WICHITA BICYCLE COUNT PROGRAM GUIDANCE MANUAL

AUGUST 2018

City of Wichita, Kansas

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INTRODUCTION

This Wichita Bicycle Count Program Guidance Manual (the Manual) will assist City of Wichita staff in developing and implementing a systematic approach to counting bicyclists in Wichita. The Manual is divided into two parts. The first part covers important concepts and best practices for counting bicyclists, including key terms, program design, count technologies, analysis and reporting methods, and quality control. The second part of the manual contains goals and objectives for the program and short- and near-term recommendations, including proposed count locations.

BICYCLE COUNT PROGRAM CONCEPTS AND BEST PRACTICES

KEY TERMS

Adjustment factors: *Calculations used to estimate annual volume from short-duration counts. Factors are derived from permanent (year-round) counter data.*

Annual Average Daily Bicycle Traffic (AADBT): *The volume of bicycle traffic over an average 24-hour period at a specific location or road/trail segment during a count year.*[1]

As-needed counts: *Short-duration counts performed in response to stakeholder requests or in response to ongoing planning needs.*

Calibration: *Adjusting the sensitivity of an automated count technology (e.g., inductive loops or pneumatic tubes) to reduce under or over counting.*

Diversion: *Undercounting caused by bicyclists avoiding a detection zone.*

Factor group: *A set of locations with similar temporal bicycling activity patterns.*

Occlusion: *Undercounting caused by certain technologies' inability to sense when two people are bicycling side-by-side.*

Permanent automated counters: *Counters installed at fixed locations that continuously monitor traffic, with the primary goal of understanding time-related activity patterns.*

Short-duration counts (SDCs): *Counts conducted over a limited duration, often between two hours and two weeks, with the primary goal of increasing the spatial coverage of the monitoring program.*

[1] Federal Highway Administration. "Traffic Monitoring Guide." 2016, https://www.fhwa.dot.gov/policyinformation/tmguide/.

PROGRAM DESIGN

Bicycle count programs typically involve a combination of permanent automated counts and routine short-duration counts. Additional counts may be conducted on an as-needed basis. This section describes how each approach contributes to a comprehensive bicycle count program.

PERMANENT AUTOMATED COUNTS

Permanent automated counters are installed at fixed locations and continuously monitor pedestrian or bicycle traffic. Their primary function is to understand the temporal variations in bicycle activity at a given location. The continuous data provided by permanent counters can be used to understand how levels of bicycling are influenced by the season, day of the week, time of day, temperature, special events, or other factors. Such analyses can be conducted with continuous data from at least one year of counting. Moreover, the patterns identified from permanent counters serve as the basis for developing adjustment factors. Permanent counters also allow for reliable identification of trends over time.

SHORT-DURATION COUNTS

Short-duration counts (SDCs) are conducted for limited durations, typically between two hours and two weeks, and may be performed manually or with automated equipment. The primary function of **SDCs** is to expand the geographic coverage of a count program. As with motor vehicle traffic monitoring, more count locations allow for greater understanding of travel patterns, additional analysis opportunities, and greater confidence in the data overall. Volume data provided by SDCs can be extrapolated to develop annual estimates using factors identified from permanent counters within the same factor group. Additional discussion on the use of factor groups is provided in the ***Analysis and Reporting Methods*** section.

Many communities begin monitoring bicycle traffic using SDCs exclusively, often collecting the data manually in an informal manner. **Manual SDCs** provide a low-cost way to begin counting bicyclists, and to collect behavioral and demographic data that is difficult or impossible to obtain through automated counting technologies. However, manual SDCs have significant limitations due to the extremely short counting interval, and they require significant staff or volunteer time to enter and manage data.

In recent years, many organizations have increased their use of automated SDCs. **Automated SDCs** often cover a longer period of time than manual counts, resulting in a richer dataset. Additionally, many automated count equipment vendors offer methods for downloading count data remotely and storing and analyzing the data directly on their website. While automated SDCs offer clear advantages over manual counts, significant data management and analysis resources are required to process and interpret data obtained from automated SDCs.

Short-duration automated counts are most effective when they are implemented as part of a systematic program that involves rotating the counters across a set of locations over a given time interval, such as every three years. However, **as-needed counts** performed in response to stakeholder requests or planning needs (e.g., to observe patterns before or after new projects are implemented, or at high-crash locations) are an important element of a comprehensive bicycle counting program. As-needed counts can be performed manually or using SDC automated counters.

COUNT TECHNOLOGIES

This section provides an overview of available count technologies, including the recommended duration and context for the technology, pros and cons, and special considerations. For additional information on count technologies, see National Cooperative Highway Research Program Report 797 (NCHRP 797) and the accompanying NCHRP Web-Only Document 229, which includes revised results and additional technologies not tested in the original study[2]. Chapter 4 of the Federal Highway Administration (FHWA) Traffic Monitoring Guide (TMG) also provides a good starting point for understanding the available technologies.[3]

Manual Field Data Collection

Description: Data collectors manually record counts of pedestrians and/or bicyclists, either directly in the field or based on video footage.

Recommended Duration: Short-duration (2-4 hour intervals focused on peak travel hours)

Recommended Context*:* Any context

Manual field data collection form

Pros	Cons
• Can be used to develop baseline user information (e.g., age, sex) and understand user behavior (e.g., helmet use, sidewalk riding). • Can be used to calibrate automated counts. • Can be conducted by volunteers, if available.	• Resource-intensive due to number of hours required for training, data collection, and data entry. • • Requires staff to manage and process data. • Limited usefulness due to short data collection periods.

Special Considerations

- It is important to consider the safety and comfort of data collectors before performing field counts.

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[2] Ryus, P., A. Butsick, F.R. Proulx, R.J. Schneider, and T. Hull. "NCHRP Web-Only Document 229: Methods and Technologies for Pedestrian and Bicycle Volume Data Collection- Phase 2." 2016. http://www.trb.org/Main/Blurbs/175860.aspx

[3] Federal Highway Administration. "Traffic Monitoring Guide." 2016, https://www.fhwa.dot.gov/policyinformation/tmguide/.

Infrared Detectors (Passive and Active)

Description: There are two types of infrared detectors, active and passive. In the case of passive infrared detectors, people passing the sensor are identified and counted based on the heat profiles they emit. In the case of active infrared detectors, an infrared beam is established across the facility between a transmitter and receiver. When the beam is broken, a count is recorded.

