many additional permanent counters need to be purchased to cover the 45 factor groups.
    - Map existing ODOT permanent non-motorized counter sites to factor groups.
    - Evaluate existing ATR locations for opportunities to add bike loops.
    - Coordinate with local agencies to see who is interested in participating in a statewide data program. Review existing non-ODOT permanent non-motorized counter locations for factor group representation.
    - Identify remaining index site needs after the first implementation phase, ODOT's existing counters, and local partner's existing counters.
- Establish continuous counter index sites that represent factor groups based on region, non-motorized travel pattern, and land use type.
- Examine short-term counts collected for ODOT projects to consider new index site locations. This may require development of a strategy for colling ad hoc data sets since there is no centralized location for this type of information currently.

- Create data quality control protocols to clean and validate continuous counter data. For example, Colorado Department of Transportation checks continuous counter status weekly and cleans continuous counter data semi-annually (i.e. removing data if there is a data gap, high un-validated directional split, or several consecutive days of zero hourly values during warm weather months). This action item is part of the ongoing MS2 Data Migration contract.
- Conduct research on incorporating pedestrian and bicycle signal activations into the count program. Detection and pushbutton activations are not designed to collect counts. As feasibility around vehicle counts is researched, expand on these on-going studies to explore applications or lessons learned for collecting non-motorized counts as well. ODOT Research has a project starting summer 2021 that will focus on estimating pedestrian volumes based on pushbutton activations. This research is expected to be applicable for this program. Bicycle activation may or may not be incorporated into this specific research effort. If not, it should be addressed in a future research project.
    - Guidance will be needed on extrapolation of intersection counts from the push buttons as related to the major street and minor street functional classifications.
- Test implementation and gain understanding of MS2 migration. Work with MS2 team to identify if and how the counter characteristics (facility type, facility location with respect to the roadway, and adjacent transit service) could be tracked in MS2 as part of the counter station set-up being completed now.
- Incorporate continuous counter data quality control protocols and create protocols for temporary count locations.
- Incorporate MS2 non-motorized data storage process. Explore MS2's access and licensing options or utilize the BikePed Portal, TransGIS, or other data sharing platforms to allow agency partners access to data and provide public-facing data after quality control processes.
- Continue collaboration with agencies that have initiated a coordinated non-motorized count program in recent years to discuss lessons learned and to help. Recommended state agencies include Colorado, North Carolina, Massachusetts, Washington, and Minnesota. Request lessons learned in regards to sharing and distributing roles and responsibilities across multiple units.

Mid-term – Test Methodologies and Protocols (Years 3 to 5)

- Review or conduct any additional research around modeling methodologies and extrapolation of short-duration counts based on continuous counts. Extrapolation of short-duration counts is critical to estimating pedestrian and bicycle miles traveled for the long-term key performance measures because they allow for coverage of the state.
    - Test methodologies using short-term counts that ODOT has collected for projects.
- Reevaluate the factor groups, number of index sites per factor, and technologies as the practice evolves to allow the ODOT program to adapt to current best practices.
- Incorporate ODOT's research on pedestrian and bicycle signal activations into the count program.

Long-term – Initiate Temporary Locations and Expand Permanent Installations State-wide (Years 5 to 10)

- Review any additional research completed around modeling methodologies and extrapolation of short-duration counts based on continuous counts to support implementation of the long-term performance measures.
- Reevaluate the factor groups, number of index sites per factor, and technologies as the practice evolves to allow the ODOT program to adapt to current best practices.
    - Consider incorporating pedestrian and bicycle LTS into the factor groups.
- If the factor groups have remained the same, establish short-term count locations that represent factor groups based on region, non-motorized travel pattern, and land use type. It is recommended that each temporary location collects at least seven days of counts before the equipment is moved to the next site. For ODOT's non-motorized count program, short duration counts will be extrapolated using the permanent continuous counts at index sites. The Pedestrian and Bicycle Program will then be able to estimate pedestrian and bicycle miles traveled per roadway and inform crash rate exposure for key performance measure tracking.
- As needed, install permanent counters on non-ODOT facilities to cover index site needs in coordination with local agency partners.