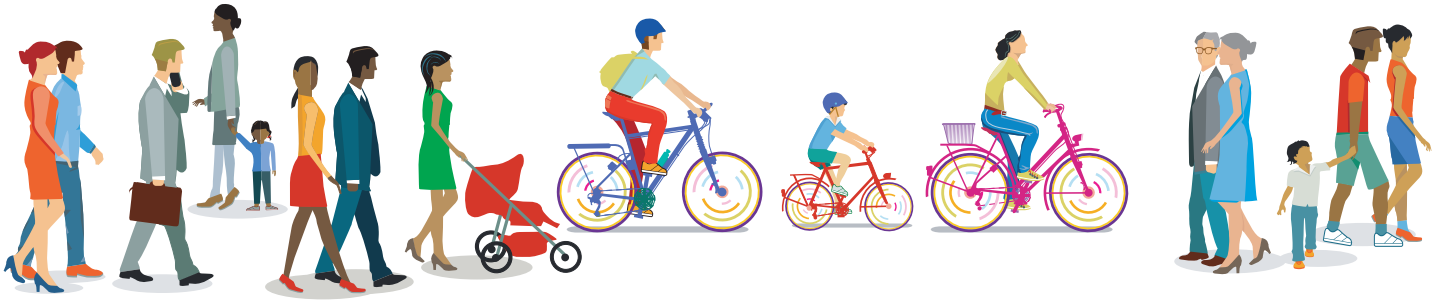
Building Active Communities Through Activity-Friendly Routes Connecting Everyday Destinations

A Guide to Counting Bicyclists and Pedestrians

Community & Clinical
CONNECTIONS
for Prevention & Health
Branch NORTH CAROLINA DIVISION OF PUBLIC HEALTH



Purpose of the Guide

This guide provides information and recommendations to organizations interested in understanding bicycle and pedestrian count data in their community. Counting bicycle and pedestrian (active transportation*) use provides the foundation for estimating non-motorized travel trends and is a useful tool for the planning and management of communities. We hope this guide will increase your knowledge in counting bicyclists and pedestrians and will empower agencies and individuals in North Carolina to establish count programs in their community.

***Active transportation per this guide refers to any self-propelled, human powered mode of transportation, such as walking or bicycling.[1]**

The guide is intended to provide:

- An overview of active transportation counting.
- Recommendations for developing an active transportation count program, including:
  - —Choosing the best location to install a pedestrian counter.
  - —Collecting and utilizing count data.
  - —Demonstrating success from organizations using active transportation count data to advance their missions.
- Methods for counting bicyclists and/or pedestrians using an automatic counter.
- An overview of the NC Division of Public Health's (NCDPH) Pedestrian Counter Loaner Program.

The guide is divided into three sections plus an appendix. Each section includes information that can be used to start an active transportation count program regardless of the equipment, location and resources available.

Section 1 provides an overview of active transportation counting in North Carolina.

Section 2 provides a broad overview of active transportation counting, including reasons to count, types of count data, methods for counting and how to start a count program.

Section 3 provides a technical overview of the installation process for the EcoCounter PYRO-Box Counter. This section will be most helpful for organizations utilizing the NCDPH Pedestrian Counter Loaner Program.

Appendix includes a glossary, case study and resources.

SECTION 1: Overview of Active Transportation in North Carolina[2-6]

Communities in North Carolina are initiating efforts to quantify data for active transportation modes to understand travel trends and plan for future bicycle and pedestrian accommodations. Historically there have been limited efforts to collect this data, which has caused an incomplete picture of a comprehensive transportation network, and has often led to underfunding for bicycle and pedestrian projects. Count programs provide a better understanding of active transportation trends both nationally and in North Carolina, providing greater leverage to plan and accommodate for bicycle and pedestrian facilities.

In 2014, the North Carolina Department of Transportation's (NCDOT) Bicycle and Pedestrian Transportation Division established a statewide bicycle and pedestrian count program. The program was developed in response to the state's growing population, urbanization and a higher demand for bicycle and pedestrian facilities. The North Carolina Non-Motorized Volume Data Program (NC NMVDP) is a collaborative program with state and local agencies collecting active transportation count data throughout North Carolina and sharing this data in a state-wide database. The overarching goals of the NC NMVDP are to evaluate facility usage over time, inform the project prioritization process, provide quantifiable evidence to support multimodal transportation such as Complete Streets policies, and improve active transportation planning and access.

In 2019, NCDPH partnered with NCDOT and the Institute for Transportation Research and Education (ITRE) to support additional pedestrian counters in communities in North Carolina with a Pedestrian Counter Loaner Program. Through this program, organizations can apply to receive a pedestrian counter(s) for up to 12 months. Increasing the number of counters in North Carolina allows more communities to collect and utilize pertinent data to inform transportation planning.

Why Is This Important?

For the first time in our history, we are raising a generation of children who may live shorter lives than their parents. In North Carolina, two out of every three adults and one out of every three children are overweight or obese, and the rates of chronic diseases in North Carolina continue to increase. While these diseases have complex causes, they have been dubbed "lifestyle diseases" and often can

Make Moving More Possible

In North Carolina almost 200 bicyclists and pedestrians are killed each year being struck by an automobile.

6.3% of households in North Carolina do not have access to a vehicle.

67% of our state's adults are considered overweight or obese.