Recommended Duration: Longer duration (2 weeks to permanent)

Recommended Context*:* Shared use path

Passive infrared detector

Pros

- Relatively low cost and easy to set up.
- Relatively portable.

Cons

- Sensors unable to distinguish between bicyclists and pedestrians.
- Subject to undercounting due to occlusion (two or more bicyclists and pedestrians traveling side by side counted as one).
- Counters may be subject to vandalism or theft.

Special Considerations (Passive Detectors)

- Sensitive to ambient background temperatures.
- Sensor should be mounted at the edge of a path around 30 to 40 inches above ground (some overhead models are available).
- Sensor should be directed perpendicular to the path of travel.
- Avoid:
  - Directing sensor at doors, windows, or metallic surfaces in direct sunlight
  - Directing sensor at vegetation or objects prone to movement
  - Locations where pedestrians are likely to linger (bus stops, entryways, kiosks, etc.)
  - Locations where snow storage or debris may block sensor

Special Considerations (Active Detectors)

- Mount sender receiver perpendicular to path of travel.
- Avoid:
  - Locations where any motorized traffic can travel between the sender/receiver
  - Locations where pedestrians are likely to linger (bus stops, entryways, kiosks, etc.)
  - Locations where animals are likely to encounter the sensor
  - Locations where snow storage or debris may block sensor

Pneumatic Tubes

Description: A rubber tube or pair of tubes is nailed or taped to the road or trail surface. When the tubes are compressed, an air pulse in the tube triggers a count to be recorded. Bicyclists are identified based on the sequence of pulses recorded. Note that bicycle-specific pneumatic tubes count bicyclists more accurately than general traffic tubes.

***Recommended Duration**:* Short-duration (several hours to a month)

Recommended Context: Shared use paths, on-street bike lanes, on-street mixed traffic

Pneumatic tubes

Pros	Cons
• Relatively low cost and easy to set up. • Very portable.	• Not appropriate for data collection in snowy conditions. • Counts motor vehicles that drive over the tubes.

Special Considerations

- Surface of detection area should be relatively flat and perpendicular to travel flow.
- Specific procedures for shared roadways vs. bike lanes or shoulders.
- Not appropriate for use in snowy conditions.
- May be prone to vandalism or avoidance where tubes are installed conspicuously.
- Additional installation equipment (tools) needed.
- Avoid:
    - Locations where stopping may occur (intersections, traffic control locations, etc.)
    - Locations where vehicles park or trucks load/unload (parking areas, bus stops, loading zones, etc.)
    - Installation in locations or in ways that may cause bicyclists to navigate around the tubes

Inductive Loop Detectors

Description: Wire loops are installed on or under the road or trail surface with a current running through them. When the magnetic field produced by these loops is disturbed by a vehicle, including a bicycle, a count is recorded. This technology is very similar to the induction loops used for traffic signal actuation and vehicle counts, although bicycle-specific loops are designed to maximize counting accuracy.

Recommended Duration: Continuous permanent counts

Recommended Context: Shared use paths, on-street bike lanes, on-street mixed traffic

Inductive loop detector

Pros

- Good for collecting bicycle only counts.
- Durable, low-maintenance, and theft-proof.
- Does not create a bump in the bikeway that bicyclists might seek to avoid.

Cons

- Not reusable.
- Sensitive to utility lines.
- Some bicycle types may not be registered due to their material composition.
- Repaving may impair function.
- High installation costs.

Special Considerations

- Best in locations with predictable path of travel for bicycle traffic (bike lane, path, etc.).
- Presence of overhead or buried utilities may interfere with the inductive loop.
- May require permitting.
- Temporary or "surface Loops" are available to avoid cuts where needed (less permanent installation).
- Avoid:
  - Locations with overhead or buried utilities
  - Locations where bicyclists may ride outside of the loop detector

Piezoelectric Strips

Description: Piezoelectric materials produce an electric current when they are compressed. This technology involves two strips of piezoelectric material installed in the surface of the road or trail. Counts are recorded when the piezoelectric strips are compressed. The strips' compression can detect bicycle volume, direction, and travel speeds.

Recommended Duration: Continuous permanent counts

Recommended Context: Shared use paths, on-street bike lanes

Piezoelectric strips

Pros

- Good for collecting bicycle only counts
- Durable, low-maintenance, and theft-proof
- Does not create a bump in the bikeway that bicyclists might seek to avoid

Cons

- High installation costs

Special Considerations

- May require permitting
- Install perpendicular to bicyclist path of travel
- Avoid locations where motor vehicles may travel across sensors

Automated Video

Description: Video footage is taken in the field, and computer algorithms are used to identify individual pedestrians or bicyclists. In some cases, video may be reviewed by vendor staff to classify pedestrians or bicyclists.

Recommended Duration: Short Duration or Permanent

Recommended Context: Shared use paths, on-street bike lanes, on-street mixed traffic, intersections

Automated video (Source: Iteris)

Pros

- Can be used to capture specific attributes, such as user movements or other characteristics.
- Video can be saved and referred to later for further observations.
- Relatively wide detection width (up to 75' depending on quality of images)
- Highly portable and relatively easy to install.

Cons

- Because of the proprietary nature and need for third party processing, the full accuracy and effectiveness of the technology is unknown.
- High cost per hour of data collection

Special Considerations

- Mounts overhead at angle; can be used for screenline or intersection counting
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- Lighting and weather conditions can affect video image
- May be restrictions based on privacy concerns
- Avoid:
  - Locations with poor lighting conditions (glare, heavy shadowing, etc.)
  - Locations where temporary obstructions may occlude data collection (delivery truck parking, etc.)

Combination Inductive Loop/Infrared Detectors

Description: An inductive loop sensor and a passive infrared sensor are installed at a single location to detect bicyclists and pedestrians and classify movements by mode. The passive infrared detector is used to obtain a combined count of pedestrians and bicyclists. The loop detector is used to obtain a bicycle-only count. Pedestrian counts can be derived by subtracting the bicycle-only number from the combined number.

