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Pedestrians and Bicyclists Count, Phase 2: Implementing and Applying Multimodal Demand Data

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13. Abstract
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Each research project will have an advisory committee appointed by the LTRC Director. The Project Review Committee is responsible for assisting the LTRC Administrator or Manager in the development of acceptable research problem statements, requests for proposals, review of research proposals, oversight of approved research projects, and implementation of findings. LTRC appreciates the dedication of the following Project Review Committee Members in guiding this research study to fruition.

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Pedestrians and Bicyclists Count, Phase 2: Implementing and Applying Multimodal Demand Data

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LTRC Project No. 19-3SA
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conducted for
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August 2023

Abstract

Long-duration pedestrian and bicycle counts, which represent a variety of community contexts and facility types, are broadly understood to be a prerequisite to unlocking a wealth of analytic possibilities for better understanding active transportation demand, tracking Complete Streets policy implementation, and evaluating safety impacts. This study, which advanced preliminary feasibility research completed in LTRC 16-4SA, initiated the collection of permanent counts in four Louisiana communities; piloted and refined protocols for planning, installing, and validating permanent counters, and classifying factor groups; and advanced development of methods for applying count data to solve active transportation planning and safety problems for Louisiana roadways. In addition, this study advanced the extent and coordination of local and regional multimodal data collection in support of statewide Complete Streets policy implementation and performance measurement as directed by the legislature in Senate Concurrent Resolution 110 (2009) and RS: 48:22.1 (2014).

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Implementation Statement

The proposed research represents the first phase of implementation of the findings described and actions recommended in LTRC 16-4SA as well as the resultant data, related products, and resources are directly applicable for implementation by DOTD. In addition, the study advances the investigation of preliminary research pertaining to data management and use, resulting in practice-ready applications for state, local, and regional entities seeking to implement and evaluate performance in the context of Complete Streets policy and design.

In addition to use by DOTD, these findings are of immediate use to Metropolitan Planning Organizations (MPOs) and local government entities throughout Louisiana and beyond. This research has resulted in practical guidance for siting, installing, validating, and maintaining permanent counters. It has also resulted in simple, accessible templates for data management and analysis as well as outreach materials for the continued development of pedestrian and bicycle count practice in the state (both permanent and short-duration counts). Principal Investigator (PI) outreach to local partners interested in continuing to advance and expand multimodal data collection has resulted in the identification of potential resources for ongoing data collection and integration of monitoring assets into planning and evaluation processes.

The data collected in the course of this study are immediately available for additional analysis in response to questions about temporal variation in non-motorized activity, the effects of COVID-19 and subsequent disruptions on walking and bicycling, and as benchmarks against which to compare and calibrate new data sources pertaining to active transportation demand in Louisiana.

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Introduction

Measuring progress toward Complete Streets policy implementation, as well as measuring the performance of individual projects in terms of safety outcomes, requires understanding patterns of and changes in active transportation demand so as to (a) evaluate safety outcomes relative to rates of exposure; (b) identify appropriate, context-sensitive Complete Streets infrastructure interventions; and (c) understand overall statewide and location-specific transportation trends that will impact long-range planning and investment [1].

Continuous, long-term count data is increasingly recognized as a key foundation for each of these types of analysis. The current lack of such data in Louisiana and the ways that this barrier hinders holistic assessment of non-motorized travel demand, vulnerable road user exposure and safety, and Complete Streets policy evaluation was recognized in LTRC Project *16-4SA Pedestrians and Bicyclists Count: Developing a Statewide Multimodal Count Program* [2]. This "Phase 1" research also concluded that the incremental development of systematic active transportation monitoring that is in coordination with existing traffic monitoring activities, and is in cooperation with local and regional agencies interested in or already engaged in data collection and analysis, is feasible and scalable (geographically and fiscally) using a combination of traditional and emerging technologies. Moreover, significant expansion of long-duration count data availability is critical to all efforts to holistically evaluate safety impacts at the project level and is an area where state leadership and investment will have the greatest impact, given that existing data sources and available proxy or surrogate measures of analysis contain important gaps that continuous count data can address.

This study builds on the research foundation of 16-4SA through the planning and implementation of permanent count locations in four communities, which are at a variety of locations representing different contexts and facility types in order to collect a minimum of one year of bicycle and/or pedestrian count data. The counts collected provide preliminary/baseline data for extrapolation of short-duration counts, trend analysis, calibration for future research, and use of secondary data sources. In addition, these pilot count stations provided an opportunity to put into practice recommended planning, installation, and validation practices as well as to develop preliminary quality assurance and quality control (QA/QC) protocols and templates for data analysis and reporting. This research also emphasized ongoing outreach and coordination with local and regional stakeholder partners to facilitate sustainable, long-term expansion of count data availability (including a “backbone” of continuous counts supplemented by short-duration automated and video-based counts as well as supplemental data sources) and positions Louisiana for success as we move toward a data-driven, Safe Systems approach to the transportation network and new infrastructure investments.

Literature Review

The first phase of this research [2] detailed a comprehensive review of the current state of the practice and related literature. Significant federal guidance has been published pertaining to developing multimodal count programs, and the U.S. Federal Highway Administration (FHWA) has clearly asserted support for walking and bicycling as part of an efficient and equitable transportation system [3, 4]. However, few states have yet to implement comprehensive statewide programs, and a lack of clear consensus around minimum data requirements, methods, and applications exists. The need for more and higher quality pedestrian and bicycle volume data, similar to that available for decades for motor vehicles, has been well-documented by transportation planners and researchers [5, 6, 7, 8]. The state of the practice remains in flux in part due to rapid technological advances in this emerging field.

This phase of the research builds upon the findings and recommendations from the preceding research, which indicates a clearly-defined need for the implementation of a robust initial set of permanent count stations, whether on-street, off-street path, or trail facilities, as a typical first step in moving from short-duration, project-oriented data collection to systematic multimodal monitoring [9, 10, 11]. This literature review focuses on key updates to the field including new work supporting exposure analysis and comparable efforts to initiate, advance, and/or evaluate statewide and/or department of transportation (DOT)-led count programs and research advancing the state of the field for incorporating multimodal data into safety analysis, equity initiatives, and planning practice.

Statewide Pedestrian and Bicycle Monitoring Program Growth

As 16-4SA concluded, there is no “one size fits all” approach to pedestrian and bicycle monitoring. Local and/or agency needs, intended data uses, and resource constraints must all be considered in the design of a count program. Tradeoffs exist between accuracy and cost, and no single technology can be expected to meet all of an agency’s needs. Thus far, no state (or region) has fully implemented a bicycle and pedestrian monitoring program of the scope described in the FHWA’s Traffic Monitoring Guide [4]; however, most DOTs engaged in statewide monitoring (e.g., Colorado, Vermont, Minnesota, North Carolina, Texas, and Virginia) are tending to follow its guidance (modified to meet local needs and resource constraints). This guidance is largely modeled on motorized vehicle monitoring, including the development of a set of high-permanent automated monitoring sites from which context-specific adjustment factors for a larger, rotating array of short-term monitoring sites can be developed.

States with well-developed count programs tend to use multiple methods: automated and manual; permanent and short term; various vendors and technologies that evolve over time; and secondary supplemental data streams, including survey data, GPS data (e.g., Strava, Streetlight), etc. to aid interpretation and application of count data [2]. Minnesota and Washington were identified as early leaders in count program development and have recently published widely practical and strategic guidance related to their count programs and/or the use of count data [12, 13].

North Carolina, another national leader in non-motorized data collection, recently completed a comprehensive evaluation of their Non-Motorized Volume Data Program (NC NMVDP) with an aim of identifying next steps for program implementation [14]. North Carolina DOT (NCDOT) has maintained a partnership with the Institute for Transportation Research and Education for several years to manage their count program, which aims to estimate annual average daily traffic (AADT) for active modes, support Complete Streets, and improve local and regional planning. This study included interviews with agencies, technology vendors, and private contractors; assessed the performance of the 72 count sensors currently in use statewide; and developed cost and benefit analyses for alternative count program options based on the efficacy, logistical considerations, and overall value of various alternatives including emerging video-based technologies. The researchers concluded that, while the performance and value of NCDOT's existing suite of counters is acceptable, emerging technology is likely to augment data collection and make it faster and easier to integrate into planning and share across partners.

In parallel with Louisiana's current research effort, Virginia DOT (VDOT) has been planning and implementing a similar pilot non-motorized count program. The first phase of this study scanned current practice, summarized extant non-motorized data collection programs, and synthesized guidance [15]. The findings of this research largely mirrored those summarized in 16-4SA. A second phase of VDOT's research focused on implementation of initial recommendations, including both a suite of permanent counters and development of a loanable inventory of portable counters for collecting short-duration counts [16, 17]. This effort focused on identifying technical recommendations for planning, siting, installing, maintaining, and using automated bicycle and pedestrian counts and concluded that:

- Further expansion of the permanent count network is needed to develop reliable annualized volume estimates from short-duration sites;
- Permanent counters should be considered for installation where feasible as part of new road construction or rehabilitation projects for efficiency;
- Safety is an issue for the use of portable on-street counters;
- Local partnerships are key and additional options are needed for establishing formal and informal agreements with partners to collect and use counts; and
- A statewide purchasing contract specifying specific products/vendors would help expedite procurement and improve consistency of data outputs.

Similarly, Tennessee DOT (TDOT) recently completed a preliminary analysis of best practices for non-motorized count collection, ultimately recommending five “Goals” for TDOT to support data collection. These included: (1) establishing standardized protocols; (2) implementing a process for centralized database development and maintenance; (3) developing analytical methods and processes for reporting performance measures; (4) sharing data with stakeholders; and (5) building multimodal monitoring capacity within TDOT and statewide [18]. Michigan DOT also recently commissioned a *Nonmotorized Data Collection and Monitoring Program Guide and Implementation Plan* [19] to establish a coordinated approach to data collection and analysis and identify roles and responsibilities for state and local stakeholders.

Finally, Texas has also taken steps to advance coordinated statewide pedestrian and bicycle counts. Previous research documented methodological considerations and developed a suite of pilot permanent count stations, including a plan for data collection and guidance for data use and distribution, as well as a preliminary demand estimation model based on household travel surveys and roadway and traffic characteristics [20]. As data collection has advanced, further research has focused on achieving consistency in count processes and the development of a consolidated count database. This effort included the installation of permanent and portable counters in Austin and Houston, an evaluation of crowdsourced secondary data sources (finding that these represented a small and biased share of all bike and pedestrian trips relative to counts), and the development of a portal for public access to count data [21].

Pedestrian and Bicycle Count Data Management and Use

As discussed in 16-4SA, non-motorized traffic is inherently more variable than motorized traffic, and thus more data is generally required to conduct inferential statistical analyses of count and/or crash data. Permanent or long-term count locations are invaluable for understanding how short-duration counts fit into overall annual trends for a given jurisdiction, climate, and/or built environment context [1, 22, 23, 9]. Reliably adjusting short-duration data generally requires a minimum of one full year of clean data from one or (ideally more) comparable sites; multiple years of data will allow continual refinement of adjustment factors as well as a critical barometer of overall trends [24].

All automated count equipment has inherent error. Adjusting for this error and validating data requires well-defined protocols and standards established by the managing agency and routine maintenance [25]. Methods of cleaning, processing, and applying continue to evolve as more cities and states develop more robust inventories of count locations and additional years of data for testing, analysis, and modeling. Researchers with the Institute for Transportation Research and Education (ITRE) (which has managed North Carolina's count program) conducted an evaluation of data quality and issues associated with widespread continuous and short-duration data collection, identifying key priorities for data processing and QA/QC protocols developed in response to the findings to improve data quality [26].

Research to better define the scale of data collection needed to develop accurate pedestrian and bicycle volume estimates has continued to advance as well. Nordback et al. [27], using continuous count data from 102 sites in six cities, found that four or more counters per factor group for bicyclists, and five or more counters per factor group for pedestrians, improve the reliability of annual average daily non-motorized traffic (AADNT) estimates derived from short-duration (7-day) counts. Griswold et al. [28] compared two approaches to factor group development, one based on land use classification and the other based on actual counts, finding that both approaches produced comparable results that exceeded the accuracy of averaging all available count data into a single expansion factor approach. Conversely, Roll and Proulx [29] took an alternative approach to estimating bicycle traffic without use of any permanent count data at all, finding that seasonal adjustment regressions models incorporating weather variables could be used to achieve reliable predictions of average annual daily bicycle traffic (AADBT) based on short-duration counts. However, this method requires consistent availability of short-term count data over multiple years, thus is suitable primarily for jurisdictions that have already integrated short-duration bicycle counts in routine traffic monitoring (but lack a network of existing permanent counters).

The use of surrogate demand inputs such as mobile trip records, particularly as a means to supplement direct data collection, continues to emerge as a key theme in this field. While outside the scope of this effort, researchers generally identify such data as a valuable complement to counts, and vice versa, with direct count data serving as a key calibration tool for the use and interpretation of third-party data sources [30]. The National Association of City Transportation Officials (NACTO) has provided recent guidance on managing mobility data (particularly that involving GPS/mobile data) with a focus on data standards and formats to optimize portability and transparency as well as addressing privacy and security concerns [31]. The principles of developing transparent processes and establishing clear protocols for data sharing, use, and storage are likewise applicable to direct counts.

Using of count data (including modeling network-level demand), assessing road user exposure, and/or benchmarking progress toward safety or other goals remains an emerging research area with limited conclusive results or nationally applied directives to guide jurisdictions. Research pertaining to non-motorized road users remains largely siloed from traditional motor vehicle traffic monitoring research and practice with motor vehicle count program guidance continuing to avoid significant discussion of non-motorized modes [32]. Turner et al.'s "Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists" [33] represents a significant synthesis of the state of the practice in this field, providing a sequential guide to assessing crash exposure—one of the most commonly cited needs for count data—at different scales (facility level to area-wide). This study provides various estimation methods, emphasizing the necessity of direct counts for most robust demand estimation models particularly in areas where extensive, recent household travel surveys have not been conducted. This research also developed an interactive Areawide Non-Motorized Exposure Tool to assist in calculations and model development at the state and MPO levels. Several studies have examined methods for modeling pedestrian and bicycle safety, typically emphasizing proxy risk factors that must be considered (sociodemographic and/or build-environment related) in lieu of or in addition to direct counts [34, 35, 36, 37]. Increasingly, socioeconomic and/or racial equity is considered as a key critical lens for framing such analyses and for interpreting results [36].

Notably, significant gaps in the current state of the research in this field have been identified. The AASHTO Council on Active Transportation (CAT) has developed a Research Roadmap [38] that highlights several areas of research needs pertaining to pedestrian and bicycle data, including the following:

- Applying and integrating active transportation data into planning and operations;
- Assessing accuracy of new bicyclist and pedestrian counting technologies;
- Improving consistency of active transportation data practices;
- Developing methods to estimate pedestrian and bicycle travel from limited counts;
- Measuring changes in bicycle ridership and effects of bicycle network development;
- Incorporating active transportation into travel demand modeling;
- Incorporating active transportation modes into transportation impact studies; and
- Addressing barriers to integrating active transportation throughout planning and engineering practice.