The aging population is continuing to grow, along with our total population, both increasing demand for pedestrian and bicycle facilities.[4,7]

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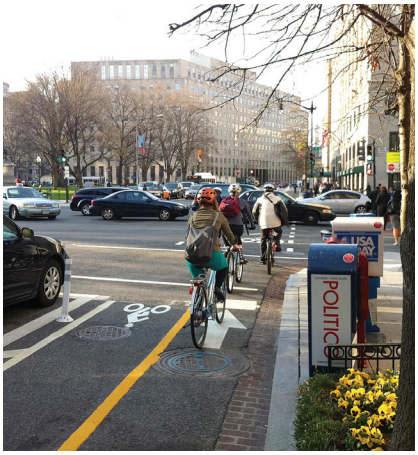
be prevented by adopting healthy lifestyle behaviors such as being physically active.

The environments in which people live can impact their health, whether it be due to lack of sidewalks and bike lanes, unsafe infrastructure and environments, or lack of access to transportation. Communities can help prevent lifestyle diseases by addressing the underlying social and economic conditions that contribute to poor health, such as economic prosperity, housing and transportation.

The Active Living Research Center released a report in 2013 stating that "counting initiatives show that levels of bicycle and pedestrian activity are increasing nationally, but vary significantly, due to differences in infrastructure, neighborhood socio-demographics, urban design, land use and other characteristics of the built environment." We must improve these conditions in order to see lasting improvements in health.

NCDPH supports the Centers for Disease Control and Prevention (CDC) Active People, Healthy Nation[SM] initiative to help 27 million Americans become more physically active by 2027. To improve access to physical activity and increase community-wide activity levels, the Community Preventive Services Task Force recommends connecting activity-friendly transportation routes with everyday destinations, making it safe and convenient for people of all ages and abilities to walk, bike and roll in their community (see Appendix A). Land use and transportation planners, public health practitioners, municipal planning entities and other partners can enhance their community impact and reach by collaborating to create and build environments that better support health. Making data-informed decisions in support of active transportation is just one method that can move us in this direction.



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"Counting initiatives show that levels of bicycle and pedestrian activity are increasing nationally, but vary significantly, due to differences in **infrastructure**, **neighborhood socio-demographics**, **urban design**, **land use** and other characteristics of the **built environment**."

—Active Living Research Center, 2013

SECTION 2: Pedestrian Counting 101[7-10]

Why Count?

If We Do Not Count It, It Does Not Count.

Counters can benefit a variety of stakeholders. Collecting active transportation data helps track changes over time. Tracking these changes can help officials plan, design and advocate for future safe spaces to walk and bike which contribute to building healthier and more active communities. For example, if a municipality is requesting funds to install a school crosswalk at a local elementary school, their local transportation agency may request count data to indicate the need for a crosswalk as evident by the amount of people walking through the area of the proposed crosswalk. Count data can be used to capture current and potential contributions towards reducing congestion, improving air quality and making data-informed decisions to ensure the built environment supports health and physical activity.

Specifically, count data can assist with:

- **Determining baseline volumes** of active transportation activity.
- **Developing** and calibrating multimodal travel demand models.
- **Evaluating trends** at different scales (site, corridor, region).
- **Evaluating the effects of new infrastructure** on bicycle and pedestrian activity.
- **Funding and policy decisions.**
- **Identifying** high-priority locations for bicycle and pedestrian facilities.
- **Inventorying** bicycle and pedestrian routes.
- **Informing** road safety audits.
- **Planning for routes and connectivity analysis.**
- **Making school siting decisions.**
- **Sharing data** with the public to inform bicycle and pedestrian activity and trends.
- **Understanding current trends** and modeling for future usage.

Establishing a Count Program

Important aspects of a count program include:

- **Assessment;** identify and inventory available bicycle and pedestrian count data in your community.
- **Site selection;** identify where the counter will be installed and/or where the count observation will be conducted.
- **Counting method;** determine what type of counting method and/or equipment to use.
- **Data management;** manage and interpret the count data.

Assessment

The Federal Highway Administration's (FHWA) Traffic Monitoring for Non-Motorized Transportation Guide recommends reviewing and developing an inventory of existing count programs before starting your own program. Connecting with the NCDOT, local government and community agencies, and your Metropolitan Planning Organization (MPO) or Rural Planning Organization (RPO) may be helpful in ensuring a full inventory is documented. Once this information has been collected, review existing count programs to assess the overall program

design, traffic patterns, data processing, summary statistics and lessons learned to determine how to best implement your new count initiative.

Check with NCDOT to learn if there are other installed counters in your community as part of the NC NMVDP. Look for any data collection efforts for pedestrians in your community by collecting traffic safety reports, traffic impact studies, environmental impact reports or any regular traffic monitoring programs that may already exist. Additionally, the NCDOT Integrated Mobility Division and ITRE have developed the Pedestrian and Bicycle Infrastructure Network (PBIN), a working database of bicycle and pedestrian facilities throughout the state that can be found on NCDOT's website.

During the assessment phase, the community could consider hosting public forums to hear from local stakeholders, bicycle and pedestrian advocates, academic and research groups and community organizations to help define the need for a count program and an implementation plan. These input sessions can help the organization pinpoint gaps in the existing databases within the community, connect count data with other community plans, policies and trail plans, and research how other similar communities have developed and implemented count programs.

Counting site selection

The count purpose will determine where, when and how data collection should be performed. When identifying potential sites, many agencies consider geography, climate, traffic volume, facility type, urbanization, special needs of community (significant number of non-vehicle ownership households, people with disabilities, children and older adults) and interest of local community.

- **Targeted locations** are usually selected to measure before and after studies from a project. These locations are generally associated with specific projects, facility types or locations with specified characteristics. These locations could be areas of safety concerns or areas with the highest expected volumes of bicycles and/or pedestrians.
- **Representative locations** are identified sites that in aggregate are representative of the traffic network in a community.
- **Control locations** are used to measure change in sites affected by a project with an unaltered site, the control location, to determine how much of an observed change can be attributed to the project.
- **Random locations** are selected at random. This approach may not capture strategic locations. Selecting randomly from within categories of desired characteristics (stratified random sampling) is an alternative form of counting that can be used.