Recommended Duration: Permanent

Recommended Context: Shared use paths

Inductive loop and infrared detector on a post

Pros

- Detects bicyclists and pedestrians and can be used to generate bicycle-only and pedestrian-only counts

Cons

- Requires work crew to install (pavement cutting; post installation for passive IR sensor and logger)

Special Considerations

- Best in locations with predictable path of travel for mixed traffic (pinch points or bridge approaches best)
- Presence of overhead or buried utilities may interfere with the inductive loop
- May require permitting
- Avoid installing in locations with overhead or buried utilities and in locations where pedestrians and bicyclists may travel outside of the loop detector or sensor

ANALYSIS AND REPORTING METHODS

Factor groups allow agencies to annualize SDCs by "grouping" together permanent and SDC count locations that exhibit a similar distribution of bicycle traffic by time of day and day of the week. While bicycle factor grouping is still an active area of research, patterns are typically presumed to be associated with surrounding land uses, climatic region, and facility types. For example, counters placed along bike lanes in Downtown Wichita, Old Town, and Delano may be placed within one factor group, while counters placed along the Prairie Sunset Trail and Redbud Path might belong to a different factor group. The use of recreational, commuting, and mixed factor groups is a common approach that is relatively easy to employ and accounts for many sites.

Within a factor group, permanent counters are used to calculate **adjustment factors** to apply to SDCs. The FHWA Traffic Monitoring Guide (TMG) recommends that between three and five permanent counters be installed per factor group. The data from all permanent locations within a factor group can be averaged together by day of week/month/year to create a robust adjustment factor that can be applied to SDCs at locations with similar characteristics of the factor group. Where possible, adjustment factors should be derived from stations with relatively high counts that consistently demonstrate similar hourly and day-of-week travel patterns. The determination of whether a location should be assigned to a particular factor group may be made based on contextual factors, as noted above, or observed hour-of-week and day-of-week patterns.

ANNUAL AVERAGE DAILY BICYCLE TRAFFIC

The factoring process enables **Annual Average Daily Bicycle Traffic (AADBT)** to be estimated based on a short-duration count. AADBT estimates represent the volume of bicycle traffic over an average 24-hour period at a specific location during a count year.[4] The City can use AADBT estimates to monitor bicycling trends and patterns where short-duration or permanent counts have been conducted.

AADBT estimates from individual locations can be used for a variety or reporting purposes. AADBT can be used to document changes in bicycling activity levels, identify high activity corridors and intersections, or calculate crash rates. AADBT estimates can also be used to develop Bicycle Miles Traveled (BMT) estimates. BMT estimates analyses require a significant amount of count data from carefully selected count locations.[5]

The reliability of AADBT estimates derived from SDCs is closely tied to the length of the SDC period, the number of automated counters feeding into the factor groups, and the location of the counters. A full discussion on methods to improve and control count data quality is provided in the ***Quality Control*** section.

QUALITY CONTROL

This section focuses on methods to ensure bicycle count data are accurate and reliable, with a focus on data cleaning and adjustment. Raw bicycle count data may need to be adjusted before they can be reliably used. Generally, there are two types of errors that occur when automated counters are used to collect data – corrupted data and systematic undercounting.

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[4] Federal Highway Administration. "Traffic Monitoring Guide." 2016, https://www.fhwa.dot.gov/policyinformation/tmguide/.

[5] Washington State Department of Transportation, K. Nordback, and M. Sellinger. "Methods for Estimating Bicycling and Walking in Washington State." 2014.

CORRUPTED DATA

There are several causes of corrupted data, including equipment malfunctions due to a problem with the equipment itself, improper installations, or subsequent damage or vandalism to the equipment after installation. Another type of error is caused by external events that cause the sensor to either count too few or too many people. For instance, plowed snow may cover the sensor for an infrared counter.

Adjustments to the data, such as by substituting count data from a similar time period or from a counter within the same factor group, can address many of these problems, but should be clearly noted on any subsequent reports or analyses. Quality control checks or visual inspection of count data results can help identify where data should be adjusted. Possible QC rules include:

- Check for a maximum consecutive number of 0 values in the data, such as 48 hours
- Check for a maximum percentage deviation between sequentially recorded ADT values at a given station (note that this rule does not work well for low-volume sites and should be reserved for sites with an average of at least 100 users per day)
- Check for a maximum hourly volume
- Check for a maximum ADT
- Check for excessive daily directional splits
- Check for count value deviations from a specified “normal” range, such as a specified multiple of the interquartile range for the count period

Some errors cannot be compensated for, such as if there are extended periods of corrupted or lost data. Routine data downloads are particularly important to minimize the risk of data loss under such circumstances.

SYSTEMATIC UNDERCOUNTING

Systematic undercounting occurs almost uniformly across all devices and is inherent in many automated counting technologies. **Occlusion** is the most common problem and is caused by the inability of certain technologies to sense when two people are walking or bicycling side-by-side. In this case, the device will register just one person. Another source of error is **diversion**, which occurs when bicyclists detour or deviate around a detection zone.

Routine calibration of counters will allow for adjustments to be made to correct for known systematic errors. The most basic form of calibration involves conducting a manual count when a counter is installed and comparing the manual count total with the total reported by the counter, and identifying a calibration factor. Permanent count sites should be calibrated on a routine basis, such as when data is collected in the field, or counters are serviced for another purpose. More advanced calibration methods may attempt to account for calibration factors that vary according to observed volume, time of day, or other factors.

THE WICHITA BICYCLE COUNT PROGRAM

COUNT PROGRAM HISTORY

This section provides an overview of the history of the Wichita count program. The goal is to provide context for the count program recommendations that follow.

The City of Wichita (the City) conducts motorized traffic counts on an annual basis using Metrocount pneumatic tubes and Miovision turning movement analysis, and shares motorized traffic counts through the City's Open Data Portal. The City conducts motorized traffic counts on an annual basis using Metrocount pneumatic tubes and Miovision turning movement analysis. The Wichita Open Data Portal contains over 1,600 motorized traffic counts from 2006 to 2015.[6] In addition to the City's count efforts, Sedgwick County collects motorized traffic counts annually on county roads outside of and adjacent to the City's boundaries. Finally, the Kansas Department of Transportation (KDOT) develops annual average daily traffic figures for state highways within Wichita.

Wichita has experience collecting bicycle counts using both manual and automated data collection practices. The City's bicycle counting program began with volunteers collecting manual counts at a small number of locations and expanded to include automated counts in 2006, when the City's Parks Department purchased three TRAFx infrared counters. The TRAFx counters were placed along shared-use paths at three locations along the Ark River Trail and the Chisolm Trail. These locations are shown in Figure 1 in the ***Count Program Recommendations*** section. The addition of the automated TRAFx counters greatly increased the amount of data collected through the program, while also bringing new challenges. In particular, staff found the accuracy of the counters to be unclear, as some unexpected results were generated in the field. Moisture has been identified as a suspected cause for inaccurate count data.[7] Additionally, because the TRAFx counters cannot distinguish between pedestrian and bicycle traffic, they are of limited value for developing estimates of bicycle volumes at these shared use path locations. The ***Count Program Recommendations*** section provides recommendations for expanding the TRAFx counters' capabilities.