Several major studies addressing one or more of these topics are currently underway and/or pending, such as NCHRP 07-31, "State DOT Usage of Bicycle and Pedestrian Data: Practices, Sources, Needs, and Gaps," which is anticipated to begin in 2022.

Objective

The purpose of this study was to begin to implement key recommendations, address remaining gaps in data availability, and address the state of the practice identified in LTRC project 16-4SA "Pedestrians and Bicyclists Count: Developing a Statewide Multimodal Count Program" in order to provide DOTD with a practical foundation for an efficient, cost-effective bicycle and pedestrian count program and continue to inform collection and use of multimodal count data.

Specifically, the objectives of the study included:

1. To install permanent counters at a set of pilot locations and collect one year of pedestrian and bicycle data representative of a variety of usage patterns and/or facility types.
2. To develop roadway factor groups for Louisiana communities and preliminary expansion factors for adjusting short-duration multimodal counts.
3. To identify, support, and inform opportunities for coordinated local and MPO-led data collection.

Scope

To build upon previous LTRC research, advance implementation of statewide multimodal data collection, and implement the application of resultant datasets, this study included the following research tasks aimed at building the foundation for implementing a statewide pedestrian and bicycle count program:

- Update and expand the literature review and count technology/vendor database from 16-4SA, focusing on new research and current best practices in development of regionally specific and context-sensitive adjustment factors for non-motorized count data and exposure calculation methodology.
- Identify preliminary factor groups representative of Louisiana roadways and identify potential count locations assessed to be representative of a variety of those factor groups in each of four case study areas (FHWA focus cities of New Orleans and Baton Rouge, and the smaller communities of Mandeville and Ruston), and conduct short-duration test counts to assess suitability and verify anticipated traffic patterns and to finalize permanent count installation locations.
- Refine factor groups, finalize long-term count locations and installation details, and conduct a pilot study involving collection of one year of continuous pedestrian and bicycle count data at locations representing different usage patterns and/or facility types in each pilot community using automated, permanent count equipment (infrared sensors, inductive loops, and/or mixed-method sensor equipment). This task includes calibration and validation of data over the course of one year or more, periodic maintenance, and refinement of protocols for data validation and quality assurance, e.g., defining draft criteria and establishing data management protocols and reporting standards for use by DOTD.
- Support DOTD in advancing coordinated statewide multimodal data collection beyond the preliminary long-duration counts directly supported through this research, including local and regional agencies, non-profits, and other state agencies through the following activities:
  - Reviewing agency policies and funding criteria to ensure that opportunities for supporting local and MPO-led data collection are clearly identified and that such activities are encouraged to move forward;

- — Developing and disseminating resources summarizing active transportation monitoring best practices (including but not limited to "Pedestrian and Bicycle Count Data Collection and Use: A Guide for Louisiana)" to promote coordinated data collection approaches and facilitate effective data sharing;
- — Identifying training and resource needs to develop capacity and expertise among traffic monitoring staff and any outside contractors employed in pedestrian and bicycle counting methods and unique considerations for these modes; and
- — Recommending protocols for DOTD staff to implement data collection, management, and storage after completion of the project, including projected resource needs and departmental and/or external stakeholder costs.

- Refine and apply methodology for developing roadway factor groups and expansion factors for adjusting short-term multimodal counts across the roadway network and continue refinement of exposure and safety analysis framework and approach, including establishing baseline data for pilot regions.

- Provide evidence-based recommendations for the continued development of a cost-effective, efficient bicycle and pedestrian count program including guidelines for ongoing maintenance of the permanent count locations and the corresponding datasets and preliminary adjustment factors developed, and provide recommendations in support of continued Complete Streets policy implementation.

Methodology

Approach

This applied research builds on previously identified recommendations and best practices [2], adapted to meet the needs and context of Louisiana communities and stakeholders. The study represents pilot implementation of practices established both in Louisiana (i.e., previous counts collected in New Orleans) and elsewhere and seeks to identify opportunities for and barriers to sustainable, ongoing expansion of systematic multimodal data collection for planning and evaluation statewide through five semi-sequential tasks.

1. Updating Bicycle and Pedestrian Research Methods

A research foundation for this work was previously completed. However, this is an emergent field in which new research and results are being continually published. To ensure alignment with current best practice, the research team conducted an annual scan of new literature pertaining to non-motorized counts with a focus on new research (2018-2021). This review emphasized the practical aspects of count program implementation and application, including the development of regionally specific and context-sensitive adjustment factors for non-motorized count data and exposure calculation methodology. In addition, this review included an annual scan for updates to the technology/vendor database initially developed under 16-4SA *(*Appendix A) and a review of documentation pertaining to potential and outcomes from use of new technologies (e.g., LTRC Project 19-1SA).

2. Identifying Preliminary Factor Groups and Conduct Short-Term Verification Counts

In this task, the team identified preliminary, rough factor groups representative of Louisiana roadways and identified a list of potential count locations assessed to be reasonably representative of a variety of those factor groups in each of the two urban case study areas (FHWA focus cities of New Orleans and Baton Rouge) as well as in a variety of small town or city contexts for consideration as a more rural case study site. Generally, test sites were identified based on the extent to which a given potential location addressed one of two applicable siting strategies [1] emphasized for the purposes of this study (given the research objectives established). These siting strategies included:

- **Representative Locations**—locations where one can reasonably expect to see "typical" patterns for a given area, context, facility type (not necessarily the highest volumes); and
- **Targeted Locations**—locations that have specific planning relevance such as network pinch points, crash locations, or key "backbone" facilities in network. Particularly important in areas with limited pedestrian/bicycle activity where representative locations are unlikely to yield user volumes that permit robust analysis.

Factor groups can be comprised of varying levels of complexity. At the most basic level, these may be derived from Area Type and Travel Pattern alone (Table 1):

Table 1. Typical basic factor groups for pedestrian and bicycle count data analysis

Area Type	Travel Pattern Anticipated	Basic Factor Group
Urban Rural University	Work Commute Recreation Utilitarian Mixed	Urban Commute Urban Recreation Urban Utilitarian Urban Mixed Rural Commute Rural Utilitarian Rural Recreation Rural Mixed University Mixed

For the purpose of this study, however, a slightly more complex range of factors was developed including primary land use, roadway classification, and pedestrian or bicycle facility type (Table 2).

Table 2. Proposed initial factor range for LTRC 19-3SA permanent count pilot installation

Area Type	Anticipated Travel Pattern	Primary Land Use	Roadway classification	Bike/Ped Facility Type
Urban	Commute	CBD	Arterial	Shared Use Trail (off-street)
Suburban	Recreational (weekend)	Non-CBD Commercial/Retail	Collector	On-Street Cycle Track/Protected Bikeway
Rural	Mid-Day peak (weekday)	Residential	Local	On-Street Bike Lane
	Utilitarian/Mixed	University	n/a (Shared-Use Trail)	Sidewalk
		Recreation Area		n/a (Shoulder/Mixed Lane)

From this "menu" of factors, a wide range of potential factor groups and sub-groups may be derived (however, some combinations are improbable and may be reasonably excluded). The following list of likely suggested factor groups (independent of roadway and facility type) for which potential count sites were considered:

- Urban Commute—CBD
- Urban Commute—Non-CBD Commercial
- Urban Commute—Residential
- Urban Mid-Day Peak—CBD
- Urban Utilitarian/Mixed—Non-CBD Commercial
- Urban Utilitarian/Mixed—Residential
- Urban Utilitarian/Mixed—University
- Suburban Mid-Day Peak—Non-CBD Commercial
- Suburban Recreational—Residential
- Suburban Recreational—Recreation Area

- Suburban Utilitarian/Mixed—Non-CBD Commercial
- Rural Utilitarian/Mixed—Non-CBD Commercial
- Rural Utilitarian/Mixed—University

Next, from this list, roadway and active transportation facility factors were considered as a filter for identifying potential count locations. The presence of appropriate facilities on which to count, where moderate to high pedestrian and/or bicycle activity is anticipated, was a prerequisite for consideration for this study and to some degree dictated which preliminary factor groups were included in this initial data collection effort.

Irrespective of site context and anticipated factor group, logistical considerations underpinning site selection included the following:

- Feasible location to secure temporary count equipment (i.e., fixed post/object in correct position in relation to expected path of bike/ped travel)
- Need to identify locations where people will generally walk or bicycle single file (to reduce occlusion errors)
- Avoids locations where people congregate or idle
- Sites where users are constrained to the area being measured (e.g., on a bridge, most bicyclists may use the sidewalk, but if bicycling on the roadway is permitted some may be missed)
- On straight, smooth, level sections of roadway or trail (not on a curve or steep grade)
- Away from potential sources of interference (e.g., water, direct sunlight for infrared sensors, utility lines for inductive loop detectors)
- Appropriateness/feasibility of counting bicyclists and pedestrians at same location
- Moderate or high anticipated bike/ped volume preferred (100-1000 people per day, except in rural locations)
- Location should NOT be expected to undergo construction/reconfiguration in near-medium term future (unless counter can be incorporated into planned improvements without major data/physical disruption)

In consultation with the Project Review Committee, the research team developed a list of proposed count locations and conducted short-duration test counts using LTRC and the University of New Orleans' (UNO) existing inventory of infrared and/or pneumatic tube counters, as well as manual counts in limited circumstances, to assess suitability and verify anticipated traffic patterns and to finalize permanent count installation locations. Counts were collected for a minimum of seven days in accordance with the *Pedestrian and Bicycle Count Data and Use: A Guide for Louisiana* [39]. The following general framework was utilized to assess the extent to which a given test site aligned with assumptions and/or made an appropriate candidate for long-term count collection.

- Are people using this facility/corridor for walking and/or bicycling?
- How many bicyclists, pedestrians, and/or total users per day (weekdays vs. weekends)?
- Ratio of bikes to pedestrians, where applicable (using manual validations)
- Directionality: ratio of "in" to "out" (where applicable) and implications for pattern analysis (e.g., disparities reflecting commute patterns)
- Usage by hour (weekdays, weekends)
- Overall pattern:
  - — Commute (distinct AM/PM weekday peaks)
  - — Recreational (high weekend usage, less pronounced peaks)
  - — Utilitarian/Mixed (consistent usage across days, time of day, may have moderate peaks)
  - — Insufficient information/limited use
  - — Other (anything distinctive such as spikes in use on a particular time/day, anything that might suggest an unusual event)
- Overall suitability as a count location: What factor group does this location represent, and are there major limitations/considerations with proceeding with this location as a permanent count site?

Assumed travel patterns were assessed for accuracy during the first phase of data collection, using a widely applied methodology for assessing factor group usage pattern based on ratios of weekend to weekday volume and morning to mid-day volume, [40, 13], wherein:

- Weekend Ratio = Peak hour weekend traffic/Peak hour weekday traffic where: peak hour is the greatest hourly traffic volume counted during that day;

- Morning Ratio = Average of weekday hourly traffic from 7 am–9 am/Average of weekday hourly traffic from 11 am–1 pm

Using parameters set by researchers in other North American cities, the following thresholds were used to categorize test counts—as well as previously collected short- and long-term automated count data—into one of three rough activity pattern groups [13]: commute, mixed or multipurpose, and non-commute or noon activity (Table 3).

Table 3. Preliminary travel pattern classification based on weekend and morning ratios

Travel Pattern	Weekend Ratio	Morning Ratio
Commute	< 1	> 1.5
Mixed or Multipurpose	< 1	< 1.5
	1.0 – 1.8	> 1.5
Non-Commute or Noon Activity	1.0 – 1.8	< 1.5
	> 1.8	Any

Results of this classification exercise were used to narrow and define the final list of permanent count locations (Task 3).

3. Long-Duration Count Data Collection Initiation

Following analysis of the short-duration count results, the team sorted proposed count locations by preliminary factor group. In collaboration with the PRC, the team finalized long-term count locations and installation details to conduct a pilot study involving collection of one year (or more where feasible) of continuous pedestrian and bicycle count data representing different usage patterns and/or facility types in each of two FHWA focus cities regions (New Orleans and Baton Rouge) and two smaller communities (Mandeville and Ruston) using automated, permanent count equipment.

For this purpose, three types of commonly utilized and well-developed technologies for automated long-duration counting of pedestrians and bicycles were used, including infrared counters for data collection on sidewalks, inductive loops for on-street bicycle facilities, and combination infrared/inductive loop sensor configurations for mixed auto/bicycle counts on shared-use trails. The research team selected EcoCounter as the equipment vendor due to accessibility of data and compatibility with existing and previous count locations, remote data retrieval functionality, and robust performance record of the company's products.

Final site selection was determined based on the following factors:

- **Feasibility** (alignment of site location and configuration with available count equipment/technology specifications)
- **Activity** (sufficient observed or anticipated pedestrian and/or bicycle activity to facilitate pattern analysis and data validation)
- **Usefulness** (utility of the location as a key network benchmark, representative example of like locations or facilities, and/or specific stakeholder interest in data outputs)

Planning for installation, calibration, and validation of the long-duration count stations included the following basic tasks:

1. Define specific proposed installation locations and collect field data to facilitate equipment configuration (in partnership with equipment vendor);
2. Secure permits/permissions for installations from all relevant authorities for each installation location;

3. Procure equipment (including sole-source vendor authorization);
4. Contract with vendor for installation (required for inductive loop sensors, optional for infrared-only and/or pneumatic tube sensors);
5. Install units according to vendor specifications and conduct initial synthetic calibration testing; adjust sensor settings as needed;
6. Conduct manual validation counts (minimum 8 hours per site) and evaluate results; develop site-specific correction factors for systemic sensor- or context-linked errors;
7. Perform periodic (i.e., monthly) site maintenance checks to ensure uninterrupted counter operation;
8. Periodically (i.e., monthly) download and visually inspect all data to identify overall trends, potential concerns, etc.;
9. Once sufficient data has been collected (minimum 3 months), conduct preliminary visual analysis of results, apply “flags” for highlighting incongruous data and, if necessary, apply mathematical rules for data QA/QC to identify and if needed, remove potentially erroneous data;
10. Once sufficient data has been collected (minimum 12 months), conduct full, detailed review of data (e.g., by month, day of week, hour of day, etc.) and develop site-specific adjustment factors for short-duration count extrapolation and/or missing data imputation; and
11. Compile and report data for all sites in standardized format, including count station metadata in tabular and spatial format.