The National Bicycle and Pedestrian Documentation Project recommends site locations based on the following criteria:

- Bicycle and pedestrian activity areas or corridors (downtowns, near schools, parks),
- Representative locations in urban, suburban and rural locations,
- Key corridors that can be used to gauge the impacts of future improvements,
- Locations where counts have been conducted historically,
- Locations where ongoing counts are being conducted by other agencies through a variety of means, including videotaping,
- Gaps, pinch points and locations that are operationally difficult for bicyclists and pedestrians (potential improvement areas), and
- Locations where either bicyclist and/or pedestrian collision numbers are high.

Once a site location is determined, the most suitable counter positioning should be determined. The counter site location is best in places where people are funneled to move from one area to the other, such as bridges and under paths. Observe the movements of people in the area to develop an understanding of the activity in the area before committing to installation. *Avoid* areas where people or objects could potentially interfere with the

counter. Ensure clear travel paths with origin and destinations. Avoid installing counters in locations where they may detect other moving objects such as doors, branches or bushes, motor vehicles, congestion, windows or reflective surfaces.

The National Bicycle and Pedestrian Documentation Project recommends the following guidance for counter siting:

- **Multi-use paths and parks**, locations near the major access points are best.
- **On-street bikeways**, locations where few, if any, alternative parallel routes are best.
- **Traditional downtown areas**, a location near a transit stop or in the center of downtown is best.
- **Shopping malls**, a location near the main entrance and transit stop is best. Count at one access point.
- **Employment areas**, either on the main access roadway or near off-street multi-use paths are best. Count at one access point, typically a sidewalk and street.
- **Residential areas**, locations near higher density developments or near parks and schools are best.

The Federal Highway Administration recommends consideration of these three factors for site selection.

1. **Differentiate bicycle and pedestrian traffic.** If bicyclists and pedestrians are travelling in the same space, specialized equipment should be used to differentiate user types (if this is a factor to be considered in data analysis).
2. **Selecting representative permanent count locations.** Selecting locations that are most representative of prevailing non-motorized traffic patterns (while still having moderate non-motorized traffic levels). In some cases, permanent count locations may be installed at low-use locations if higher use is expected after bicycle and pedestrian facility construction.

Types of count data

Collecting active transportation count data can be a short- or long-term initiative and/or project-specific. The three main types of count data found across the literature include (1) permanent continuous, (2) short duration coverage and (3) short duration project-specific.

Permanent Continuous

This type of counting is collected by installing equipment that monitors active transportation traffic volume 24 hours per day and is usually collected for at least one year. Continuous data shows if there is variation in facility volume throughout the day, week or year, and can be used to understand the effects of weather and temperature on activity levels over time.

Short Duration

This type of counting is the most common method for counting because it does not require any special equipment. Short duration counting is collected on a less than continuous basis and is mostly used to identify trends that can be representative to a geographic area. Short duration count projects can be as little as 30 minutes to several weeks or months. This data can be expanded to estimate for volumes for longer periods of time. FHWA's 2014 Traffic Monitoring Guide recommends short duration counts to be conducted at a minimum of 24 hours a day for seven consecutive days so weekends and weekdays are represented.

The National Bicycle and Pedestrian Documentation Project offers a standard procedure for collecting manual short duration counts.

Short Duration Project-Specific

These types of studies are used for specific projects. Data is collected with a greater level of detail, including information such as the demographics of people utilizing the facility, the type of activities observed and it is often collected in person. An example of this would be conducting a study for a safety analysis that focuses on crosswalk volumes.

3. **Optimal site location:**
   a. On straight, level sections of road or trail, not on curves or near a steep grade.
   b. On smooth pavement or another compacted surface.
   c. Where the traveled way is clearly delineated, and deviation is not common.
   d. For infrared sensors, avoid placement near water or in direct sunlight.
   e. For infrared sensors, avoid placing where counter is directly facing the roadway unless a vertical barrier exists.
   f. For inductive loop detectors, not near high-power utility lines that could disrupt or distort the detection capability.

Counting Methods

Counting can be conducted via manual or automatic counting.

- **Manual counting** is the most common method utilized for counting, and data can be collected either in-person through manual counts or by a video recording to manually process count data. Manual counts are best for measuring context-specific project data, such as measuring change in pedestrian activity during an event or after a safety project. Manual counting can provide more detailed data than a continuous counter, such as gender, age or ethnicity of users. The two main methods are screen line counting and intersection turning movement counts. The National Bicycle and Pedestrian Documentation Project has a standard procedure in place to support the collection of manual counts.
  - **Screen line counting** is conducted at midblock locations on roads or trail segments. It is the easiest manual count method to use and is a simple technique that makes it easier to train volunteers and obtain reliable data. It is most often utilized by establishing a visible or invisible line across a roadway or sidewalk and counting the number of pedestrians who pass over that line. This data is then used to determine general use of a facility.
  - **Intersection turning movement counting** is conducted at locations where two or more roadways and/or major commercial driveways meet. The number of pedestrian crossings is counted by intersection leg through the intersection. This counting method is often conducted for safety or operational analysis under peak-hour conditions.
- **Automatic counting** collects continuous data and can be used for short duration and permanent continuous counts. Automated devices require minimal maintenance and can count in any weather or time of day. There are a variety of automatic counting technologies to choose from, below is a list of the most commonly used.
  - **Passive and Active Infrared** are the most commonly used electronic counters. These devices sense pedestrians through infrared radiation patterns emitted by persons with background temperature. A battery-powered passive infrared sensor is mounted, temporarily or permanently on one side of the facility being counted. NCDPH is currently providing passive infrared counters to partner communities that count only pedestrians. They can gather both continuous counts, collecting data for more than one year, and direction of travel data, which can be downloaded remotely. Electronic counters have broad application, they can be mounted on sidewalks and trails or embedded in roadway pavements.
  - **Automated Video** can be used to count bicyclists and pedestrians as well as other

user activity. Algorithms are used to count pedestrians from video recordings for screen line, crosswalk or intersection counts. This type of data is generally used for less than one week at a time.