Through the use of remaining Energy Efficiency Conservation Block Grant funds, the City purchased two Eco-Counters and two Metro Counters in 2013.[8] Of the four counters purchased, three count only bicyclists and one counts both bicyclists and pedestrians. City staff have not yet deployed or operated the counters due to other program priorities and limited resources.

The City also uses additional data sources to supplement its bicycle count program. In particular, the City leverages Census and American Community Survey, Strava, and Bike Share ICT data. With 20 stations primarily located around Downtown Delano and Old Town, the Bike Share ICT provides a window into commuter and recreational bicycling trips around some of Wichita's busiest streets. The Zagster-based system is owned by the Health & Wellness Coalition of Wichita, which is a strong partner with the City and is generally willing to share bike share system data. Strava data represents a detailed look at a small portion of bicycling trips Wichita. From July 2017 to

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[6] City of Wichita, Wichita Open Data Portal. "Wichita Traffic Counts." Accessed 06/04/2018. http://opendata.wichita.gov/datasets/wichita-traffic-counts/data?geometry=-98.6%2C37.482%2C-96.072%2C37.863&selectedAttribute=Count_.

[7] Counting agencies in other states have experienced difficulties in accurately collecting data from TRAFx counters that have moisture build up.

[8] The use of grant funds was limited to the acquisition of the counters, not including installation or ongoing costs

June 2018, over 2,000 unique Strava users recorded over 35,700 bicycling trips within Wichita. As Strava typically collects data on trips taken by "Confident" bicyclists (versus "Intersected but Concerned"), its data should be used in context appropriate settings and not extrapolated to reflect all bicyclists' behaviors or trips.

The City of Wichita participates in, and receives count data from, the annual Wichita Area Metropolitan Planning Organization (WAMPO) bicycle and pedestrian counts. WAMPO conducts annual bicyclist and pedestrian counts across Sedgwick County and parts of Butler and Sumner County. Since 2012 WAMPO has collected bicycle and pedestrian counts at 35 locations across the WAMPO region. Volunteers collect manual counts over two-hour time periods. The data is used by WAMPO to understand bicycling and walking trends and locations of bicycling and walking activities, and to plan for future system improvements. Data from WAMPO's bicycle and pedestrian count programs is posted online, and findings from the annual volunteer count are summarized in an annual report.

In 2017, WAMPO began using the ActiveICT Mobile App in beta form to assist with the manual data collection effort. Through the ActiveICT Mobile App, count volunteers can access their count locations, input count data, and upload photos and comments from the field. The development of the ActiveICT Mobile App was supported in part by grant funding from the Knight Foundation Fund at the Wichita Community Foundation.[9] WAMPO is partnering with Wichita State University to improve the app. A student team is using the app to collect data at 10 sites around campus.

COUNT PROGRAM GOALS AND OBJECTIVES

This section describes the goals and objectives that have been established for the Wichita bicycle count program. The goals and objectives directed the general approach to the selected count locations, with a focus on building upon past count efforts, measuring the impact of bikeway and street projects, and focusing on high crash corridors. The count program recommendations below were developed to achieve these goals and objectives.

1. DOCUMENT BICYCLE USE TRENDS AND PATTERNS. Understanding bicycle use trends and patterns will allow the City to track its progress towards its bicycling ridership goal, to measure the impact of future infrastructure improvements, and to generate additional metrics based upon ridership levels.
    a. The **short-term objective** for this goal is to accurately measure current levels of bicycling with a focus on understanding trip patterns. For example, certain routes may see higher levels of recreational-purpose bicycling trips, while others may serve more commuter-purpose bicycling trips. These trip purposes are reflected in count data, since the distribution of counts by time of day and day of week varies by trip type. Understanding not only the amount but also the purpose of trips will equip the City to more accurately measure and plan for changes in bicycling trip behaviors.
    b. The **long-term objective** for this goal is to measure and track changes in bicycling ridership levels and trends across the City, along key corridors, and potentially based on specific ridership profiles such as age, gender, and race. This long-term objective will require additional resources to track ridership levels on a regular, consistent basis and in-person surveys to record elements of riders' identities. Elements such as age, gender, and race can assist the City in understanding not only total ridership levels, but also how ridership levels change along corridors and by demographics.

[9] WAMPO, "2017 Bicycle & Pedestrian count Results Report." Accessed 06/04/2018. http://www.wampo.org/Work/OW%20Documents/2017%20Report.pdf.

2. INFORM AND REVIEW INVESTMENT DECISIONS. Understanding the impact of investment decisions will equip the City to make informed infrastructure investment decisions based on anticipated changes in bicycle use.
    a. The **short-term objective** for this goal is to accurately measure the impact of infrastructure investments on levels of bicycling along corridors where bicycle facilities have been implemented.
    b. The **long-term objective** is to measure and track changes in bicycling ridership levels, vehicle speed, traffic volumes, traffic crashes, and economic activities at the investment's location and along nearby key corridors, and bus and Q-Line stops. This long-term objective will require additional resources and encompasses a broader evaluation approach intended to track the wide-ranging impacts of the infrastructure investment. By taking a broad approach, the City can track the effects of investments on safety and economic activity attributable to changes in the local infrastructure.

3. DEVELOP BICYCLE CRASH RATES. Developing bicycle crash rates was a priority goal identified in the Bicycle Master Plan. As a program goal, developing bicycle crash rates will require accurate and consistent measurement and reporting of bicycle volume and traffic crash data.
    a. The **short-term objective** for this goal is to accurately measure the bicycle crash rate along key safety corridors. Understanding the bicycle crash rate along corridors with a high level of reported bicycle crashes will be an important first step to developing a citywide method for estimating bicycle crash rates.
    b. The **long-term objective** for this goal is to measure and track changes in the bicycle crash rate across the city.