4. Coordinated Statewide Data Collection Support

Inter-jurisdictional outreach and partnerships are needed to sustain successful non-motorized traffic monitoring. Most infrastructure interventions, project evaluations, safety studies, etc. will be conducted on local streets. State engagement in existing data collection efforts and development of guidance for future local/regional data collection can ensure compatible datasets and collaboration and efficient use of resources. To this end, the research team supported DOTD in advancing coordinated statewide multimodal data collection beyond the preliminary long-duration counts directly supported through this research, including local and regional agencies, non-profits, and other state agencies, through the following activities:

- Reviewing agency policies and funding criteria to ensure that opportunities for supporting local and MPO-led data collection are clearly identified and that such activities are encouraged to move forward
- Developing and disseminating resources summarizing active transportation monitoring best practices (including but not limited to *Pedestrian and Bicycle Count Data Collection and Use: A Guide for Louisiana)* to promote coordinated data collection approaches and facilitate effective data sharing. This included development and delivery of several presentations tailored to specific local or regional audiences (including parish planning and engineering staff, MPO Technical Advisory Committee Members, and local advocates)
- Identifying training and resource needs to develop capacity and expertise among traffic monitoring staff and outside contractors employed in pedestrian and bicycle counting methods and unique considerations for these modes (including development and implementation of a full-day workshop for planning and engineering consultants engaged in project-level data collection)
- Developing recommendations for DOTD staff to support coordination of ongoing data collection, management, and storage after completion of the project, including resource needs for ongoing maintenance, strategies for sustainable count program growth, and guidance on data application and use.

5. Data Application Methodology Development

Concurrent with Task 3 data collection, the research team continued to refine methodology for developing roadway factor groups and expansion factors for adjusting short-term multimodal counts across the roadway network and to research potential opportunities to incorporate resultant data into exposure and safety analytic frameworks and approaches used in Louisiana, including establishing baseline data for the pilot regions. This task included the following primary activities:

- Calculation of areawide (parish, MPO, and state level) exposure rates using methodology and tools outlined in the "Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists" [33]
- Analysis of count data to determine hourly, daily, monthly, and seasonal trends, relationship of activity volumes to weather conditions, reassessment of factor group classifications, and development of summary tables and charts to aid in interpretation of count data for individual sites and the permanent counter network overall
- Development of expansion factors for each site (for which 12 months or more of data is available) by which to extrapolate short-duration counts and summary analysis of like-patterned factor groups
- Development of recommendations in support of sustainable, ongoing multimodal count data collection and coordination at local, regional, and state levels, reflecting stakeholder input and the role of enhanced data availability and application in continued Complete Streets policy implementation.

Discussion of Results

1. Bicycle and Pedestrian Research Methods Update

Robust ongoing research and dialogue around multimodal data collection and use has occurred over the last few years. The research team reviewed approximately two dozen relevant new reports, articles, and/or manuscripts pertaining to non-motorized count data collection and use. As previously described (literature review), this state-of-the-practice research emphasized new guidance on data usage for risk/exposure analysis, data management, and modeling applications. Based on the growing list of states (Appendix B) that have researched and/or initiated new data collection efforts and expansion at the local and regional levels in the scope of these activities; the types of technology deployed; and the end-user applications of the resulting datasets, short- and long-duration multimodal data is increasingly assumed to be within the necessary scope of work for state and local DOTs. Program growth at all levels of government tends to be incremental. States with established count programs (e.g., Minnesota, North Carolina) continue to lead the way in developing new partnerships and research applications. States with emergent programs (e.g., Virginia, Texas, Michigan) have completed key planning activities to guide, standardize, and pilot implementation of counts.

COVID-19

The impact of COVID-19 on active transportation patterns, planning, and data collection efforts was a key area of research that the team necessarily monitored during this study. Many jurisdictions paused or deferred planned short-duration counts during the early months of the COVID-19 pandemic based on significant changes in mobility patterns documented and observed [41]. How the pandemic has impacted walking and bicycling activity has varied over time and geographically [42]. However, jurisdictions with permanent counters installed have had a distinct advantage in quantifying the degree and character of these impacts and have been able to use the data to support rapid-build temporary facilities to promote socially-distant physical activity [43]. Definitions of what constitutes a return to “normal” conditions vary widely by geography and context, including variable application and enforcement of policies intended to mitigate virus spread. Where possible, practitioners recommend comparing current data to past results to understand both the impacts of disruption (in terms of magnitude as well as divergent patterns) and points of inflection where "routine" data collection may be presumed to resume [44, 45].

Surrogate Data Sources

In parallel with direct counts, the use of mobile phone data in planning applications has rapidly grown; however, practitioners caution that it must be used in conjunction with direct counts in order to validate the data and calibrate both the magnitude and character of inherent error in extrapolating from biased sample data [15, 46]. This includes data from specific apps in which individuals track their own activity (such as Strava Metro, which is now being offered at no cost to local governments) as well as data from companies that aggregate geolocated data points from a variety of apps which are collected passively and reflect all types of movements (such as Streetlight, that offers algorithm-derived, modally classified trip data at the network level). While these options offer valuable context and many applications in planning, their cost, data limitations, and relative opacity of process for data calibration purposes means that at this point, they do not provide an adequate substitute for direct counts. Rather, such surrogate data sources complement counts and allow for development of better network-wide demand estimates.

Technology and Equipment

Meanwhile, minimal substantial change has occurred in the range of vendors and/or specific equipment technologies currently on the market to support pedestrian and bicycle data collection although several vendors and/or products previously identified have subsequently left the market (Appendix A). The use of artificial intelligence to derive counts from video has continued to expand with vendors offering both camera technology and video processing services. So far, these are being deployed primarily at the research level, with some municipal authorities engaging in pilot programs but limited in use among state agencies. LTRC's *Evaluation of Counting Device for Pedestrians and Bicyclists* [47] evaluated two products currently on the market that aim to provide modally-classified counts at locations in New Orleans and Baton Rouge where traditional count technology is impractical. The results of this study (as compared to manually reviewed video data) were unsatisfactory in terms of accuracy, and continued use of the specific products tested was not recommended [47]. While these products continue to show promise for versatile, short-duration count solutions in locations where mechanical options are not feasible, they remain disproportionately expensive on a cost-per-data-hour basis, and in some cases, the researchers found they perform poorly under heavy traffic conditions and adverse weather conditions. In addition, technical and logistical challenges associated with installing the devices, and difficulty diagnosing apparent data errors, may discourage their widespread adoption.

SCRAM

Finally, a key piece of new guidance published during the study period includes the FHWA's *Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists* (SCRAM) [33], which provides a standardized model for statewide and MPO-level exposure estimates based on American Community Survey (ACS) and National Household Travel Survey (NHTS) factors (see Section 5 for model application for Louisiana and its metropolitan areas).

This guide reinforces the primacy of direct counts for both facility-specific analysis and network-level modeling using continuous count data to adjust short-duration counts across the network through an eight-step process for selecting and determining an appropriate measure of risk (Figure 1). This process begins with determining the use of the risk measure (e.g., measure progress toward aggregate safety targets, network screenings, project prioritization, countermeasure evaluation, or site evaluation). Next, the geographic scale (either facility-specific or areawide) must be established along with the preferred definition of risk. Three general definitions of risk are provided:

1. Observed crash rate (crashes divided by a selected measure of exposure): a commonly used metric that may result in inaccurate results in areas with low crash frequency and/or low exposure.

    Examples: crashes per 100,000 people; crashes per 1000 bicycle commuters, crashes per million vehicle miles traveled (VMT)

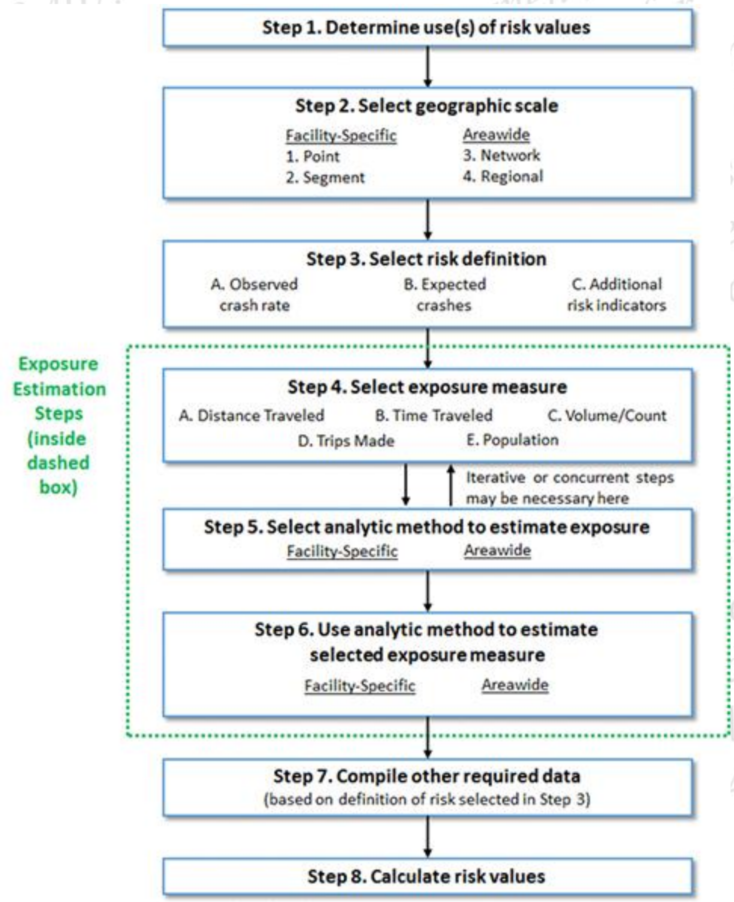
2. Expected crashes (based on statistical models in which exposure may be one of several inputs): a more useful approach for areas with low crash frequency, but requiring advanced statistical techniques.

Example: Safer Streets Priority Finder, which combines past crash outcomes with a built-in statistical model for predicting future risk-based proxy variables for exposure

3. Additional risk indicators (observed crashes plus other factors such as facility type, vehicle speed/volume, land use, exposure, etc.): a useful approach for systemic safety analysis, but lacking a numeric crash rate value as an output.

   Examples: traffic control devices, speed limits, points-of-interest (POIs), roadway or intersection geometric characteristics

Figure 1. SCRAM eight-step risk measure selection process [33]



The fourth step involves selecting the preferred measure of exposure (i.e., distance, time, volume, trips, or population). Population (including specific sub-populations) is an efficient metric for areawide analysis. Given an absence of travel survey data for

Louisiana communities, volume/count-based exposure measures for points or segments are the most feasible exposure metric for facility-specific evaluation although bike share system data and route choice data (e.g., Strava) can also be used as inputs.

The next step involves deriving the analytic method to derive the data required for the selected exposure metric, whether site counts; model-based (direct demand, regional travel demand, trip generation, flow, discrete choice, geographic information system (GIS)-based, simulation based, etc.); or travel surveys. A balance must be drawn between direct counts and modeled outputs. It is not feasible to collect counts network-wide, necessitating the use of demand estimation models to fill in gaps. Direct demand models draw from volume data at sample locations with representative land use, urban form, facility type, etc., and can use regression analysis to extrapolate the resulting data but may miss important variables that impact travel volumes and patterns. Traditional regional travel demand models typically lack sufficient spatial detail for pedestrian and bicycle activity analysis, and/or are resource intensive to develop and update. Turner et al. summarized a variety of innovative models and methods but ultimately focused on direct demand models as the most versatile option in many contexts [33].

At their most basic, counts used as exposure measures make no assumptions about distance or time traveled. To develop effective direct demand models, count data at a representative sample of locations with a range of facility types and land uses is needed. Baseline continuous count data from which to develop adjustment factors is a key prerequisite. Long-duration counts may in turn be used to extrapolate short-duration counts (using adjustment factors) to achieve a sufficiently diverse sample. The resulting AADT for a segment may be multiplied by segment length to calculate pedestrian or bicycle miles traveled (PMT or BMP.) Volume/count data can be based on direct counts or demand estimation models, with segment-level volume data used to estimate intersection volume where needed multiplied by motor vehicle volume to derive a more comprehensive measure of exposure, and/or aggregated counts on parallel segments that make up a corridor to develop an overall corridor volume. Calculating pedestrian and bicycle volume over a corridor, however, can be challenging because of the granular nature of distinct segments, requiring numerous counts to accurately define.

The key limitation of a direct demand model, moreover, is that it is specific to the area for which it was developed and therefore may not be transferred for use in another location. Turner et al. summarized a suite of models built from input datasets ranging from 34 to

647 count locations. In Louisiana, only New Orleans currently has an inventory of (short-duration, mostly manual) count locations within this range. Thus, development of direct demand models for Louisiana jurisdictions is largely beyond current feasibility. However, the data derived from this study provides an important first step for future model development.

Final steps in the guide include compilation of other data sources (such as recommended roadway inventory for systemic safety analysis, Table 4) and calculation of final risk values, wherein: Risk = expected or measured crashes (by kind and severity)/Exposure.

Table 4. FHWA systemic safety approach potential risk factors

Variable	Roadway and Intersection Features	Traffic Volume Features	Other Features
Number of lanes	x		
Lane width	x		
Shoulder surface width/type	x		
Median width/type	x		
Horizontal curvature, delineation, or advance warning	x		
Horizontal curve and tangent speed differential	x		
Roadside or edge hazard rating (potentially including sideslope design)	x		
Driveway density	x		
Presence of shoulder or centerline rumble strips	x		
Presence of lighting	x		
Presence of on-street parking	x		
Intersection skew angle	x		
Intersection traffic control device	x		
Number of signal heads versus number of lanes	x		
Presence of backplates	x		
Presence of advanced warning signs	x		

Variable	Roadway and Intersection Features	Traffic Volume Features	Other Features
Intersection located in/near horizontal curve	x		
Presence of left-turn or right-turn lanes	x		
Left-turn phasing	x		
Allowance of right-turn-on-red	x		
Overhead versus pedestal mounted signal heads	x		
Average daily traffic volumes		x	
Average daily entering vehicles		x	
Posted speed limit or operating speed			x
Presence of nearby railroad crossing			x
Presence of automated enforcement			x
Adjacent land use type, such as schools, commercial, or alcohol-sales establishments			x
Location and presence of bus stops			x

Source: https://safety.fhwa.dot.gov/systemic/pdf/FHWA_SystemicApproach_PotentialRiskFactors.pdf

Currently, there is no single commonly accepted metric for pedestrian or bicyclist exposure. FHWA requires reporting of raw numbers of fatalities and serious injuries, as well as rates by population. Analysis of crash rate by commute mode share data is the only other nationally available metric. The SCRAM provides additional guidance for use or examples of exposure variables in project selection processes, both to estimate the cost of crashes [48] and to develop overall priority scores for a range of projects [49].

The guide also highlights the importance of local and regional travel survey data as a key input providing valuable data into non-commute trip behaviors, travel time and distance, and trip origins and destinations. This represents a current gap in Louisiana's ability to holistically evaluate active transportation demand, which may be partially (though not fully) addressed through use of surrogate data sources, which collectively (as discussed above) can provide insight into existing and latent active transportation demand.