— **Mobile Technologies** are a new and emerging form of counting. This includes using app based counting software and/or GPS enabled route trackers.

— **Inductive Loops** are usually cut or embedded into pavement permanently to detect the metal wheels of bicycles passing over them.

— **Rubber Pneumatic Tubes** are placed, usually temporarily, across a path or roadway to count bicyclists. As a bike passes over the tube, a pulse of air travels to a detector that records the count. These are generally used for temporary installations.

The FHWA Traffic Monitoring Guide provides a simplified flowchart for selecting active transportation count equipment.

1. What Are You Counting?

2. How Long?

Permanent ↑ ↓ Temporary/ Short Term

Technology	Bicyclists Only	Pedestrians Only	Pedestrians & Bicyclist Combined	Pedestrians & Bicyclist Separately	Cost
Inductance Loops[1]	●			◐	$$
Magnetometer[2]	○				$-$$
Pressure Sensor[2]	○	○	○	○	$$
Radar Sensor	○	○	○		$-$$
Seismic Sensor	○	○	○		$$
Video Imaging: Automated	○	○	○	○	$-$$
Infrared Sensor (Active or Passive)	○[3]	●	●	◐	$-$$
Pneumatic Tubes	●			◐	$-$$
Video Imaging: Manual	○	○	○	●	$-$$$
Manual Observers	●	●	●	●	$$-$$$

○ Indicates what is technologically possible.
● Indicates a common practice.
◐ Indicates a common practice, but must be combined with another technology to classify pedestrians and bicyclists separately.
$, $$, $$$: Indicates relative cost per data point.
[1] Typically requires a unique loop configuration separate from motor vehicle loops, especially in a traffic lane shared by bicyclists and motor vehicles.
[2] Permanent installation is typical for asphalt or concrete pavements; temporary installation is possible for unpaved, natural surface trails.
[3] Requires specific mounting configuration to avoid counting cars in main traffic lanes or counting pedestrians on the sidewalk.

SECTION 3: PYRO-Box Counter Installation

Learn about the in-depth preparation for the installation of the EcoCounter PYRO-Box. Section 3 will focus solely on this specific pedestrian counter because it is the counter that is utilized for the Pedestrian Counter Loaner Program at NCDPH.

The PYRO-Box is a sophisticated and versatile people counter that is suitable to many applications. The PYRO-Box can count pedestrians in urban and rural environments and can be used for both temporary and permanent installations. The PYRO-Box uses a passive-infrared sensor, pyroelectric technology and a high-precision lens to count people passing within the range of the sensor by detecting body temperature. Due to its well-engineered sensor and innovative ORION algorithm, the PYRO-Box can simultaneously detect two people walking in a slightly staggered formation. The PYRO-Box is easily moved to various counting locations and the sensor is self-calibrating making for a simple installation.

Specifications of PYRO-Box Counter

Dimensions:
195 x 110 x 275 mm (7.5 x 4 x 11 inches)

Weight: 2.7 kg (6lb)

Operating Temperature:
-40 degrees F to 130 degrees F

Waterproof IP66

Material: Polyamid (30% glass fiber)

Color: Gray (RAL- 7045)

Sensor Range: Up to 30m

There are several steps in the counter installation process, and it is important to allot time to plan accordingly.

Pre-Installation

1. Research and Plan

- Consider the annual costs of maintenance estimated at $300.
  - The PYRO-Box runs on an internal and external battery. The internal battery life is 10 years and the external battery (6V) has a battery life of two years.

2. Connect and Collaborate

- Contact your local public works department, local planner/planning department and public health department to discuss potential partnership opportunities. Things to consider, depending on resources and manpower available include data sharing and management, counter installation assistance and counter monitoring to ensure data collection accuracy and equipment condition.

This is important in order to:

- Garner support of the program and placement of counter;
- Share or define timeline for data collection;
- Gain approval of counter location if needed.

3. Conduct a Site Visit Prior to Installation

- This ensures that the installation day goes smoothly, and the counter does not have to be relocated later due to overlooked interferences. Examples of interferences to look out for include cars in detection zone or pedestrians unexpectedly bypassing detection zone. Review the PYRO-Box installation video for a visual of the installation process.

Preparation for Installation

The materials necessary for installation include:

- Gloves,
- Marker,
- Measuring tape,
- Computer with Bluetooth to activate counter,
- Safety vests,
- Metal wire for securing counter, and
- Camera to document site location and device installation.

To ensure optimal counting, install the PYRO-Box across from an immobile, non-glass or metal object to ensure the detection zone is well-defined. For example, if the PYRO-Box is being installed on a shared-use path, it could be installed across from a large tree.

Installation

View PYRO-Box Installation User Guide for a more comprehensive overview of installation.

Post-Installation

1. After the counter has been installed, validation of count accuracy must be completed before leaving the site to ensure the counter is counting pedestrians and there are no interferences. To review the validation process please refer to the PYRO-Box Installation User Guide.
2. Establish a process for monitoring and analyzing the data over an identified period of time. If you have access to the Eco-Counter's data software platform, Eco-Visio, there are several tutorials for how to analyze and visualize your data according to your needs and purposes for using the collected data.