COUNT PROGRAM RECOMMENDATIONS

This section provides general recommendations related to program design, count technologies, analysis and reporting methods, and quality control. It also includes recommendations for expanding the Wichita bicycle count program to include additional locations. These recommendations are presented in two phases. The first phase (**Phase 1**) can begin immediately through 2021, and primarily uses the City's existing count technology and staff resources. The second phase (**Phase 2**) can be implemented starting in 2022 and running through 2025, requires additional investments in counting and program management resources.

GENERAL RECOMMENDATIONS

PROGRAM DESIGN

- The City should invest in a larger number of permanent counter locations that seek to accurately collect data from individual nonmotorized modes, versus a smaller pool of counter locations that generate combined counts.
- During the initial stages of the City's program, permanent counters should be placed at locations with higher pedestrian and bicycling activity, such as the downtown, Wichita State University campus, school zones, commercial areas, major regional trails and bicycle corridors, and other popular recreation facilities as candidates for permanent count sites. High pedestrian and bicycling activity levels typically yield more meaningful counts than areas of low activity, and the count data can then be used for factor development purposes.

- Additionally, the City should seek out “pinch point” locations within popular walking and bicycling destinations for installation of permanent counters. Such locations can assist count efforts in more accurately counting the total level of activity within the area, and in factor group development. Pinch points are places in a corridor where pedestrians and bicyclists are channeled, such as bridges over major barriers or local streets channeling into a major street.
- To maximize the extrapolation accuracy of SDCs, the City should conduct automated counts for at least one week following standardized protocols. Ideally, the SDC count would be conducted for two weeks to observe the full day-of-week patterns at the count site and ensure an adequate number of observations. The City can maximize the accuracy of its SDCs by counting during high volume periods, such as during the summer months and during seasonably mild, dry weather conditions.
- The City should select SDC locations that support the goals and objectives established for the Wichita count program. Additionally, to achieve a representative coverage of SDC sites, count sites should not be limited to high volume locations. Counting only at high volume locations will likely result in bicycle traffic estimates that are biased.
- While current research has not yet determined an ideal number of SDC locations, it is recommended that the City identify SDC locations based on their count program goals, upcoming infrastructure projects, and available staffing and resource levels for managing the counting technology and data.

COUNT TECHNOLOGIES

- The City should implement technology that is appropriate based on the context and duration of the count. Some technologies are not capable of distinguishing bicyclists in certain contexts. For example, passive infrared sensors placed on a shared-use path will capture a combined pedestrian and bicyclist count. Table 1 provides guidance on which count technologies are appropriate in given contexts for short duration and permanent counts.

Table 1. Recommended Count Technologies by Context and Duration

Context	Short-Duration / As Needed	Permanent
Bicycles in Bike Lane	Pneumatic Tubes*	Induction Loops* Piezoelectric Strips*
Bicycles in Mixed Traffic	Pneumatic Tubes	Induction Loops
Pedestrians and Bicycles on Multi-Use Trail (separate counts)	Combination: Passive Infrared + Pneumatic Tubes*	Combination: Passive Infrared + Induction Loops* Combination: Passive Infrared + Piezoelectric Strips*
Pedestrians and Bicycles on Multi-Use Trail (combined count)	Passive Infrared* Active Infrared Radio Beam	

***Indicates preferred technology**

QUALITY CONTROL

- Automated counters should be calibrated with a manual count during installation to ensure accurate results. A short observation period of 15 to 30 minutes is sufficient unless bicycle volumes are extremely low. In that case, staff can trigger the counter by riding a bike across the path of the counter several times. However, this should not be the default method since a single bicyclist doesn't represent the varying user characteristics that occur.
- For TRAFx or other infrared counters not paired with a bike-specific counting device, staff should conduct a manual count, tracking bicycles and pedestrians separately to enable better mode-specific estimates. These counts should be conducted on a quarterly basis to understand how mode split varies throughout the year. After a few years, if mode split is relatively stable by season, these counts may no longer be needed.
- The City should review and adjust the data collected to ensure several important types of reporting errors are not included in permanent count records, and to substitute missing data with reliably estimated data support further analysis and reporting
- Consider partnering with WAMPO and/or Wichita State University to assist with the quality control process.

DATA MANAGEMENT AND ANALYSIS

- As count data accumulates over time, it will be important to have an orderly and consistent process for managing the data. Vendor databases should be used to the extent possible. However, these do not necessarily include the quality control or analysis capabilities recommended in this manual. As a result, some external data storage and processing will be needed.
- A typical data management process is outlined below:
    - Count data is uploaded from native formats into vendor software.
    - Appropriate quality control procedures available in vendor software should be performed.
    - Original or modified data should be exported from the vendor software to Microsoft Excel for further quality checks or corrections. This may include visual scanning or quantitative checks.
    - Corrected/final data should be stored in a Microsoft Access database or other relational database (location data and count totals should be stored in separate tables). Storing large amounts of data in spreadsheets is generally not recommended as it can be unintentionally edited or lost and is difficult to query across years or locations.
    - For short-duration counts, adjustment factors should be applied to develop annual estimates (see below for more detail).
    - Aggregate count results should be stored in a GIS database and/or excel for mapping or future analysis.
- Wichita may benefit from one to three factor groups. Having a single factor group is not ideal for creating annual estimates at a given location, but is not unreasonable for the beginning stages of a program. Additional factor groups introduce greater data management and process requirements but should improve annual estimates.
- If Wichita chooses to have three factor groups, they should represent commuter, recreational, and mixed patterns. Count locations can be assigned to one of these groups based on a visual review of the data. Alternatively, quantitative criteria can be used. In either case, the intent is to compare the distribution of bicycling activity during commute times (weekdays, morning and afternoon peaks) and

recreational times (weekends, off-peak times). Day-of-week and month-of-year factors for each factor group should be developed from permanent count locations and applied to short-duration count locations that roughly match the respective pattern (commute, recreational, or mixed activity). On an annual or bi-annual basis, count results should be reported. Possible analyses to conduct for the report include:

- Annual trends at individual locations
- Annual trends at a benchmarked set of locations
- Crash rates at high-crash intersections
- Time of day, day of week, and monthly patterns
- Relationship of count data to Strava data at individual locations and system-wide (subject to acquisition of Strava data)

PHASE 1 COUNTER INSTALLATION RECOMMENDATIONS (2018-2021)

The goal of the first phase of counter installation is to establish the City's bicycle count program using its available equipment and staff resources, to collect immediate pre- and post-bicycle facility installation data, and to begin to collect data at high-crash corridors. The proposed Phase 1 count locations were selected based on the following considerations:

- Draft 2018-2027 Capital Improvement Projects (CIP)
- WAMPO 2017-2020 Transportation Improvement Program (TIP)
- Wichita 2012 Bicycle Plan's Priority Bikeway Network
- Recorded bicycle-motor vehicle crashes from 2013 to June of 2018
- 2017 WAMPO manual bicycle count data

See attached map of proposed Phase 1 count locations.