Finally, Turner et al. discuss the imperative for assessing and accounting for exposure in evaluation of countermeasure effectiveness. Facilities that improve conditions for walking and bicycling tend to attract more users, which typically increases exposure.

Given the low overall numbers of crashes that are likely to result on any given segment, empirical Bayesian methods are recommended to compare outcomes before and after installation. The authors note that results are improved in comparing a batch of sites with similar interventions to a control group without, rather than simply evaluating outcomes on one site before and after, and/or to assess observed conflicts among road users rather than (or in addition to) crash rates alone [33].

2. Preliminary Factor Group Identification and Short-Term Count Verification

An initial set of nearly 50 potential count locations was identified in partnership with the PRC (Appendix C) representing a variety of contexts and facility types in Southeast Louisiana. This list was evaluated to identify the area type, primary land use, roadway classification, existing bicycle and/or pedestrian facility, anticipated travel pattern, anticipated travel volume, facility jurisdiction, and overall suitability for conducting short-duration test counts (including existence of previous count data, if available). Short-duration test counts using infrared, pneumatic tube, and/or manual counts were then conducted to assess suitability and verify anticipated traffic patterns to finalize permanent count installation locations. In all, counts were collected at 19 installation points covering 13 sites between June 2019 and March 2020 (Table 5).

Table 5. Short-duration test count locations, 2019-2020

Count Location Name	Count Location Cross Street	Facility Type	City	Sensor Type	User Type	Data Begin Date	Data End Date
Westbank MRT	Eliza St	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	6/11/2019	6/25/2019
Newton Street	Teche St	Shared lane (on-street)	New Orleans	EcoTUBES	Bicycles	6/11/2019	6/25/2019
Wisner Trail	Desaix St	Shared-Use Trail	New Orleans	EcoTUBES	Bicycles	6/28/2019	7/15/2019
Wisner Trail	Desaix St	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	6/28/2019	7/15/2019

Count Location Name	Count Location Cross Street	Facility Type	City	Sensor Type	User Type	Data Begin Date	Data End Date
Capital Heights Ave	Moore St	2-way bike lane	Baton Rouge	EcoTUBES	Bicycles	7/16/2019	8/1/2019
Downtown Greenway	Napoleon St	Shared-Use Trail	Baton Rouge	EcoTUBES	Bicycles	7/16/2019	8/1/2019
Downtown Greenway	Napoleon St	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	7/16/2019	8/1/2019
Mississippi River Trail	South Blvd	Shared-Use Trail	Baton Rouge	EcoTUBES	Bicycles	7/16/2019	8/1/2019
Mississippi River Trail	South Blvd	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	7/16/2019	8/1/2019
BREC I-110 Trails - Scotlandville	Jones St	Shared-Use Trail	Baton Rouge	EcoTUBES	Bicycles	8/1/2019	8/20/2019
BREC I-110 Trails - Scotlandville	Jones St	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	8/1/2019	8/20/2019
BREC I-110 Trails - Airline Terrace	70th St	Shared-Use Trail	Baton Rouge	EcoTUBES	Bicycles	8/1/2019	8/20/2019
BREC I-110 Trails - Airline Terrace	70th St	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	8/1/2019	8/20/2019
E Thomas St (Hwy 190)	N Cate St (North)	Sidewalks	Hammond	EcoPyro	Pedestrians	9/6/2019	9/24/2019
E Thomas St (Hwy 190)	N Cate St (South)	Sidewalks	Hammond	EcoPyro	Pedestrians	9/6/2019	9/24/2019
Dalrymple Dr	March St	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	11/15/2019	12/8/2019
Gardere Ln	Old Hermitage Pkwy	Sidewalk	Baton Rouge	EcoPyro	Mixed Bike/Ped	11/15/2019	12/8/2019
Nicholson Dr	E Boyd St	Shared-Use Trail	Baton Rouge	EcoPyro	Mixed Bike/Ped	2/13/2020	3/18/2020

Pilot count locations for New Orleans and Baton Rouge were principally made based on the availability of existing dedicated bicycle and/or pedestrian facilities representing key network links and/or corridors of particular stakeholder interest. For the selection of a rural or small-town pilot counter locations, the following criteria were applied:

- Population of less than 50,000
- Target locations: one shared-use trail and one pedestrian-oriented "main street" area
- Demonstrated evidence of bicycle/pedestrian activity (per any of the methods described below)
- An active walking/bicycling community and/or local plans and policies supporting active transportation

Challenges encountered during the collection of short-duration pilot counts at these locations included needing to provide additional field team support for safety during installations on mixed-traffic facilities; delays due to inclement weather and materials failure (i.e., relatively fresh asphalt unable to hold road nails securing tubes due to softening in extreme heat); and damage to one sensor due to vandalism (which left the sensor functional, but more vulnerable to theft).

For each location, two hours of manual observation were conducted to verify sensor accuracy and assess contextual factors that may impact site selection. For all sites assessed, data was charted and analyzed by day of week, travel direction, hour of day (weekend vs. weekday), and a preliminary travel pattern was calculated using the Morning and Weekend Ratio method [13]. These data were summarized and presented to gain insight into active demand at the location and suitability for permanent counter installation including assessment of overall volumes across related sites, days of the week, a period of time, or daily travel patterns that relate to the nature of facility use (Appendix C). In most cases, observed user patterns approximately matched anticipated results based on local knowledge and initial observation. At some locations, total daily user volumes were found to fall short of expectations, eliminating them from consideration for permanent counter installation. Full short-duration test count results are available in Appendix C.

In addition, count data for locations where data had previously been collected (within the last 5 years) in New Orleans, Baton Rouge, and Mandeville was reviewed to identify travel patterns and characteristics that may represent an appropriate location for a continuous counter. This data collected by UNO Transportation Institute and the New

Orleans Regional Planning Commission through the Pedestrian Bicycle Resource Initiative [50] and from the first phase of *Pedestrians and Bicyclists Count* [2] served as an additional important source of context for identifying suitable permanent count locations and estimating anticipated activity volumes and patterns, particularly for locations where automated counts had previously been collected. This included the review of findings from 71 manual count locations and 14 automated count locations in Orleans Parish, Jefferson Parish, St. Tammany Parish, and Baton Rouge, including the calculation of preliminary factor groups for the latter category. From this review, several locations where new or additional continuous count activities were assessed to be feasible and potentially valuable.

In Baton Rouge, data provided by Capital Region Planning Commission (CRPC) summarizing the findings of automated (tube) counts collected by CRPC from 2015-2017 and manual counts collected by Bike Baton Rouge were also reviewed to aid in the identification of suitable Baton Rouge count locations and to establish an indicator of overall relative volume anticipated in the region. Among automated short-duration count sites, the highest daily average volumes were observed at locations along the Mississippi River Levee Trail, on East Lakeshore Drive, and on the trail surrounding Milford Wampold Memorial Park. Manual counts collected by Bike Baton Rouge in September 2017 consisted of 2-hour counts on weekday evenings from 5-7 p.m., and 1- to 2-hour counts collected on a Saturday at noon. A few sites also included a 2-hour Monday 10 a.m.-12 p.m. count. These "snapshot" counts, which included both intersection counts and 'screenline' (i.e., mid-block) counts, were collected simultaneously at all locations and thus useful in evaluating relative activity levels across a variety of locations of interest to the bicycle advocacy community in Baton Rouge. Again, the highest observed totals were found on trails surrounding recreational areas. In addition, a relatively high volume of bicyclists was observed on Capital Heights Avenue.

The locations and summary 2019 averages by day of week of four TrafX infrared counters installed by BREC in 2018 on the Perkins Road Park/Pennington Trail were reviewed, highlighting robust use of this facility. These counts have not been manually validated to verify sensor accuracy or contextual factors (e.g., possible overcounts due to sensor placement or user behavior), and hourly data breakdowns were not available so data from these sensors are not included in the analytic results below. However, analysis of daily and long-term usage patterns on this recreational facility may be integrated into local active transportation monitoring as Baton Rouge's network of trails and on-street facilities continues to grow. Key characteristics and/or summary statistics for all short-duration counts collected or reviewed (as calculated using data available through June 2019) are provided in Appendix C.

Finally, the results of an LTRC study [47] evaluating a third-party automated image-processing count device were considered with an emphasis on assessing the potential suitability of the pilot count locations where the devices were installed; and, for which video footage was manually reviewed to assess device performance, providing average daily pedestrian and bicycle totals for each study period for further monitoring activity. These count locations were selected in part due to the known challenge of collecting count data at locations with unconstrained pedestrian pathways and/or lack of dedicated bicycle infrastructure, and thus were excluded from eligibility for installation of permanent mechanical counters at that time.

In addition to previously collected counts, surrogate data sources were reviewed to assess relative demand and suitability, particular for rural areas where no direct counts were available, including:

- ACS Mode of Transportation to Work data
- Strava data visualizations provided by DOTD showing relative activity levels among app users statewide
- Local pedestrian and/or bicycle plans, particularly proposed facility maps and demand analyses (e.g., documents associated with Moving New Orleans Bikes [51] and the Baton Rouge Pedestrian and Bicycle Master Plan [52])

The primary goal of the test counts, and review of previously collected data and plan documents, was to assess overall suitability as a count location by determining:

- What preliminary factor group or anticipated set of conditions and activity patterns does this location represent (to the extent that such data is available);
- What is the expected relative total non-motorized user volume; and
- Whether there are major limitations/considerations with proceeding with this location as a permanent count site.

The findings of the test counts contributed to the development of a smaller list of potentially feasible permanent installation locations that meet study goals and represent a mix of contexts where enough pedestrians and/or bicyclists may reasonably be expected to travel.

Given the scope of the study, technical limitations of the equipment, and limited state of development of active transportation networks within the subject communities, it was not possible to identify feasible count locations representing every potential combination of key factors. Not all sites selected for advancement to consideration as permanent count locations met the recommended guideline of a minimum of 100 users per day [13], particularly in more rural or suburban areas. In addition, budgetary and logistical constraints render the national guidance recommending 3-5 permanent count locations per factor group or more [13, 4, 27] generally infeasible (and out of scope) for this pilot implementation effort.

In addition, final site selection confronted three fundamental challenges, which are likely to be common in any Louisiana community where multimodal traffic monitoring is planned:

1. It is difficult to effectively capture activity where no dedicated (or poorly designed or maintained) bicycle and pedestrian facilities exist, even if non-motorized activity is evident. This may be compounded by prevalent road design features that prohibit the use of tubes (e.g., angled parking) and/or high roadway average daily traffic (ADT). Observation of test count locations during this task revealed high rates of sidewalk bicycling as well as frequent incidence of pedestrians in roadway, even where some dedicated bicycle or pedestrian infrastructure exists.
2. The current period of rapid planned expansion of bikeway networks and changes in the range and design of facility types being implemented in the two major subject communities (New Orleans, which was in the process of implementing 75 miles of new or upgraded low-stress bikeways during the study period, and Baton Rouge, which was in the early stages of implementing a recently adopted Pedestrian and Bicycle Master Plan [52]). In New Orleans, several existing conventional bike lanes were identified as targets for upgrade to physically protected lanes (typically involving reconfiguration of the lane alignment), further complicating permanent counter site selection).
3. Pedestrian and bicycle activity volumes in rural areas is particularly difficult to assess given either direct counts or surrogate measures. Test counts, when collected over short periods (days or weeks), may yield inconsistent results that miss or over-

represent irregular events (e.g., recreational groups that use a facility periodically). In these areas, local stakeholder insight may be the most important guiding factor in identifying appropriate monitoring locations.

3. Long-Duration Count Data Collection Initiation

Following the analysis of the short-duration count results, the team drafted an initial suite of specific locations identified by the research team and PRC in October 2019 as suitable targets for long-duration count data collection. Additional research was recommended for a second list of locations, which were ultimately finalized in June 2020 following delays related to COVID-19. A final additional site (Government Street) was added in March 2021 after determination that the project's construction schedule and the research team's extended data collection timeline would coincide sufficiently to include this high-priority location in the scope. Meanwhile, the research team coordinated the purchase and installation of four additional counters in New Orleans and Ruston, which were supported through research initiatives external to this project using compatible methods, equipment, and validation procedures. The data from these units would be used to simultaneously support multiple projects and expand the total number of data hours available to support this study. The final list of permanent count locations and their pre-installation anticipated factor group variables are listed in Table 6.

Table 6. Final permanent count station locations

Count Location	City	Community Type/ Context	Primary Surrounding Land use	Facility Type	Anticipated Relative Volume	Previously Observed Activity Pattern (if known)
Norman Francis Pkwy Trail	New Orleans	Urban	Mixed-Use	Shared-Use Trail	High	Multipurpose
Esplanade Avenue	New Orleans	Urban	Residential	Bike Lanes	High	Multipurpose
Wisner Trail	New Orleans	Urban	Recreation Area	Shared-Use Trail	Moderate	Multipurpose
Dalrymple Drive Trail	Baton Rouge	Urban	Recreation Area/Residential	Shared-Use Trail	High	Recreational
River Road MRT	Baton Rouge	Urban	Recreation Area/CBD	Shared-Use Trail	High	Multipurpose

Count Location	City	Community Type/ Context	Primary Surrounding Land use	Facility Type	Anticipated Relative Volume	Previously Observed Activity Pattern (if known)
Rock Island Greenway Phase 1	Ruston	Suburban/ Small Town	Residential	Shared-Use Trail (soft surface)	Moderate	Recreational
Capital Heights	Baton Rouge	Urban	Residential	Bike Lanes	Moderate	Multipurpose
Gardere Lane	Baton Rouge	Suburban	Mixed-Use	Sidewalk	Moderate	Multipurpose
Nicholson Drive	Baton Rouge	Suburban/ University	University	Shared-Use Trail	Moderate	Multipurpose
Tammany Trace	Mandeville	Suburban	Residential	Shared-Use Trail	Moderate	Recreational
Mandeville Lakefront Path	Mandeville	Suburban/ Small Town	Non-CBD Commercial	Shared-Use Trail	Moderate	n/a
Government St	Baton Rouge	Urban	Non-CBD Commercial	Bike Lanes	Low	Multipurpose
Lafitte Greenway*	New Orleans	Urban	Mixed-Use	Shared-Use Trail	High	Multipurpose/ Commute
Behrman Park*	New Orleans	Urban	Recreational	Shared-Use Trail	Moderate	n/a
Baronne St*	New Orleans	Urban	CBD	Protected Bike Lane (one way)	Moderate	Commute
Algiers MRT*	New Orleans	Urban	Mixed-Use/Recreational	Shared-Use Trail	High	Multipurpose
Rock Island Greenway Phase 2*	Ruston	Suburban/ Small Town	Mixed-Use	Shared-Use Trail	Low	n/a

*Denotes count location supported through partnership with external funder

Planning and Permitting

For each location, specific proposed installation sites were defined, diagrammed, and shared with the equipment vendor to develop equipment configurations suitable for the context. Field visits to each location were conducted to collect measurements on proposed facilities, and photograph and mark proposed installation locations (Appendix D). Once installation plans were complete and detailed quotes obtained for equipment, the installation plan was submitted to the PRC for approval (October 2019). Next, two tasks were simultaneously undertaken: procuring the equipment and securing authorization for installation from relevant stakeholders at each location.