If you need additional assistance with analyzing and presenting your count data, the National Bicycle and Pedestrian Documentation Project offers free summary reports that highlight the valuable information gained from continuous counts. If you use the Eco-Counter automatic count technology, the National Bicycle and Pedestrian Documentation Project will provide a free summary report of the data in exchange for submission of the annual automatic count data to the project.

To manage this data and assure a quality count program, consider the following best practices recommended by Eco-Counter:

- Document site and equipment specifications;
- Develop a schedule for short-duration counts;
- Conduct a manual verification test for proper installation on a regular basis;
- Formulate seasonal adjustment factors to account for seasonal variation.

APPENDIX A. Active People, Healthy Nation℠

ABOUT ACTIVE PEOPLE

Active People, Healthy Nation℠ is a national initiative led by CDC to help 27 million Americans become more physically active by 2027. Increased physical activity can improve health, quality of life, and reduce healthcare costs.

WHAT WORKS: STRATEGIES TO INCREASE PHYSICAL ACTIVITY

We can increase physical activity in communities using the following strategies.

Why 27 Million?

If 27 million Americans become more physically active, we will double the Healthy People 2020 goal and reduce the risk of at least 20 chronic diseases. To reach this goal, communities can implement strategies to increase physical activity across sectors and settings.

- Complete Streets policies
- Zoning policies
- Comprehensive or Master plans
- Safe Routes

- Shared-use agreements
- Workplace facilities and policies
- Parks and recreation centers

- Comprehensive physical education
- Opportunities to be active before, during, or after school

- Events combined with multi-channel messaging

- Walking or other activity groups
- Groups that support people with disabilities or chronic conditions

- Peer or professional support
- Technology

- Point-of-decision signage

TO LEARN MORE ABOUT THE STRATEGIES, VISIT:

Community Preventive Services Task Force Finding for Physical Activity (www.thecommunityguide.org)

Physical Activity Guidelines for Americans, 2nd edition (Chapter 8)

Community Strategies, Centers for Disease Control and Prevention, 201 (www.cdc.gov/PhysicalActivity)

WHAT WORKS: STRATEGIES TO INCREASE PHYSICAL ACTIVITY

Activity-Friendly Routes to Everyday Destinations

Improves the design of communities by connecting routes such as sidewalks, trails, bicycle lanes, and public transit to destinations such as grocery stores, schools, worksites, libraries, parks, or health care facilities. This strategy makes it safe and easy to walk, bicycle, or wheelchair roll for people of all ages and abilities.

Access to Places for Physical Activity

Creates or enhances access to places for physical activity and provides information to encourage their use. Places can include public parks and trails, fitness and recreational facilities, schools and universities, malls, senior centers, and worksites.

School and Youth Programs

Uses a combination of strategies to increase physical activity before, during, and after school. Components include physical education, recess, classroom physical activity, staff Involvement, before- or after-school programs, and family and community engagement.

Community-Wide Campaigns

Promotes physical activity by combining a variety of strategies, such as media coverage and promotions, risk factor screening and education, community events, and policy and programmatic initiatives, such as walking trails or social supports.

Social Supports

Provides supportive social networks, friendships, and actions that can help people start, maintain, or increase physical activity. Social supports include buddy systems and walking or other activity groups.

Individual Supports

Supports individuals to incorporate physical activity into their daily routines by teaching behavioral skills such as goal setting and problem-solving. These strategies are tailored to a person's individual interests and needs.

Prompts to Encourage Physical Activity

Prompts such as signs or reminders inform and motivate people to make an active choice in specific environments.

FOR MORE INFORMATION ABOUT STRATEGIES THAT WORK TO INCREASE PHYSICAL ACTIVITY, VISIT:
www.cdc.gov/physicalactivity/activepeoplehealthynation

APPENDIX B. Glossary

Bicycle Boulevards: A street with low motorized traffic volumes and speeds, designated and designed to give bicycle travel priority.

Bicycle Facility: A general transportation term to describe improvements and provisions to accommodate or encourage bicycling, including parking and storage facilities, and shared roadways not specifically designated for bicycle use.

Complete Streets: Streets that make it easy to cross the street, drive a car, bicycle or walk along the street. Streets designed to allow safe access for all users, including public transportation riders, bicyclists, pedestrians, transit users and motorists.

Land Use: Regulation of the use of land, specifically the occupation or use of land or water area for any human activity or purpose.

Multimodal: Refers to the availability of multiple transportation options, especially within a system or corridor. A multimodal approach to transportation planning focuses on the most efficient way of getting people or goods from place to place by means other than privately owned vehicles; by bus, trolley, light rail, streetcar, cable car and/or ferry systems.

Pedestrian Facility: A general transportation term to describe infrastructure and support equipment that accommodates pedestrians, such as sidewalks, curb ramps, shared use paths, crosswalk, signals and signs.

School Siting: The process of selecting locations in the community for new schools that takes into account community land use patterns, infrastructure needs, environmental hazards and other issues.

APPENDIX C. Pedestrian Counter Loaner Program Application

Counting pedestrians can help communities identify pedestrian traffic volume changes over time to plan, design and advocate for future accommodations for safe places to walk and bike. Count data can be used as an essential tool to capture current and potential contributions towards reducing congestion, improving air quality and making data-informed decisions to ensure the built environment supports health and physical activity.