In addition to the City's existing bicycle counting equipment, the City should consider purchasing moveable pneumatic tubes that can be used to strengthen the City's initial technology investments. The moveable pneumatic tubes used in tandem with the City's existing TRAFx counters will allow the City to differentiate between bicycling and pedestrian count movements. The City should also continue to partner with WAMPO to collect manual counts. Manual count data can be used to collect information on bicycle user characteristics, behaviors, and volumes prior to investing in automated count infrastructure. The proposed Phase 1 count locations are outlined in

Table 2 and shown in the attached Phase 1 map .

Table 2. Phase 1 Recommended Count Locations

Count Location	Duration	Setting	Technology	Related Goals	Notes
E 2nd Street North & N Topeka Avenue	Permanent	Bike Lane	Piezoelectric Strips	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	Use City-owned MetroCount Advanced Bicycle Counter. Two CIP street construction projects planned for 2nd Street North between N Washington Ave and North Main Street (construction in 2018 and 2022). Located along the Priority Bikeway Network and on a high crash corridor.
E Mt Vernon Street & S Topeka Avenue	Permanent	Bike Lane	Piezoelectric Strips	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	Use City-owned MetroCount Advanced Bicycle Counter. Two CIP street construction projects planned along E Mt Vernon Street and S Topeka Avenue, both in 2019. Located along the Priority Bikeway Network and on a high crash corridor.
W Lincoln Street & Ark River Path	Permanent	Shared Use Path	Combination: Passive Infrared + Induction Loops	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	Use City-owned Eco-Counter Urban Post MULTI. East Bank Ark River Path constructed in 2017. The Bebe, McCormick, and Irving Street Bikeway was planned for 2021 construction in the 2017 CIP. Project connects the Prairie Sunset Trail to the Arkansas River Path. Located along the Priority Bikeway Network.
Ark River Trail & Westside Athletic Field	Permanent	Shared Use Path	Combination: Passive Infrared + Induction Loops	Goal 1: Document Bicycle Use Trends and Patterns	Use City-owned TRAFx counters, and Eco-Counter Urban Post Zelt Selective Loops Current count location.
Chisholm Trail & N Fountain Avenue	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns	Use City-owned TRAFx counters, add pneumatic tubes. Current count location. Connects to the Priority Bikeway Network.
Chisholm Trail & N Hillside Street	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns	Use City-owned TRAFx counters, add pneumatic tubes. Current count location.
K-96 Bicycle Path & Rosebud Path	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for 2019. Connections to recently completed trail work in adjacent community, and the Priority Bikeway Network.

Count Location	Duration	Setting	Technology	Related Goals	Notes
W Douglas Avenue & S Sycamore St	Short Duration	Mixed Traffic	Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	Streetscape Improvements planned for 2018/2019 along W Douglas Avenue. Located along the Priority Bikeway Network and on a high crash corridor.
Washington & E Douglas Avenue	Short Duration	Bike Lane	Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	Streetscape improvements planned for 2020 along E Douglas Avenue. Repeat popular manual count location. Located along the Priority Bikeway Network and on a high crash corridor.
N Topeka Avenue & E Central Avenue	Short Duration	Bike Lane	Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 3: Develop Bicycle Crash Rate	Repeat popular manual count location. Located along the Priority Bikeway Network and on a high crash corridor.
Ark River Path & Keeper of the Plains	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns	Repeat popular manual count location.
Prairie Sunset Trail & S 119th Street West	Short Duration	Unpaved Trail	Manual	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP project programmed for 2021 improving the Prairie Sunset Trail from S 119th Street to S Hoover Road. Repeat popular manual count location.
Prairie Sunset Trail & S 167th Street West	Short Duration	Unpaved Trail	Manual	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP project programmed for 2021 improving the Prairie Sunset Trail from S 167th Street to S 135th Street. Repeat popular manual count location.

The technology requirements for the recommended Phase 1 count locations include:

- City-owned equipment:
  - 3 TRAFx counters – 1 counter to remain at permanent site, 2 to be moved between 3 short duration count sites
  - 2 MetroCount Advanced Bicycle Counters – to be installed at 2 permanent count sites
  - 1 Eco-Counter Urban Post MULTI – to be installed at 1 permanent count site

    - 1 Eco-Counter Zelt Selective Loops – to be installed at 1 permanent count site
- Items to be purchased:
    - 3 sets of pneumatic tubes – to be moved between 7 short duration count sites

Table 3 outlines a recommended schedule for Phase 1 permanent and short duration count technology implementation over a three-year schedule. The City should adjust this schedule as additional resources and count locations are added, and as the program moves into Phase 2.

Table 3. Phase 1 Technology Schedule and Responsibilities

Technology	Year 1 (2019)	Year 2 (2020)	Year 3 (2021)	Responsible Party	Anticipated Maintenance
TRAFX (3)	• Ark River Trail & Westside Athletic Field • K-96 Bicycle Path & Rosebud Path	• Ark River Trail & Westside Athletic Field	• Ark River Trail & Westside Athletic Field • Chisholm Trail & N Fountain Avenue • Chisholm Trail & N Hillside Street	• Primary: Planning • Secondary: Bicycle/Pedestrian Advisory Board	• Replace batteries once per year • Download data in field
MetroCount Advanced Bicycle Counter (2)	E 2nd Street North & N Topeka Avenue E Mt Vernon Street & S Topeka Avenue			• Public Works – Street Maintenance	• Internal batteries must be replaced every 290 active counting days • Download data in field monthly
Eco-Counter Urban Post Multi (1)	W Lincoln Street & Ark River Path			• Public Works – Street Maintenance	• Download data in field monthly
Eco-Counter Zelt Selected Loops (1)	Ark River Trail & Westside Athletic Field			• Public Works – Street Maintenance	• Download data in field monthly
Pneumatic Tubes (3)	• K-96 Bicycle Path & Rosebud Path • W Douglas Avenue & S Sycamore St • Washington & E Douglas Avenue	• N Topeka Avenue & E Central Avenue • Ark River Path & Keeper of the Plains	• Chisholm Trail & N Fountain Avenue • Chisholm Trail & N Hillside Street	• Public Works – Street Maintenance	• Inspect and repair tubes every few days during deployment

The Phase 1 count locations can be used during the program's launch and through 2021, with locations added and adjusted as additional support becomes available, and bicycle facility projects are planned and programmed. Wichita has three major bicycle projects moving forward in the near-term, including the Redbud Path, the South Canal and Mt Vernon Bikeways, and the Prairie Sunset Trail. Collecting pre-installation counts ahead of these major projects will assist the City in understanding the impact of its investments on local bicycling activity.