The approval process for securing a purchase order for the initial batch of equipment resulted in approximately six weeks of delay. Other researchers have likewise found that delays relating to government procurement regulations can be a barrier to count program implementation and suggest that development of a statewide contract for equipment purchase could be a useful tool for streamlining the bid/procurement process, negotiating group pricing, and/or ensuring compatible data streams across different jurisdictions [16]. In addition, equipment delivery was delayed due to long lead times from the manufacturer (estimated 4-6 weeks) as well as a customs paperwork issue that resulted in the order being returned from the UPS processing facility in New Orleans to Germany. Equipment was ultimately delivered in January 2020.

Meanwhile, permissions for installation were required for each count location. The process of securing approval resulted in delays ranging from less than one month (locally-owned facilities requiring only email confirmation of authorization to proceed) to 16 months. In the case of the Baton Rouge Mississippi River Trail counter, formal Letters of No Objection were required from the U.S. Army Corps of Engineers (USACE) and the Coastal Protection and Restoration Authority (CPRA) in order to secure a final permit from East Baton Rouge Parish to complete the installation. A summary of involved stakeholders and approval documentation is provided in Appendix D. For the first batch of counters, outreach to secure approvals began in December 2019, with a request accompanied by a packet of diagrams outlining the locations and extent of the installation (Appendix D). Permission to install the Wisner, Esplanade, and Norman Francis Parkway counters was granted by email from New Orleans Department of Public Works. Secondary stakeholders (i.e., the Department of Parks and Parkways) were informed of the planned installation and given the opportunity to raise any questions or concerns. On Esplanade Avenue, this included stipulations and guidance pertaining to avoiding harm to tree roots, plantings, and the historic curb stones in place at the installation location. During a field visit to finalize installation plans, the team was approached by local community stakeholders responsible for maintenance of the adjacent pocket park, who provided further direction about mitigating potential impacts. The Lafitte Greenway counter required approval from the New Orleans Recreation Department also granted by email just prior to the planned installation date in March 2020.

In Baton Rouge, early communications (beginning January 15, 2020) centered on determining conclusively the relevant jurisdiction of each proposed count site. Dialogue with BREC and East Baton Rouge Parish continued until a final determination of BREC's ownership of the relevant portion of the Dalrymple Drive Trail on March 9, 2020. It was determined that a memorandum of understanding (MOU) with detailed installation diagrams would need to be developed to proceed. The process of executing the MOU was delayed due to COVID-19 related staffing and capacity issues and was ultimately executed on August 15, 2020 (Appendix D).

Originally, two permanent counters were planned for installation on Mississippi River Levee Trail sections, one in New Orleans and one in Baton Rouge. Outreach to relevant authorities began immediately to initiate the process as formal permitting requirements were anticipated. In New Orleans, the research team reached out to the Southeast Louisiana Flood Protection Authority - West (Algiers Levee District) in December 2019. A permit request was drafted and submitted on February 7, 2020. However, this was rejected due to inability to issue a Letter of No Objection for a term of longer than one year. At this point, a mobile counter was temporarily installed near the proposed count location as an interim measure while discussion with local partners to resolve installation concerns continued. Ultimately, however, the challenges identified with permanent installation at this location were determined to exceed the team's capacity to address, and a new site with similar equipment configuration needs in a nearby neighborhood (Behrman Park Trail) was selected as an alternate location.

Meanwhile, in Baton Rouge, an initial meeting to identify the process and stakeholders involved in levee trail installation began in January 2020, with a follow up meeting with CPRA in February 2020. After this meeting, the research team submitted a draft permit request on February 6, 2020. CPRA provided feedback and requested revisions, and the request was resubmitted February 7, 2020. This request was forwarded to USACE, who returned it requesting additional information. As an interim measure, a portable count unit was similarly installed at a location near the proposed count site in anticipation of a prolonged approval process. A revised and expanded permit request was resubmitted to CPRA on April 23, 2020, with the proposed installation location adjusted to eliminate the need to disturb earth on the crown of the levee structure (Appendix D). This request was approved by CPRA and submitted to USACE on July 10, 2020. USACE's permitting process experienced delays (attributed to staff turnover). Ultimately, a Letter of No Objection was issued by the New Orleans District Corps of Engineers on March

29, 2021. The City of Baton Rouge Department of Public Works - Engineering Division provided a final installation permit on June 30, 2021 (Appendix D).

In Ruston, local partners agreed to complete the installation of their first count station in-house. This unit, ordered and shipped separately, was similarly delayed and was delivered in March 2020. Due to staff furloughs and other impacts of COVID-19, installation was delayed until August 2020.

The second batch of count locations, approved in April 2020, was delivered in June 2020. Discussion around installation and approvals for units on Gardere Lane, Capital Heights, and Nicholson Drive began well in advance in March 2020; however, parties involved were uncertain about whose authority was required to proceed and whether a formal MOU would be required. Stakeholder meetings were called in June and July to address the issue. The research team provided a draft MOU modeled after the agreement executed with BREC in September 2020; however, final approval via informal email confirmation from East Baton Rouge Parish was not granted until February 19, 2021.

In St. Tammany Parish, approval for installation was relatively straightforward and the units were installed as quickly as possible in August 2020.

Finally, the Government Street counter, added to the scope in late 2020, was approved under the authority of DOTD (though in the process of transfer to local ownership). In addition to standard installation diagrams, DOTD required a traffic plan, which resulted in increased contractor installation costs (Appendix D). Approval of the installation request and traffic plan took approximately one month, though installation was delayed due to weather and vendor scheduling issues.

Overall, increased familiarity with the purpose and use of pedestrian and bicycle count equipment (e.g., in New Orleans and St. Tammany Parish, where similar equipment had previously been utilized) appears to lead to faster and more streamlined approval processes. Conversely, relying on local government support for installation (e.g., Ruston); installation in locations governed by more than one authority or where informal stakeholders assert authority (e.g., Esplanade Avenue); and installation in environmentally sensitive locations (such as on or adjacent to a levee structure) tends to lead to longer implementation/installation lags. Levee trails represent an important facility type in Louisiana, and interest in collecting data about their use is likely to continue in locations where they exist. Establishing expedited approvals processes for integrating data collection into future expansion, construction, and/or maintenance projects is recommended to reduce the friction associated with securing permits for work impacting flood protection structures.

Installation and Validation

While theoretically some EcoCounter permanent count solutions can be installed with very little technical expertise and only hand tools, the installation of inductive loop sensors, which requires the cutting of existing pavement or asphalt and basic familiarity with electrical engineering, necessitated identification of contractor support. The research team solicited bids from several contractors. However, only one vendor responded affirmatively with the expertise and capacity to complete the installation. Following university contracting and procurement protocol, Jack Harper Electrical LLC was engaged to complete the installation of all units in New Orleans, Baton Rouge, and Mandeville. Ruston handled installation of their permanent count equipment in-house. The contractor handled utilities marking and conducted a final site visit in advance of each installation to confirm dig and sensor locations. All units were installed in accordance with vendor specifications and installation guides, provided along with equipment. Final installation dates for all counters utilized in this project (including those whose purchase and/or installation was externally funded) are listed in Table 7.

Following installation of each unit, an initial synthetic calibration test was conducted to confirm successful sensor installation and activation. This consisted of repeated passes of the research team and/or contractors on foot and on bicycle through the sensor zone at different speeds and distances, in each direction, to confirm that the units were correctly counting and classifying facility users. At some locations, sensor settings were adjusted (via mobile app) from default settings to improve reliability until at least 10 passes of each mode, in each direction, were correctly counted.

Table 7. Final permanent count station list and installation dates

Site #	Site Name	Facility Type	City	Equipment	Modes	Install Date
3	Norman Francis Parkway Trail	Shared-Use Trail	New Orleans	EcoMulti	Peds, Bikes	3/3/2020

Site #	Site Name	Facility Type	City	Equipment	Modes	Install Date
6	Algiers MRT	Shared-Use Trail	New Orleans	EcoPyro	All	3/16/2020
12	Lafitte Greenway	Shared-Use Trail	New Orleans	EcoMulti	Peds, Bikes	3/7/2020
20	Baronne St Bike Lane	Protected Bike lane	New Orleans	EcoTubes	Bicycles	9/28/2017
25	Wisner Trail	Shared-Use Trail	New Orleans	EcoMulti	Peds, Bikes	3/4/2020
39	Esplanade Ave Bike Lanes	Bike Lanes	New Orleans	EcoZelt	Bikes	3/13/2020
40	Behrman Park Trail	Shared-Use Trail	New Orleans	EcoMulti	Peds, Bikes	11/6/2020
41	Tammany Trace	Shared-Use Trail	Mandeville	EcoMulti	Peds, Bikes	8/26/2020
42	Mandeville Lakefront Path	Shared-Use Trail	Mandeville	EcoPyro	All	8/27/2020
48	Rock Island Greenway - Phase 1	Shared-Use Trail (unpaved)	Ruston	EcoMulti	Peds, Bikes	8/24/2021
49	Rock Island Greenway - Phase 2	Shared-Use Trail	Ruston	EcoPyro	All	3/17/2021
44	Dalrymple Drive Trail	Shared-Use Trail	Baton Rouge	EcoMulti	Peds, Bikes	3/11/2021
45	Nicholson Drive Trail	Shared-Use Trail	Baton Rouge	EcoMulti	Peds, Bikes	3/10/2021
46	Capital Heights Bike Lanes	Bike Lanes	Baton Rouge	EcoZelt	Bicycles	3/11/2021
47	Gardere Lane Sidewalk	Sidewalk	Baton Rouge	EcoPyro	All	3/10/2021
43	Baton Rouge MRT (Casino)	Shared-Use Trail	Baton Rouge	EcoPyro	All	2/13/2020
56	Baton Rouge MRT (Water Campus)	Shared-Use Trail	Baton Rouge	EcoMulti	Peds, Bikes	7/19/2021
57	Government St Bike Lanes	Bike Lanes	Baton Rouge	EcoZelt	Bicycles	7/18/2021

After installation, the research team performed manual validation counts, in two-hour increments for a minimum of eight total hours per site[1], to confirm sensor function more comprehensively. The intent of the validation counts was to identify systemic as well as contextual issues which impact total counts reported as well as to develop-site specific correction factors to address such errors.

Overall, net sensor accuracy for total active users based on manual validation was found to be within +/- 10% at all count locations, providing relatively high overall confidence in the data (Table 8, Figure 2). However, issues with several key types of common errors were observed:

- **Occlusion:** A common error wherein both pedestrians and bicyclists traveling in pairs or groups are counted as single users, resulting in an under count. This is most common on shared-use trails with higher volumes and more recreational users, such as the Tammany Trace, Lafitte Greenway, and Mississippi River Trail in Baton Rouge.
- **Modal or directional misclassification:** In some locations, a percentage of bicyclists are missed by the inductive loop sensor but logged by the infrared sensor, resulting in an under count of the share of users who are bicyclists. This was identified as a significant issue on the Wisner Trail, where inbound bicyclists were observed to frequently travel down the centerline of the two-way trail between the inductive loops, resulting in approximately 9% of total bicyclists misclassified as pedestrians. In addition, while directional accuracy was generally observed to be high, several infrared sensors appear to systemically overreport users as "IN" when in fact they were traveling "OUT." This tendency was also observed during previous studies involving automated infrared counts, and no clear explanation for why this occurs has been identified. In most cases, user directionality (especially on trails or sidewalks) is of relatively limited interest, so such errors don't represent a major limitation in equipment use.

[1] Excluding one externally-funded location in Ruston for which only four validation hours had been collected at the time of this analysis

- **Users outside of sensor zone:** Net accuracy of the total recorded counts for the corridor (including any users who bypass the sensor zone) is generally lower. In a few locations (e.g., Baronne St., Tammany Trace, and Norman Francis Parkway), parallel sidewalks, roadways, or alternative/shared lanes capture a substantial share of overall pedestrian and bicycle traffic. Although this does not represent a problem with the overall operation of the counters and their use in measuring facility use, it is important to understand who is not being counted and why within a given corridor.

- **Obstructions:** Although no instances of significant sensor obstruction were identified during the validation count periods, this is identified as a potential cause of bad data, resulting in either extreme overcounts for the period of obstruction (e.g., a one hour spike in activity due to individuals loitering in the vicinity of the counter) or under count (e.g. unusual or prolonged zero counts due to an obstruction of the sensor itself such as a vehicle parked over inductive loops, forcing bicyclists to bypass the sensor).

- **False positives:** Of all accuracy issues noted, false positive counts represent the most challenging to identify and resolve. During initial validation counts at some locations (the results of which were discarded after resolution), issues with electrical interference resulting in false positive infrared counts were identified. This was resolved by wrapping the infrared sensor unit in aluminum foil per manufacturer recommendation, which generally eliminated the observed occurrence of false counts. In other instances, no clear explanation for occasional false or double counts could be determined. In nearly all locations during validation count trials, the number of false positive passes recorded was less than the number of users missed due to occlusion, resulting in net accuracy within acceptable thresholds. The only exceptions identified include Nicholson Drive, where false positive pedestrian counts resulted in a 3.6% net overcount and Capital Heights, where two double counts and zero occlusion errors were observed. In both cases (as in some other locations), low overall user volumes during observation periods impact the degree to which errors affect average accuracy calculations. Additional observation is recommended to improve data reliability.

The effect of these observed errors is that accuracy of the sensors, when disaggregated by mode and direction, is generally lower, with a tendency to under count bicyclists and variably over and under count pedestrians due to a combination of occlusion and misclassification errors (Figure 3 and Figure 4).