To request the use of a counter please complete the request form at:
communityandclinicalconnections.formstack.com/forms/pedestrian_counter_loaner_request

The Community and Clinical Connections for Prevention and Health Branch has partnered with the North Carolina Department of Transportation to support the NC Non-Motorized Volume Data Program by providing data from counters that are installed through the Pedestrian Counter Loaner Program. If selected to participate in the Pedestrian Counter Loaner Program, through this partnership, CCCPH counters will receive various monitoring and management processes for data collected through the installed counters. This includes, data monitoring, data quality assurance and control, equipment validation, and data reporting. The Institute of Transportation Research and Education provides these services through a partnership with the NCDOT. Data collected will be reported annually through Eco-Visio 5 web-based software provided by Eco-Counter to include annual counts tabular data file and summary charts/graphs.

APPENDIX D. Case Study: The Use and Analysis of Pedestrian Counting at the Brevard Greenway, Brevard, NC

Case study completed by the Institute of Transportation Research and Education's North Carolina Non-Motorized Volume Data Program, 2016: Continuous Count Station Overview and Data Summary

Site Overview

A continuous count station was installed on Brevard Greenway in Brevard, NC, east of a parking lot on Salem Lake Road. This paved trail is part of a system of multi-use paths throughout Brevard that connect to Pisgah National Forest. The counters were located about half a mile south of the Ecusta Road access and west of the Transylvania Activity Center. Table 1 contains information related to the site and photographs of the completed site installation are shown in Figure 1.

Figure 2 is a site diagram that shows equipment placement for the count station that comprises the site. Bicyclists on the greenway are detected by a set of two inductive loops positioned in the path (indicated as blue diamonds) and pedestrians are detected by an infrared sensor mounted on a post (indicated with a red triangle).

Table 1. Site Description

Active Since October 13, 2015

Pedestrian Travel Pattern: Rural Recreation

Pedestrian Volume Group: Low

Bicyclist Travel Pattern: Rural Recreation

Bicyclist Volume Group: Low

Station Location Coordinates: N35.25736 W82. 70768

Station Name/ID: BRV_BGW / 870001

Directional Distribution

Northbound	*Southbound*
Pedestrians (53%)	Pedestrians (47%)
Bicyclists (51%)	Bicyclists (49%)

Figure 1. Continuous Count Station Installation

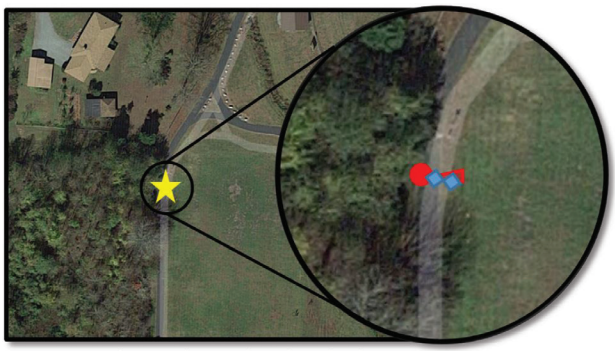

Figure 2. Site diagram showing bicycle and pedestrian count equipment placement

Analysis Period

Data analysis took place from December 1, 2016 through November 30, 2017. This range was selected based on available data and reporting by season. Data is broken out into seasonal groupings: December–February as winter, March–May as spring, June–August as summer, and September–November as autumn. Specific graphs showing seasonal bicycle and pedestrian activity are covered under detailed information outlined later in this report.

Summary Count Data

Over 30,000 pedestrian counts and over 26,000 bicycle counts were recorded during the 12-month analysis period. The overall volume of non-motorized users at this facility varied from approximately 2,700 to over 6,000 counts per month. Table 2 is a summary of statistics for both bicycle and pedestrian count data. Correction factors have been applied to the data based on a site-specific validation study. Figure 3 displays the average high and low temperatures for this community during 12-month analysis period. This site showed some correlation between temperature and non-motorized volumes.

Table 2. Summary Volume Statistics*

Pedestrians		
	Highest Volume	**Lowest Volume**
Season	Spring	Winter
Month	February	September
Day of Week	Wednesday	Saturday
Date	August 10, 2017 (424)	August 08, 2017 (0)
Peak Period	Thursdays 6–7 PM	
12 Month Pedestrian Count	31, 093	
Annual Average Daily Pedestrian Traffic	118 AADPT	
Bicyclists		
	Highest Volume	**Lowest Volume**
Season	Summer	Winter
Month	July	December
Day of Week	Sunday	Monday
Date	August 10, 2017 (424)	August 08, 2017 (0)
Peak Period	Weekends 11AM–5PM	
12 Month Bicycle Count	26,362	
Annual Average Daily Bicycle Traffic	72 AADBT	

*Data has been adjusted based on correction factors, Annual Average Traffic calculated using AASHTO method.

Pedestrian Data

The lowest monthly volumes for pedestrians was recorded in December, as shown in Figure 3. December was the only month with less than 2,000 pedestrian counts. The low pedestrian volumes in the winter are likely due to cold weather and the winter holidays. The highest monthly pedestrian volumes were February, March, October and November; however, this is due to these months having less incidents of equipment malfunction rather than confirmed higher volumes of pedestrians. Pedestrian volumes were relatively consistent throughout the week, with volumes averaging over 120 pedestrians per day Tuesday through Thursday.

Bicycle Data

The lowest monthly volumes for bicyclists were recorded in December and January, also shown in Figure 3. Both months had less than 1,500 bicycle counts. The highest monthly volumes were recorded in July when over 3,000 bicyclists rode by the site. Bicyclist volumes were highest on the weekends, with peak periods occurring late morning to the afternoon. Weekday traffic peaked from 6PM to 7PM.