The City is also investing in major downtown street reconstruction and streetscape projects along E 2nd Street North and W Douglas Avenue, between 2018 and 2021. Multiple redevelopment and infrastructure projects are kicking off in the Delano neighborhood in 2018. The City's $79 million West Bank redevelopment effort, including the multi-use sports stadium, will greatly impact all modes of transportation in the neighborhood.

PHASE 2 COUNTER INSTALLATION RECOMMENDATIONS

Phase 2 builds upon the count efforts initiated in Phase 1, and moves the City forward in meeting the program's three goals within the 2022 to 2025 timeframe. While Phase 1 largely relies on equipment that the City already has, Phase 2 assumes it will expand its counting equipment inventory and resources in tandem with its growing bicycle network. As for Phase 1, Phase 2 count location recommendations are based on of the City's draft CIP, the Priority Bikeway Network, crash data, and manual bicycle count data. Since the WAMPO TIP identifies projects beyond 2022, the City should review and update the Phase 2 location recommendations prior to initiating this stage. The proposed Phase 2 count locations are outlined in Table 4 and are shown in the attached Phase 2 map.

Table 4. Phase 2 Recommended Count Locations

Count Location	Duration	Setting	Technology	Goal	Notes
E 17th Street North & Redbud Trail and N Oliver Ave	Permanent	Bike Lanes	Piezoelectric Strips	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for 2025.
Douglas Avenue & Market Street	Permanent	Bike Lanes	Piezoelectric Strips	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	CIP Funding programmed for 2023-2024 for E Douglas Avenue street streetscape improvements. Located along the Priority Bikeway Network and on a high crash corridor.
Delano Path & Chisholm Trail Junction (W 1st Street North)	Permanent	Shared Use Path	Combination: Passive Infrared + Induction Loops	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for 2023. Significant projects planned for the Delano neighborhood starting in 2018.
Chisholm Trail & W McCormick Street	Short Duration	Shared Use Path	Combination: Passive Infrared	Goal 1: Document Bicycle Use Trends and Patterns	CIP Funding programmed for 2023. Connects to the planned Bebe, McCormick, and Irving Street

Count Location	Duration	Setting	Technology	Goal	Notes
			+ Pneumatic Tubes	Goal 2: Inform and Review Investment Decisions	Bikeway. Connects to the Priority Bikeway Network.
Chisholm Trail & W Central Avenue and W Zoo Boulevard	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	CIP Funding programmed for 2023. High crash corridor on W Central Avenue.
Delano Path & Ark River Trail	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for 2023. Significant projects planned for the Delano neighborhood starting in 2018.
McAdams Bike Path (I-135) & E 17 Street North	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for bike lanes west of I-135 in 2019, and shared use path east of I-135 in 2025. Connects to the Priority Bikeway Network.
N Hoover Road & W Zoo Boulevard	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions	CIP Funding programmed for 2025. Connects to the Priority Bikeway Network.
Lavon Street & E 13 Street North and N Roosevelt Street	Short Duration	Shared Use Path	Combination: Passive Infrared + Pneumatic Tubes	Goal 1: Document Bicycle Use Trends and Patterns Goal 2: Inform and Review Investment Decisions Goal 3: Develop Bicycle Crash Rate	CIP Funding programming for 2025. High crash corridor on E 13 Street North.

The technology requirements for the recommended Phase 2 count locations include:

- City-owned equipment:
    - 3 TRAFx counters – 1 counter to remain at permanent site, 2 to be moved between 3 short duration count sites
    - 3 sets of pneumatic tubes (purchased for Phase 1) – to be moved between 5 short duration count sites
- Items to be purchased:

- 2 piezoelectric strip sets (MetroCount Advanced Bicycle Counters) – to be installed at 2 permanent count sites
- 1 combination passive infrared and induction loop set (Eco-Counter Urban Post MULTI) – to be installed at 1 permanent count site
- 2 passive infrared (TRAFx counters or other vendor) – to be moved between 6 short duration count sites
- 2 sets of pneumatic tubes – to be moved between 6 short duration count sites

Table 5 outlines a recommended schedule for Phase 2 permanent and short duration count technology implementation over a three-year schedule. The Phase 2 schedule includes continued collection of counts at the Phase 1 locations. However, some of the Phase 1 locations are shifted from their original three-year schedule to allow for Phase 2 location pre-construction counts. The Phase 2 schedule will likely need to be adjusted as project funding is updated in future City CIPs and WAMPO TIPs. As in Phase 1, the City should adjust this schedule as additional resources and count locations are added, and as the program matures.

Table 5. Phase 2 Technology Schedule

Technology	**Year 1** (2022)	**Year 2** (2023)	**Year 3** (2024)
TRAFX (5)**	• Ark River Trail & Westside Athletic Field* • Chisholm Trail & W McCormick Street • Chisholm Trail & W Central Avenue and W Zoo Boulevard • Delano Path & Ark River Trail • McAdams Bike Path (I-135) & E 17 Street North	• Ark River Trail & Westside Athletic Field* • K-96 Bicycle Path & Rosebud Path* • N Hoover Road & W Zoo Boulevard	• Ark River Trail & Westside Athletic Field* • Chisholm Trail & N Fountain Avenue* • Chisholm Trail & N Hillside Street* • Lavon Street & E 13 Street North and N Roosevelt Street
MetroCount Advanced Bicycle Counter (4)	E 2nd Street North & N Topeka Avenue* E Mt Vernon Street & S Topeka Avenue* E 17th Street North & Redbud Trail and N Oliver Ave Douglas Avenue & Market Street		
Eco-Counter Urban Post Multi (2)	W Lincoln Street & Ark River Path* Delano Path & Chisholm Trail Junction (W 1st Street North)		
Eco-Counter Zelt Selected Loops (1)	Ark River Trail & Westside Athletic Field*		
Pneumatic Tubes (5)	• Washington & E Douglas Avenue* • Chisholm Trail & W McCormick Street • Chisholm Trail & W Central Avenue and W Zoo Boulevard • Delano Path & Ark River Trail • McAdams Bike Path (I-135) & E 17 Street North	• N Topeka Avenue & E Central Avenue* • Ark River Path & Keeper of the Plains* • K-96 Bicycle Path & Rosebud Path* • W Douglas Avenue & S Sycamore St* • N Hoover Road & W Zoo Boulevard	• Chisholm Trail & N Fountain Avenue* • Chisholm Trail & N Hillside Street* • Lavon Street & E 13 Street North and N Roosevelt Street