Table 8. Validation count summary results—Net sensor accuracy and contextual error rate

Site #	Site Name	Number of Validation Hours	Number of Total Users Observed (in sensor field)	Net % Accuracy of sensor			Context errors: % observed outside sensor range		
				Bikes	Peds	All	Bikes	Peds	All
3	Norman Francis Parkway Trail	11	858	92.9%	94.7%	93.8%	8.6%	15.3%	12.1%
6	Algiers MRT	12	785			98.2%			0.5%
12	Lafitte Greenway	13	1496	95.5%	91.7%	94.2%	5.5%	6.5%	5.9%
20	Baronne	11	96	96.9%			22.0%		
25	Wisner	12	744	90.4%	113.8%	99.1%	1.6%	0.4%	0.7%
39	Esplanade Ave	12	923	92.6%			2.9%		
40	Behrman Park Trail	11	95	73.9%	102.8%	95.8%	0.0%	2.7%	2.1%
42	Tammany Trace	10	336	94.9%	97.2%	95.8%	16.7%	10.8%	14.3%
42	Mandeville Lakefront	10	1058			98.9%			3.4%
43	BR MRT - Casino	2	35			100.0%			2.8%
44	Dalrymple Drive Trail	9 (bike); 6 (ped)	285	98.6%	97.3%	97.9%	10.3%	2.7%	6.6%
45	Nicholson Trail	10	56	95.0%	108.3%	103.6%	4.8%	2.7%	3.4%
46	Capital Heights	9	98	101.0%			0.0%		
47	Gardere	8	77			94.8%			23.8%
48	RIG - 1	8	148	100.0%	96.5%	96.6%	0.0%	0.0%	0.0%
49	RIG - 2	4	21			100.0%			12.5%

Site #	Site Name	Number of Validation Hours	Number of Total Users Observed (in sensor field)	Net % Accuracy of sensor			Context errors: % observed outside sensor range		
				Bikes	**Peds**	**All**	**Bikes**	**Peds**	**All**
56	BR MRT - Water Campus	8	184	97.5%	92.3%	94.6%	7.0%	1.9%	4.2%
57	Government St	8	31	100.0%			8.8%		

Figure 2. Validation count net accuracy by hour of data—all counters

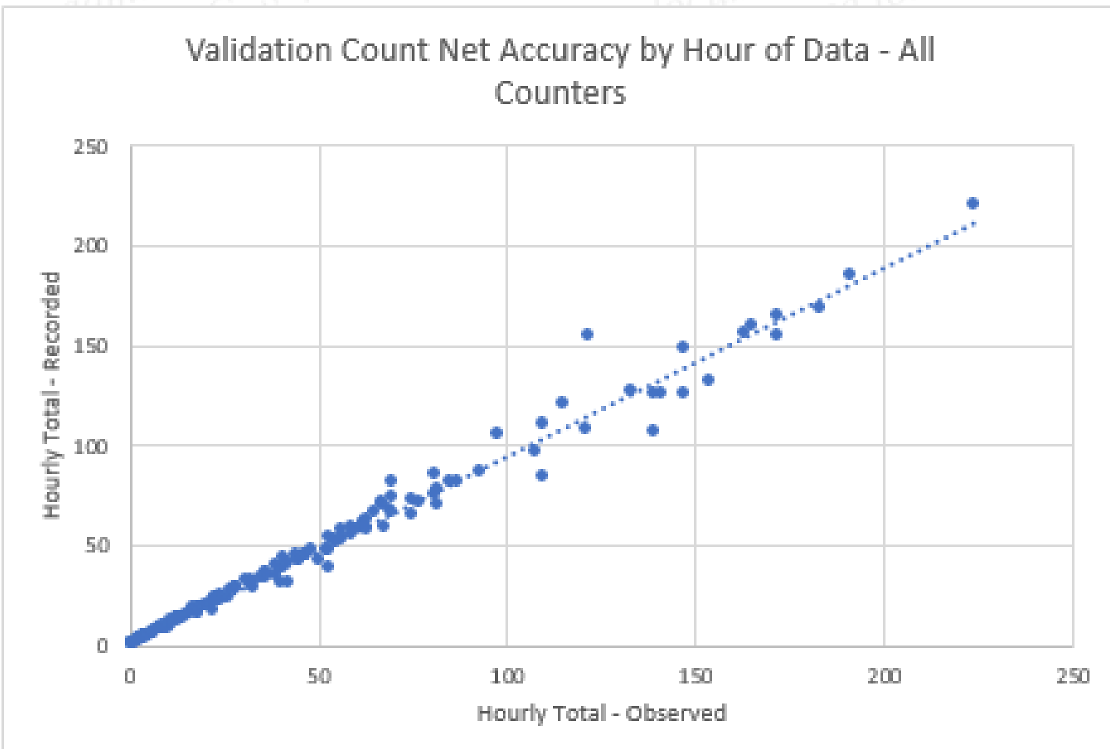


Figure 3. Validation count net accuracy by direction and mode—Infrared sensors

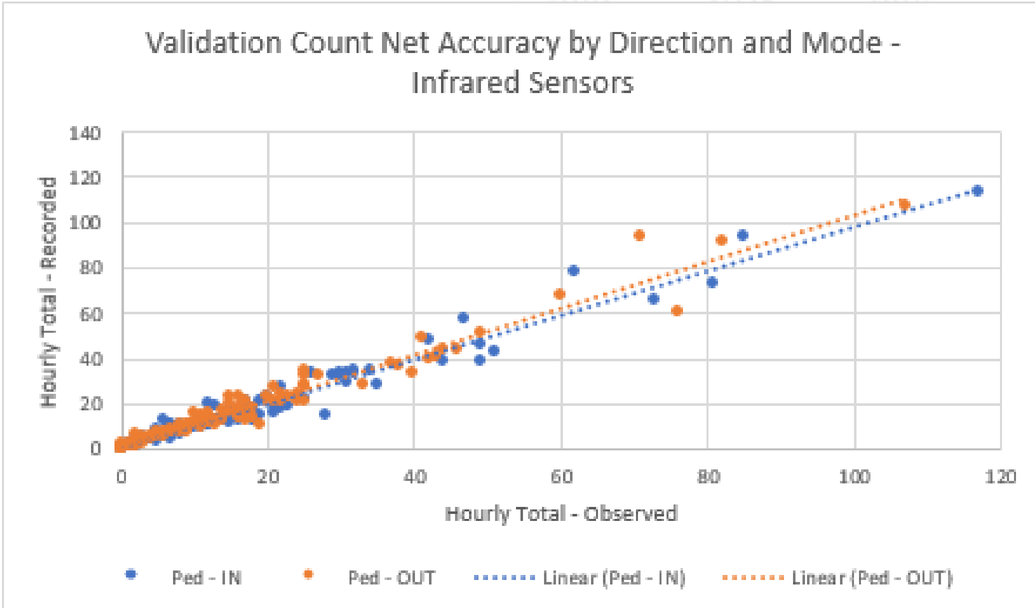
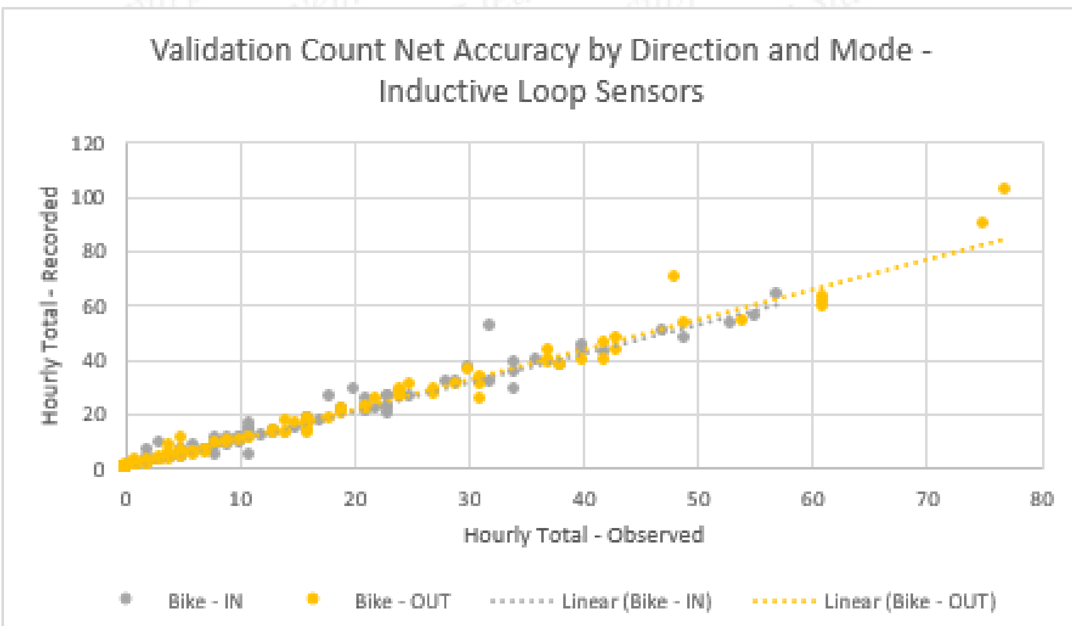


Figure 4. Validation count net accuracy by direction and mode—Inductive loop sensors



Maintenance and Monitoring

Subsequently to initial validation counts at each location that were generally collected within 1-2 months of installation (with additional one-hour tests conducted following battery replacement or other major maintenance activities), the research team performed periodic site maintenance checks (bi-monthly for counters in New Orleans, quarterly for counters in Baton Rouge and Mandeville, and semi-annually for counters in Ruston due to travel distances involved). The purpose of these maintenance checks (see Appendix D) was to conduct a brief (e.g., 15 minute) sensor operation validation, visually inspect equipment for damage, insect activity, vegetative overgrowth, graffiti, etc., and address any issues observed.

On an approximately quarterly basis, preliminary visual analyses of the data (in tabular format and through production of simple charts) were conducted to calculate preliminary average daily user volume figures and identify rough thresholds for flagging and investigating incongruous data. This included reviewing any observed count volume spikes to check whether they corresponded to special events in the area (e.g., holidays, sporting events, social activities) as well as checking whether recorded periods of low activity or zero-counts corresponded to unusual weather events. For New Orleans' counters, the months immediately following counter installation were characterized by unusually high volumes on nearly all facilities observed, excluding Baronne Street which experienced a sharp decline in activity due to impacts of COVID-19. Thus, preliminary analysis of this data was assumed to not be representative of typical conditions and was analyzed principally to (a) better understand the impacts of pandemic travel and social restrictions on active transportation use and (b) to determine a point at which patterns and magnitude of pedestrian and bicycle activity returned to more "typical" conditions, based on limited pre-pandemic data available at select locations. Ultimately July 1, 2020, was identified as a functional starting point for analysis. All summary trends reported subsequently use this as the analysis starting point unless otherwise indicated. However, it is important to note that as of this reporting date, restrictions and disruptions related to COVID-19 persist, which may impact summary results. Annual reviews of the data and updates to key benchmarks are recommended to better understand long-term shifts.

Several notable negative events occurred during the study period impacting data completeness and/or quality. Three count locations received severe damage due to vandalism (Gardere Lane) or presumed automobile collisions (Lafitte Greenway, Dalrymple Drive) which permanently disrupted collection of infrared sensor data. Periods of data loss resulting from issues with batteries impacted several sites. In some cases, dead batteries were preceded by a period of erratic sensor activity, compounding these data losses. In a few cases, sensors stopped collecting and/or transmitting data entirely for unexplained reasons unrelated to battery life. In some cases, these issues were identified quickly and addressed. In other cases, issues went unnoticed for longer periods or were identified but not resolved due to lack of replacement equipment available and/or lack of a clear diagnosis of the cause of the error. In all such cases, any presumed or suspected erroneous data has been excluded from analysis below.

After at least 12 months of data were collected for each site, the data were downloaded for full, detailed review to identify and remove errors; summarize key site statistics; chart data patterns by month, day of week, hour of day, etc.; and develop site-specific adjustment factors for short-duration count extrapolation and/or (if needed) missing data imputation. The results of this review are summarized below in Section 5: Data Application Methodology Development.

Finally, hourly and daily data were compiled in a standardized format including basic count station metadata and usage notes, in tabular and spatial format (Appendix E). The data formatting presented is intended to be accessible to any count manager or analyst (i.e., no special software required) and to allow compatibility with most types of count equipment technology, provided it is disaggregated to at least the hourly level. Classification by mode and direction of travel are recommended but optional.

4. Coordinated Statewide Data Collection Support

Inter-jurisdictional outreach and partnerships are needed to sustain successful non-motorized traffic monitoring because most infrastructure interventions, project evaluations, safety studies, etc. are conducted on locally owned roads. State engagement in existing data collection efforts and development of guidance for future local/regional data collection can ensure compatible datasets, collaboration, and efficient use of resources. To this end, the research team has used this research effort to support DOTD in advancing coordinated statewide multimodal data collection through outreach to and partnership with local and regional agencies, non-profits, and other state agencies.

Funding and Policy

First, this included a review of agency policies and federal funding guidelines to identify opportunities for supporting local and MPO-led data collection. The Federal Highway Administration explicitly permits the purchase of counting equipment and/or expenses associated with data collection and monitoring for pedestrians and/or bicyclists through at least 10 federal funding programs widely used by states, MPOs, local governments, and transit agencies to improve or expand infrastructure, including Federal Transit Administration (FTA) Capital Funds, the Highway Safety Improvement Program, the National Highway Performance Program, Surface Transportation Block Grants, the Transportation Alternatives Set-Aside, Recreational Trails Program, Safe Routes to School programs, Statewide Planning and Research/Metropolitan Planning Funds, and the Federal Lands and Tribal Transportation programs (Table 9).

Although these programs may be expected to evolve with the passage of the Infrastructure Investment and Jobs Act (IIJA), the inclusion of active transportation monitoring as a supported activity under a variety of federal programs is not expected to change. Thus, government agencies at all levels have opportunities to access funds, either through formula allocations or competitive grant programs, that can support pedestrian and bicycle count program development.

Table 9. Pedestrian and bicycle funding opportunities—U.S. Department of Transportation transit, highway, and safety funds

Funding Program	Counting equipment	Data collection and monitoring for pedestrians and bicyclists
BUILD		
INFRA		
TIFIA Loans		
FTA Capital Funds	Yes	Yes
Associated Transit Improvement	Yes	Yes
CMAQ		
HSIP	Yes	Yes
National Highway Performance Program	Yes	Yes

Funding Program	Counting equipment	Data collection and monitoring for pedestrians and bicyclists
Surface Transportation Block Grants	Yes	Yes
Transportation Alternatives	Yes	Yes
Recreational Trails Program	Yes	Yes
SRTS	Yes	Yes
PLAN (Statewide Planning and Research/Metropolitan Planning Funds)	Yes	Yes
NHTSA 402 – State and Community Highway Safety Grant Program		
NHTSA 405 – National Priority Safety Programs		
FLTTP (Federal Lands and Tribal Transportation programs	Yes	Yes

Notes: Updated January 21, 2021 under FAST Act. Adapted from
https://www.fhwa.dot.gov/environment/bicycle_pedestrian/funding/funding_opportunities.cfm

State DOTs play an important role in encouraging local expansion of active transportation monitoring. Currently, though providing evidence of existing or latent active transportation demand is included as a criterion in scoring competitive funding applications (e.g., Recreational Trails, Safe Routes to Public Places, Local Road Safety Program), pedestrian and bicycle counts are not required or specifically incentivized by policy in Louisiana, either as an input for prioritizing projects or as an output of project implementation for use in evaluation. DOTD could encourage local data collection by highlighting in program guidelines where count equipment or monitoring activities are an eligible expense and by encouraging inclusion of count data, where available, in project identification, prioritization, and planning activities (e.g., Stage 0 feasibility studies).