Table 3 shows average pedestrian activity by day of week. This site's pedestrian sensor was damaged at an undetermined point and was subsequently replaced; however, the presence of the damaged data-collecting sensor leads to higher magnitudes of error in the analysis outcomes for this data collection year. The highest average daily volumes were recorded on Wednesdays and the lowest were recorded on Saturdays. Daily averages on Tuesdays through Thursdays were over 120 pedestrians. The weekend volumes averaged close to 100 pedestrians a day. The overall average was 116 pedestrian counts a day.

Table 4 shows the pedestrian pattern observed at this site by hour of day and day of week. Volumes were highest each day from 1PM to 4PM. An average of over 12 pedestrian counts per hour occurred every day during the peak, except for on Fridays. The highest hourly volumes occurred on Thursdays from 6PM to 7 PM when an average of 16 pedestrians were detected by the sensor.

Hourly pedestrian volumes are depicted graphically in Figure 4. The figure shows daily local peaks occurring between 1PM–4PM, suggesting that nearby schools may use the facility for children's recreation.

Seasonal variation in pedestrian activity is shown in Figure 5. Pedestrian patterns were consistent in all seasons. This outcome may be due to the data scrubbing resulting from the damaged pedestrian

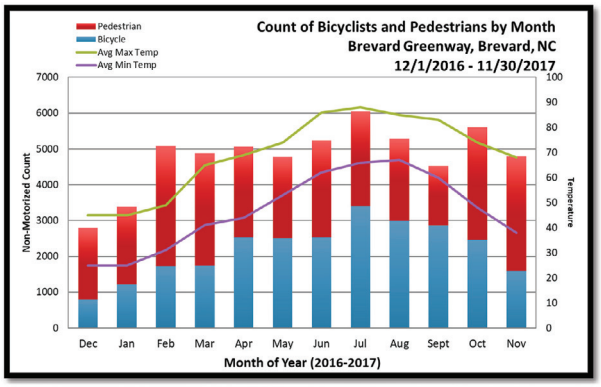

Figure 3. Non-Motorized counts by Month and Temperature

Day of Week	Pedestrian Count
Sun	114
Mon	114
Tue	125
Wed	126
Thu	123
Fri	108
Sat	104
Average	**116**

Table 3. Average Pedestrian Count by Day of Week

Day of Week	Bicycle Count
Sun	98
Mon	59
Tue	62
Wed	70
Thu	61
Fri	63
Sat	92
Average	**72**

Table 5. Average Bicyclist Count by Day of Week

Hour	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Avg
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	1	1	2	1	2	1	1
7	3	4	4	3	4	4	5	4
8	5	7	7	7	7	7	7	7
9	9	9	9	9	7	9	10	9
10	9	11	10	12	10	10	14	11
11	10	10	9	10	10	9	12	10
12	8	10	8	10	10	9	9	9
13	10	9	9	10	9	11	9	10
14	13	10	12	12	10	11	8	11
15	13	8	10	13	9	7	8	10
16	11	8	10	9	8	9	7	9
17	8	10	12	14	13	7	6	10
18	6	8	12	8	16	7	4	9
19	4	5	10	5	7	4	2	5
20	3	2	3	2	2	2	1	2
21	1	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
Avg	5	5	5	5	5	4	4	5

Table 4. Pedestrian Patterns by Day of Week and Hour of Day

Hour	Sun	Mon	Tue	Wed	Thu	Fri	Sat	Avg
0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0
2	0	0	0	0	0	0	0	0
3	0	0	0	0	0	0	0	0
4	0	0	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0
7	1	1	1	2	1	1	1	1
8	3	2	1	2	2	2	2	2
9	4	3	3	3	3	4	4	3
10	7	5	4	4	4	5	8	5
11	9	6	5	4	5	4	11	6
12	11	5	6	4	4	4	10	6
13	12	5	4	5	4	5	9	6
14	12	5	3	6	4	6	11	7
15	13	5	5	5	6	6	11	7
16	11	5	5	6	6	7	8	7
17	7	6	7	6	7	6	5	7
18	4	5	7	11	7	6	5	7
19	3	4	5	6	5	4	4	4
20	2	1	2	4	2	2	2	2
21	0	0	0	1	0	1	1	0
22	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0
Avg	4	2	3	3	3	3	4	3

Table 6. Bicyclist Patterns by Day of Week and Hour of Day

sensor; more data needed to be scrubbed from the dataset in the summer and autumn which are seasons with historically higher volumes. The period of most consistent activity occurred from late August until early November. This pattern could be due to the pleasant weather, a small population increase due to Brevard College student activity, and special events along the trails on weekends.

Detailed Bicycle Count Information

Table 5 shows average bicycle activity by day of week. The highest daily averages occurred on the weekends with Sunday having more traffic. The lowest daily average was recorded on Mondays. An average of 72 bicycles were counted at the site every day.

Table 6 shows bicyclist patterns at the site by day of week and hour of day. Peak bicyclist volumes occurred on Sundays between 11AM and 5PM. Hourly volumes ranged from 9 to 13 bicycles during this time. Another volume peak was observed on Saturdays between 10AM and 5PM. The period with the highest hourly volumes during the weekdays occurred between 5PM and 7PM. This is likely due to people using the trail for recreation after work hours.

Hourly bicyclist volumes at this site are depicted graphically in Figure 6. The graph shows an increase in bicycle activity between 7AM and 10AM with a peak every day around 6PM. Weekend bicyclist volumes rose sharply around 9AM and maintained a fairly consistent level until around 4PM.

Seasonal variety at the site is shown in Figure 7. Bicyclists volumes were consistently high in the summer months, and high on weekends in the late spring and early fall. Winter had significantly lower volumes compared to the rest of the seasons, likely caused by the cold weather. Weekend volumes exceeded 150 bicyclists per day on at least one weekend in all seasons except winter.