***Phase 1 location; ** Based on the City's experience with TRAFx counters through Phase 1 it may decide to purchase more TRAFx units or use an infrared counter from a different vendor.**

The City should purchase similar equipment models to the technology used in Phase 1. Using similar models and vendor-provided software will streamline the City's maintenance and program management efforts. The City can adjust the number of additional passive infrared and pneumatic tube sets purchased in Phase 2 based on their staff's availability to move the counting technology between the Phase 1 and Phase 2 short duration automated count sites.

The Phase 2 count locations can be used during the program's expansion between 2022 and 2025. During this time, Wichita has programmed three significant bicycling projects, including the Chisolm Trail and Delano Path, the Hoover Bikeway, and the WSU Bikeway Connections. As in Phase 1, the City should collect pre- and post-installation counts to measure the impact of these investments on local bicycling activities. Additionally, the City has major downtown programs scheduled for E Douglas Avenue between 2022 and 2024. As mentioned above, the Phase 2 count sites will likely need to be adjusted as WAMPO's 2022 to 2025 TIP programs are announced.

The positioning of multiple counters during Phase 1 and Phase 2 along key bicycling routes and investment-focused corridors will assist the City in developing corridor and neighborhood-based AADPT estimates. The corridors with the highest level of proposed counters are the Ark River Path (4), the Chisholm Trail (4), Topeka Avenue (3), and Douglas Avenue (3). In addition to the proposed automated counters, the City should continue to partner with WAMPO in identifying manual count locations that can be used to support AADPT estimate developments along key bicycling and investment corridors.

EMERGING DATA SOURCES

The increasing availability of user-generated location data collected by GPS- or cellular network- enabled devices may have significant implications for Wichita's Bicycle Count Program. User-generated data is already in use for motor vehicle planning and operations and has some significant advantages over count data. For example, this data covers a wider geographic area and data management and processing are typically provided by the company that collects the data.

As of 2018, Strava is the primary provider of bicycle user data. Strava collects GPS trace data from bicyclists (and runners) who use its app to track their performance. Since Strava's user base consists largely of recreational or competitive bicyclists, it is not likely to represent the full spectrum of bicyclist types in Wichita. In particular, as bicycling infrastructure is implemented in hopes of attracting new bicyclists onto Wichita streets, Strava data may not reflect an uptick in ridership. Nevertheless, Strava data can be a useful data source for observing the relative use of routes by experienced bicyclists. Paired with count data for validation, Strava could serve as the basis for crude citywide bicycle activity estimates. If used for this purpose, it would be most appropriate to demonstrate relative use rather than absolute volumes.

To determine the potential use of Strava data in Wichita, a pilot project is recommended. This project would involve comparing Strava data with observed counts from permanent and short-duration counts to understand how much of the bicycling activity in Wichita is accounted for within Strava's dataset as well as how Strava reflects bicycling activity in different contexts and on different types of facilities. There is no established guidance for how many validation locations are needed. For example, the Colorado Department of Transportation recently released a report that found Strava trips represent anywhere from 3 to 30 percent of total bicycle use, depending on the location[10]. With such variability, using Strava to predict overall levels of bicycling at an individual location is not recommended. However, Wichita may determine that the variability within the City is much lower than what was found in Colorado. In general, validating Strava data at more locations will improve the ability to use the data to estimate systemwide bicycling activity. Staff time and resource limitations for conducting counts are likely to be the most significant challenges for validating Strava data.

Over the next several years, it is likely that additional companies may enter this market, potentially lowering the cost and improving the quality and usability of crowdsourced data. Vendors such as Streetlight Data and Streetlytics draw from a wider user base that represents a less biased segment of the population than does Strava currently. These vendors could potentially use proprietary algorithms to detect bicycle trips from mobile device data. Regardless of the future direction of user-generated data, counting data will provide valuable insight into bicycling activity in Wichita. Count data provides a rich data source for understanding location-specific patterns and will be needed to validate any future datasets based on samples of the population.

DATA SHARING

The City of Wichita will need to consider how to share pedestrian and bicycle data with researchers, advocacy organizations, developers, consultants, and members of the public. There are a variety of ways the data might be shared. From the perspective of a non-City user, the most accessible method may be to post the data on a website. The Delaware Valley Regional Planning Commission's pedestrian and bicycle count portal is an example of a very robust web portal for pedestrian and bicycle count data. The portal provides AADPT and AADBT estimates for count locations throughout the DVRPC region as well as the underlying short duration count data, including counts by day and hour. Users can access the data through an interactive map or download it through a link to the DVRPC's ArcGIS server. In addition to sharing data with others, an online portal might also be used to store manual count data.

PUBLIC-FACING REAL TIME DISPLAYS

The City of Wichita may also wish to consider installing public-facing real time displays at automated count locations. Such displays can encourage walking and bicycling by letting pedestrians and bicyclists know they count and by conveying to other roadway users that pedestrians and bicyclists are welcome and expected. Eco Display is also fully customizable and can display counts, journey times, or safety messages.

The most common public facing real-time display known as the Eco-DISPLAY Classic (formerly Eco-TOTEM). The Eco-Display can be set up to only count cyclists with loops, or it can be configured to count cyclists and pedestrians using loops and passive infrared.) Public-facing real time displays are most appropriate in high-profile locations that already have significant bicycle volumes. Potential locations in Wichita include:

- Intersection of E. 2nd Street North and N Topeka Avenue
- Arkansas River Trail and Westside Athletic Field

[10] Colorado Department of Transportation. Strava Metro Data Analysis Summary. June 2018. https://www.codot.gov/programs/bikeped/documents/strava-analysis-summary_06-25-18.pdf