MPOs similarly can play a key leadership role as the conduits of several eligible federal funds and as leads in project scope development and feasibility analysis. MPOs can support member jurisdictions by providing funding for equipment/capital costs, integrating the use of short- and long-duration pedestrian and bicycle counts into routine traffic monitoring programs and long-range transportation plans, and encouraging or requiring the collection of multimodal data at the project level, [e.g., by including such data collection activities as a mandatory component of requests for proposals (RFPs) and requests for qualifications (RFQs) for feasibility studies, corridor plans, etc., and defining minimum data requirements or data collection parameters which consultants must follow].

Ultimately, local jurisdictions, are best positioned to plan and manage day-to-day operations for continuous counters by identifying representative and/or high priority count sites, primary data uses, and channels of dissemination. Moreover, most federal funding programs, require a local match component for which funds must be raised, whether through general funds, as an approved expenditure for municipal bond funds, etc. Data collection and evaluation activities were found during this research to be particularly attractive to private and philanthropic funders, for whom sponsorship of one or more count stations can represent a discrete, tangible contribution that aligns with branding goals (e.g., through installation of a public display counter with sponsor logo or information).

Ultimately, multimodal data collection is highly variable and scalable with costs ranging from less than $5,000 for the installation of one permanent counter and ongoing operational expenses of less than $500 per year, plus a few hours per month of local agency staff time, to major network monitoring operations managed by private sector contractors with full-time maintenance staff and annual operating budgets over $100,000 per year, not including equipment costs (Table 10).

Table 10. Estimated pedestrian and bicycle count program costs

	Estimated Cost
Capital Costs	
Equipment	$2,500 - $10,000 per location
Installation	$0 - $3000 per site
Operational Costs	
Maintenance	Estimate 2 hours staff time per month per unit for field maintenance, data monitoring

	Estimated Cost
Supplies	Replacement batteries every 1-2 years, $35 - $200 each
Data transmission	~$400 per year, per site (recommended)
Data processing and reporting	Variable depending on scale:
Project-level (< 10 local sites)	Integrate into existing staff workflows; estimate 1 day per month dedicated to management
Program-level (> 10 sites and/or wide geographic range; may include short-duration counts)	Dedicate 1 FTE staff (50% field, 50% office)
Regional/Statewide Support activities	Designate point-person with expertise for data compilation, troubleshooting, reporting

Although there may be significant benefits and economies of scale associated with large, centralized programs managed by professional contractors (e.g., dedicated technical staff, maintenance of replacement component inventory), there are also key advantages to keeping count program operations primarily local. Local partners are best positioned to be able to rapidly respond to maintenance issues, accurately contextualize and interpret findings, and directly apply results to planning and projects.

Most agencies involved in multimodal data collection employ or have employed multiple methods (either concurrently or sequentially) to sustainably support active transportation monitoring. Initially, project-based efforts and pilot studies are often coordinated by local agencies directly or with university or consultant partners, while expansions to ongoing network-level monitoring typically involve partnerships between state DOTs or MPOs and local governments (depending on geographic scope and/or funding source).

For instance, one of the most robust statewide count programs in the country, North Carolina's Non-Motorized Volume Data Program (which began in 2015) was led by North Carolina State University's Institute for Transportation Research and Education who served as a contractor to NCDOT. The program began as a pilot similar to "Pedestrians and Bicyclists Count, Phase 1 and 2." This program expanded, region by region, to cover the entire state over time and grew to include full-time field staff to manage the growing demands of a statewide network of over 70 count stations. However, in 2020, the program transitioned to a collaborative agency model where NCDOT and local agencies lead program development and operations, and ITRE has stepped back into a reporting and tech support only role [53]. This is indicative of the imperative for local ownership as well as some degree of ongoing state leadership in order to sustain program operation over time.

Outreach and Education

Currently, there are no contractors in Louisiana (excluding academic researchers) with demonstrated expertise in multimodal data collection, so it was not feasible to develop cost estimates for a fully outsourced program implementation. Stakeholders identified lack of training among private sector partners as a key gap in integration of these activities into routine business. On the other hand, except for the processing of AI-driven video-based counts, the technical skills required for non-motorized counting are relatively limited. The most important factor for program success is local knowledge and time spent in the field.

Thus, after identifying the range or possible funding opportunities and management structures, the next step was to begin the process of developing and disseminating resources summarizing active transportation monitoring best practices for a variety of audiences; to promote coordinated data collection approaches; and to facilitate effective data sharing and use. This included identifying key stakeholders and training and resource needs to develop support and demand for multimodal data collection with elected and agency decision-makers and to develop capacity and expertise among planners and traffic monitoring staff as well as outside contractors involved in data collection.

This included outreach and engagement with each of the four communities where permanent counters were installed as well as the development and delivery of materials for outreach to a wide range of stakeholders in the New Orleans metro area as a pilot model for an integrated approach to regional data collection, which may be replicated in other regions of the state.

In New Orleans, the implementation of this study corresponded to a simultaneous effort to provide evaluation support to the city's participation in the national "Big Jump

Project” sponsored by People for Bikes as well as the implementation of the first phases of the recently completed “Moving New Orleans: Bikes” plan. This partnership provided funding for two additional permanent counters and included short-duration automated and manual counts. The goal of the partnership was to create a framework for sustainable ongoing pedestrian and bicycle monitoring, the development of demand-based performance metrics, and the transfer of methods for network and project-level monitoring. Collaborating with the City of New Orleans led to the identification of unrealized opportunities to embed data collection into project construction and permitting, such as integrating new count stations into future phases of Mississippi River Levee Trail construction. Gaps and next steps have also been identified. While the foundation of a robust network of trails-based count stations is now in place, New Orleans needs more data capturing activity on on-street facilities and non-recreational pedestrian spaces as well as more geographic diversity to reflect the city’s focus on equitable infrastructure development. This partnership has shown the value and feasibility (as well as the operational complexity) of a mixed methods approach that integrates manual, short-duration, and long-duration counts to create a narrative about short- and long-term impacts of incremental network growth.

Next Steps in New Orleans:

- Developing a process for integrating routine data collection into project delivery processes (ongoing, City of New Orleans and New Orleans Regional Planning Commission)
- Building staff capacity for in-house management and/or funding “bridge” support for ongoing University/non-profit partner activities (UNO Transportation Institute and the City of New Orleans have co-created a proposal for external foundation support for this purpose, pending)
- Formalizing shared-use agreements for equipment and future data collected (as-needed)
- Developing an online dashboard to share summary data with the public (in development with City of New Orleans)

In the City of Ruston, this study similarly coincided with a partnership sponsored by the Blue Cross Blue Shield Foundation of Louisiana, evaluating the health equity impacts of the city’s active transportation network development effort. This partnership provided funding for one additional permanent count station and a mobile infrared counter. In Ruston, the count data are already being actively used to support grant applications and show the success of previous investments. The count activities provide a nexus for outreach and training for municipal staff, building local capacity and a framework for routine evaluation.

Next Steps in Ruston:

- Health impact evaluation activities are ongoing; these efforts, combined with data on facility use, will collectively inform an assessment of how the city's growing pedestrian and bicycle network is or can contribute to improved long-term health outcomes as well as improved accessibility for all Ruston residents
- Creating templates to make ongoing data collection sustainable given limited staff and to support development of online data dissemination (to be completed by December 2022)

In St. Tammany Parish (Mandeville), the count stations are currently installed with an informal agreement. The parish is currently in the process of updating their Bicycle and Pedestrian Master Plan, which provides an immediate opportunity to incorporate existing data and expand data collection efforts.

Next Steps in St. Tammany:

- Present interim results, formalize the transfer of management of existing sites and advise on integration of data into planning processes (pending)

In Baton Rouge, a variety of stakeholder partners are currently loosely engaged in this research effort. The development of formal MOUs during the installation process proved challenging with issues around post-project costs and liability rising to the center. Continued conversations around these issues are needed to clarify roles and responsibilities and establish data use cases that demonstrate the value of ongoing monitoring. A formal MOU is in place with BREC for one count location (Dalrymple) which may serve as a template for other local/MPO partnerships in the future (Appendix D), and an initial conversation presenting the efforts of this research to new staff responsible for pedestrian and bicycle planning at CRPC has been held to-date. Meanwhile, CRPC is currently engaged in a regional pedestrian and bicycle planning process and is interested in integrating recommendations for data collection and performance measurement into this process.

Next Steps in Baton Rouge:

- Present interim results and advise on integration of data into planning processes (pending)
- Collaborate to develop transition plan and formalize agreements as needed
- Support MPO in integrating non-motorized count data into regional plan and expanding regional network of permanent count locations

Finally, this project has facilitated the development of a partnership with the New Orleans Regional Planning Commission (NORPC) to pilot a multi-faceted effort to institutionalize pedestrian and bicycle counts throughout the region, building on this study as well as NORPC's previous data collection and reporting efforts. This partnership began in May 2021 with a presentation (Appendix F) of the 2018 "Pedestrian and Bicycle Count Data Collection and Use: A Guide for Louisiana" to RPC's Technical Advisory Committee (TAC), intended to introduce the concept of multimodal data collection to a regional audience and familiarize key stakeholders with the results of "Pedestrians and Bicyclists Count: Phase 1." Next, the research team supported RPC in initiating a series of meetings with leaders throughout the eight-parish region to encourage the local implementation of permanent counts; gauge level of interest among parish staff; and identify barriers, questions, and site priorities. This included introductory presentations (Appendix F) as well as, where requested, field visits to scope potential count locations and collect initial data needed to estimate equipment costs and configuration needs. RPC has agreed to provide STP>500K funding to support 80% of capital costs (including equipment and installation) for 2-4 count locations per interested parish. Local agencies would be responsible for operations and maintenance and would agree to share the data with RPC, who would in turn serve as a regional repository and integrate the results into long range planning efforts.

In general, among parishes interviewed so far, most are enthusiastic about the proposed program and do not perceive the 20% capital cost share as a major barrier. On the other hand, stakeholders indicate that they desire tools to make operation and data management as low-barrier as possible, given limited staff time and capacity. Stakeholders also noted that while it would be optimal to coordinate counter installation directly into upcoming project construction, the complexity of reworking contracts already underway may outweigh the potential cost savings. Thus, for projects that are well advanced, post-completion installation is preferred. In the future, people counters should be incorporated into the planning and design stages of projects where pedestrian and bicycle accommodations are being upgraded. For state-funded projects, this will require the development of standard design specifications to guide their placement and installation. In general, parishes also indicated that support for installation of permanent counters may be a barrier, unless this cost is covered as part of the MPO's 80% capital cost funding support.

Parish stakeholders and RPC generally agreed that an initial approach of siting counters on a mix of existing on and off-street facilities (where both exist), recreation-oriented, and commute-oriented locations, as well as geographic diversity (e.g., each side of the Mississippi River) is optimal. However, the current extent of pedestrian and bicycle network development is a constraint. Another possible challenge identified is the complexity of equipment procurement processes; additional research is needed to clarify opportunities to streamline vendor and procurement policies to align with federal, local, and MPO requirements.

Key features of the proposed MPO/local partnership program to expand data collection which local stakeholders identified as reasons to participate included:

- Ability to demonstrate a need more easily for sidewalks on state routes in the future
- Providing insight into changes in the area over time that would inform planning
- Show the impact of network improvements on usage of key regional facilities (e.g., levee trails)
- Illustrate one aspect of the economic impact of infrastructure investments (e.g., through activity in commercial areas

Simultaneously, RPC has begun to require consultant contractors to integrate multimodal counts into a pilot set of RFPs for feasibility studies that focus on pedestrian and bicycle accessibility. The goal is to advance consistent integration of pedestrian and bicycle counts into planning and Stage 0 processes, along with standard vehicular counts. There is currently no policy in place for how to do this or what requirements contractors must abide by; nor was there sufficient expertise among active vehicle count subcontractors to assume this goal could be easily met. Instead, the RFPs were released indicating that a pedestrian and bicycle count component would be required and requested that selected contractors must develop a plan for implementation. Ultimately, the agency's goal is to develop a replicable model policy that standardizes the parameters of short-duration multimodal counts.

As part of the research team's outreach efforts, UNO Transportation Institute has provided technical assistance and plan review and has hosted two 4.5-hour consultant training workshops on January 5 and February 22, 2022, in order to develop a baseline understanding of the principles and practice of bicycle and pedestrian counts to private sector consultants as well as local and MPO agency staff (Appendix F). These workshops targeted current New Orleans area disadvantaged business enterprise (DBE) vehicle count subcontractors as well as the prime contractors working on the RPC pilot projects, but were open to all parties interested in expanding capacity for active transportation data collection as part of their planning practice or technical services. The workshops also included a field demonstration of installation and validation protocols for pneumatic tube and infrared count devices as well as operation and maintenance of inductive loop counters. RPC intends to use completion of this workshop as a prerequisite for successful bids on future projects where pedestrian and bicycle accommodation is a priority.

Tools and Templates

Finally, a key component of local outreach to ensure sustainability of both currently installed and any future pedestrian and bicycle counters is to develop a model for coordinated data management. Outreach to local partners has included sharing of draft materials in various formats (tabular, spatial, graphic, and narrative) and discussion of staff capacity, local goals for data use and dissemination, and minimum basic requirements for sustaining data collection. In general, the goal is to maintain a low barrier to participation through use of uniform data formats, simple software tools, and summary data templates to aid in data reporting. DOTD or another statewide entity could support this goal through minimal technical assistance (e.g., by maintaining a web-based repository of sample data and downloadable templates and providing a point of contact for questions and guidance).

Some jurisdictions (including state and regional agencies) may use these basic data outputs as building blocks for more sophisticated analytic and planning processes. These outputs are discussed below in Section 5 and detailed in Appendix I.

5. Data Application Methodology Development

Concurrent with pilot data collection effort, the research team continued to refine methodology for developing roadway factor groups and expansion factors for adjusting short-term multimodal counts across the roadway network, including establishing baseline data for pilot regions and continued refinement of an exposure and safety analysis framework and approach. This has included application of SCRAM methodology to assess areawide exposure to the extent that data is available, a thorough review of preliminary data collected (including development of QA/QC guidelines and recommendations); calculation of preliminary factor groups based on morning and weekend peak ratios; identification of next steps for developing more nuanced and regionally appropriate factor group classifications; development of expansion factors for pilot count sites; analysis of weather impacts on regional activity; a review of the observed impacts of COVID-19 on activity patterns and magnitude; and an exploration of potential next steps for data analysis and application for local, regional, and state agency use.

Areawide Exposure Estimation

As part of network screening to identify potential count locations, an initial scan of statewide active commute mode share (based on ACS Means of Transportation to Work data, Table B08103) was conducted at the parish level to identify areas of relatively high pedestrian and/or bicycle commute activity (Appendix G).