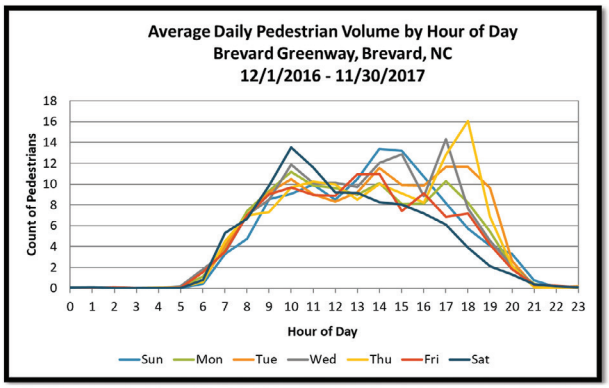

Figure 4. Average Daily Pedestrian Volume by Hour of Day

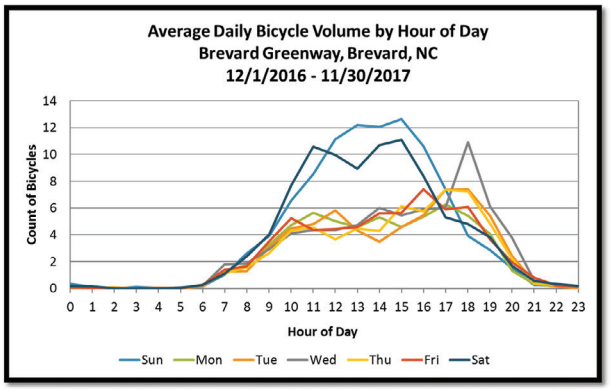

Figure 6. Average Daily Bicycle Volume by Hour of Day

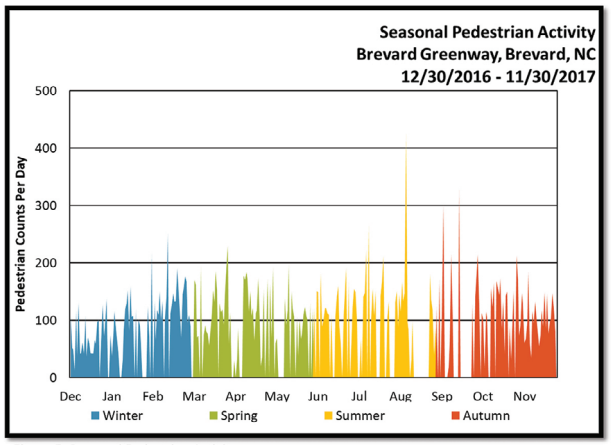

Figure 5. Seasonal Pedestrian Activity

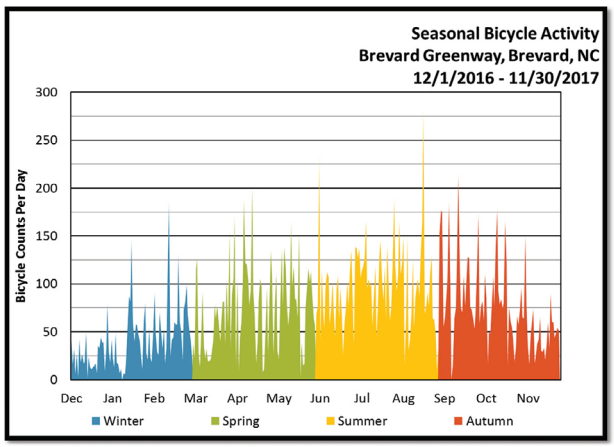

Figure 7. Seasonal Bicycle Activity

Appendix E. References

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Resources

For more information on the North Carolina Non-Motorized Volume Data Program, please visit: **itre.ncsu.edu/focus/bike-ped/nc-nmvdp**

For more resources on promoting active communities, please visit: **eatsmartmovemorenc.com/resources** and/or **movemorenc.com**

Appendix F. Contributors

Building Active Communities Through Activity-Friendly Routes Connecting Everyday Destinations
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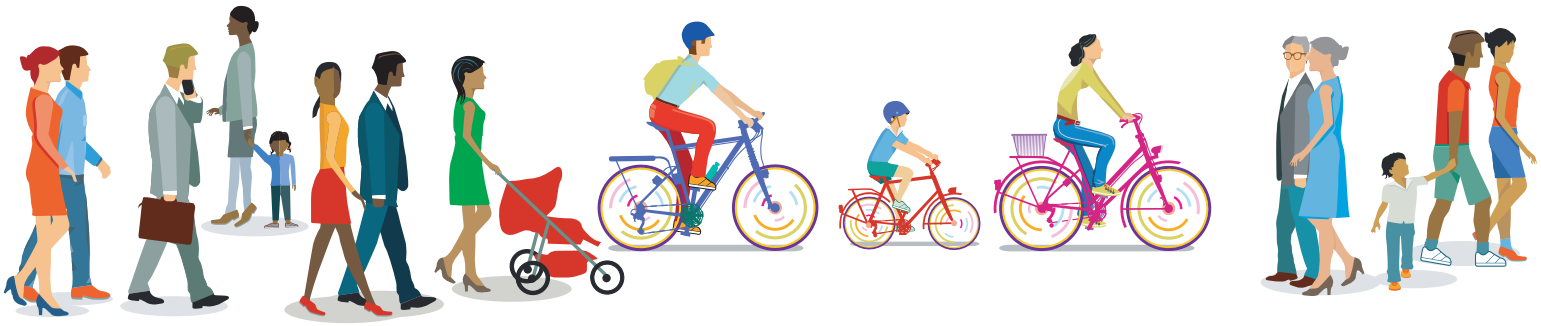

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