This data can also be used to develop a measure of exposure that normalizes total crashes by the number of pedestrian or bicycle commuters, which helps account for higher expected crashes in areas where there is robust non-motorized activity (Appendix G). This calculation can be useful in identifying areas where fatal and severe crashes may be disproportionate to the rate of walking and bicycling. However, it is important to note that low total crash and commute mode share numbers and high volatility from year to year. Also, the high share of walk/bicycle trips for purposes other than commuting to work limit the reliability of this exposure metric. It may, however, be used to track trends over time and reveal jurisdictions with consistently higher crash rates per active commute population.

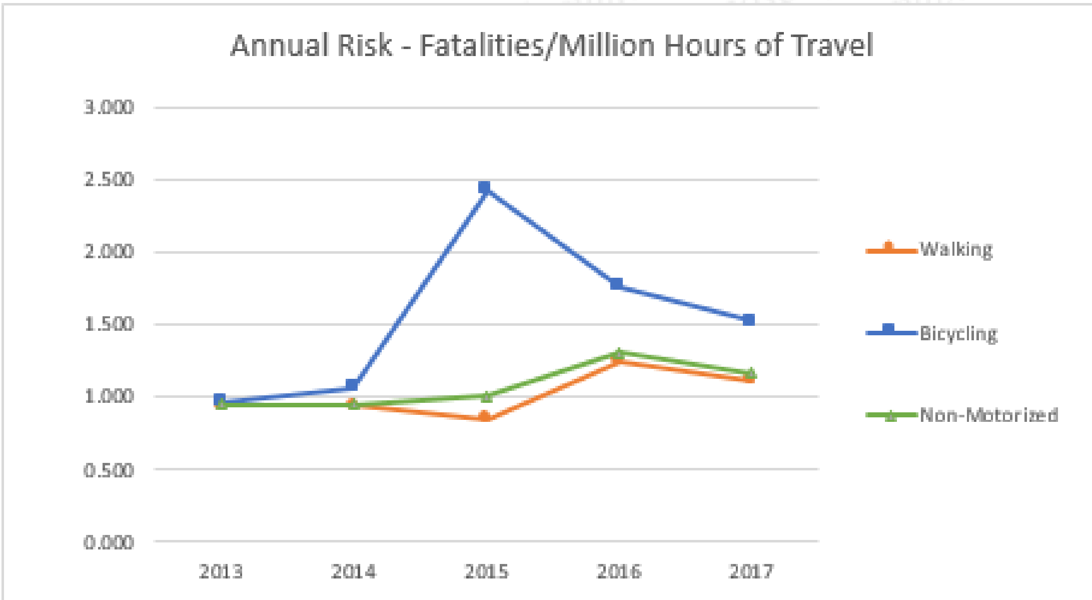
Within urban areas, a scan of high rates of active commuting at the census tract level can similarly help reveal areas of relatively high active transportation demand (correlating strongly to other predictors of demand such as income and low vehicle ownership); and analysis of crash rates relative to commute mode share can help illuminate safety trends in areas where active transportation is increasing overall. However, commute trips represent a relatively small share of all trips likely to be made by walking or bicycling. Moreover, the very low percentage of commutes made by active modes in much of the state result in high margins of error for walking and bicycling American Community Survey (ACS) commute estimates; lack of data availability entirely where survey sample sizes are too low to draw meaningful conclusions; and related high volatility from year to year, which results in this method of exposure calculation being of limited utility at the statewide scale.

The SCRAM tool provides a more robust method of exploring areawide exposure; using National Household Travel Survey (NHTS) (2009, adjusted by population to better represent subsequent years); ACS (1-year estimates for each analysis year) —and Fatality Analysis Reporting System (FARS) data to estimate active trips for the entire state based on Census division groupings (Appendix G, Table 44) and at the metropolitan statistical area (MSA) level (based on data from MSA "peers" with similar active commute mode shares). Where local data is available (e.g., state or regional travel surveys), this information may be substituted for default values for improved accuracy. The SCRAM provides a simple spreadsheet tool to derive the following measures of exposure for pedestrians, bicyclists, and total non-motorized trips:

- Total estimated annual trips
- Total estimated annual miles traveled
- Total estimated annual hours traveled

Annual exposure in terms of number of trips, miles of travel, and hours of travel has remained relatively static statewide during the analysis period of 2013-2017, with bicyclist exposure trending slightly up overall. During the same period, non-motorized fatalities have trended up for both modes. As a result, overall risk using the SCRAM tool as measured in fatalities per million hours of travel appears to be increasing (Figure 5). Additional charts detailing estimated statewide exposure over time may be found in Appendix G.

Figure 5. Annual risk for non-motorized users in Louisiana (fatalities per million hours of travel)



Similar metrics may be derived for each MSA in Louisiana. Overall, during the period for which data is available, estimated pedestrian fatalities per million estimated hours of travel have trended upward in 6 out of 9 MSAs (Figure 6). Figures for bicyclist fatalities per million hours of travel tend to be more volatile due to lower total numbers of fatalities (Figure 7). Using both fatal and serious injury crash totals as an input in this tool would likely reveal clearer trends over time. Among Louisiana MSAs, only the New Orleans metro area (RPC) is in the top quintile nationally (of 405 total) for bicycle trips, and none are in the top quintile for walking trips. For full MSA-level SCRAM results, see Appendix G.

Figure 6. Pedestrian fatalities per estimated million hours of travel—Louisiana MSAs [33]

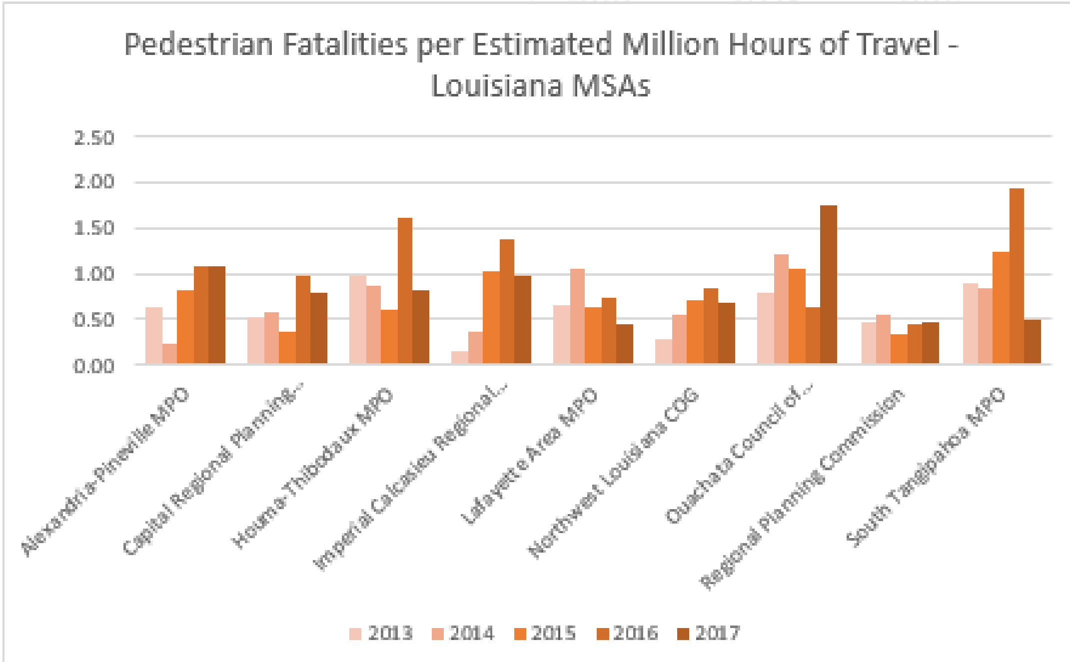
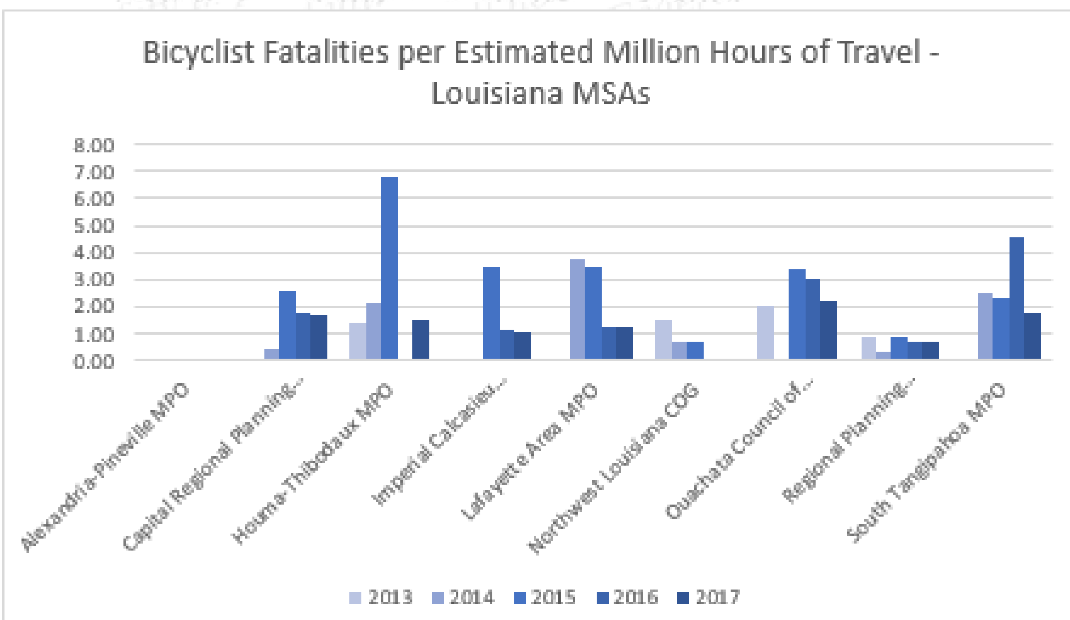


Figure 7. Bicyclist fatalities per estimated million hours of travel—Louisiana MSAs



Importantly, this tool has not been updated by FHWA since publication and is currently limited to 2013-2017 data. The methodology embedded in the tool is replicable, however, and future analysis could include annual updates of state and MSA-level exposure metrics over time. In addition, this tool is inherently limited by lack of available data below metro area level. Within a given MSA, active commute activity can vary widely. Thus, exposure metrics derived may be of limited utility for local planning and performance measurement at parish/county or municipal scale.

At the local level, other tools that aim to model risk based on crash data and built environment as well as demographic factors as proxies for exposure, such as the City of New Orleans' Safer Streets Priority Finder (SSPF) [54], may provide more actionable area-wide inputs for integration into direct demand models, safety indices, or other tools that aim to factor rates of pedestrian and bicycle activity into evaluations of safety performance.

Data Cleaning and QA/QC Guidelines

Data quality assurance/quality control (QA/QC) is essential to any traffic monitoring activity. As discussed above, a variety of factors can impact the quality of data, and the existing procedures for QA/QC for motor vehicles cannot be directly transferred to non-motorized datasets due to the lower average volumes and much greater variability of pedestrian and bicycle activity. Standard processes for eliminating data that is not within, for example, two standard deviations of the mean, would likely result in the deletion of many hours or days of accurate, valid activity reflecting local conditions on a given facility. A more nuanced and localized approach to data review and processing to ensure valid results is required. However, the general framework for assessing data quality will always consist of several basic steps:

1. Chart and visually inspect data.
2. Determine criteria for assessing outliers.
3. Utilize professional judgement and context knowledge/research to make decisions about which data to include and exclude from the dataset.
4. Document all editing decisions and retain a copy of the raw dataset.

First, daily and hourly data must be downloaded for the specified time period, including directional information by mode, where applicable. Charting the data by hour (for shorter count durations) and by day (for longer count durations) will typically reveal most significant data gaps, spikes, or irregularities. In cases where unusual data is observed at the daily level, further investigation of hourly data is warranted. As discussed above, reasons for irregular data are myriad, ranging from blocked sensors to equipment malfunction to special events and holidays. Not all unusual data is erroneous. Thus, particularly where counters are new and no previous historical data exists against which to compare results, an initial review of atypically low or high counts to identify dates that correspond to major events or disruptions is an important initial step.

Once at least three months of uninterrupted data have been collected (with validation counts confirming equipment reliability), a series of conditional and statistical quality assurance tests may be applied to the data to identify and, if needed, filter invalid data from statistical calculations. Recommended tests for flagging and/or excluding data vary and should not be applied uniformly across sites without consideration for overall site characteristics and user volumes (i.e., lower volume sites require looser thresholds to account for high inherent variability). Table 11 outlines a series of tests that may be applied to systematically assess large volumes of data. Parameters for thresholds (e.g., number of standard deviations, percentage of daily total) should be tailored to the specific site based on preliminary manual review of data (3 months or more) and/or factor group classification (where comparable count sites exist). Initial parameters should be defined using professional judgement and presumed to be preliminary and revised following collection of 12+ months of data and/or major changes in context (such as significant land use changes or facility upgrades).

Table 11. Recommended QA/QC conditional formatting tests

Test	Description
Gaps	Identify number of hours in a day for which no data is available (no transmission)
Zero Counts	Determine how many intervals (hours, days) in a row with zero counts recorded
Daily Maximum	Exclude data that exceeds a determined upper threshold above which volumes are not physically reasonable. Parameters may vary by day of week/month of year.

Test	Description
Hourly Maximum	Exclude data that exceeds a determined upper threshold above which volumes are not physically reasonable. Parameters may vary by day of week/month of year.
Overnight Hourly	Test if any hours between 12am and 5am exceed a maximum expected value for low-volume hours
Overnight Total	Test if total volume of users recorded between 12am and 5am exceed a maximum expected percentage of daily total
Standard Deviation - Mean	Flag data that is more than X standard deviations above or below the mean (by direction if applicable)
Standard Deviation - Direction	Flag data that is more than X standard deviations above or below the mean of opposite-direction volumes
IQR	Identify Outliers based on interquartile range of all counts of a particular type (including direction, weekday v. weekend, etc.), excluding any previously flagged data

Data exceeding determined parameters may be flagged for further review, omission, and/or correction (see Appendix H for an example of how to partially automate this process). Flagged data should again be cross-checked against special events and extreme weather conditions. Note that low-user-volume count locations will often experience greater volume volatility and require additional review. Data strongly suspected to be incorrect should be scrubbed (and if necessary, sources of potential error investigated if not apparent). In some cases, hourly data may be scrubbed and daily totals must be recalculated either as-is or by imputing values representing hourly average totals in place of the omitted data.

For the purpose of this report, daily totals for days with up to four hours of data omitted (less than 20%) were recalculated, but imputed values were not included in order to reduce estimation errors for further data applications. Thus, the daily totals for these instances (flagged in the summary file) may be assumed to represent under counts overall. In cases where 5 or more hours (20% or more) of data were scrubbed, the day's data was omitted from analysis entirely. Table 12 summarizes the cumulative percentage of all data to-date (installation date through August 3, 2022, or date at which sensor was removed or permanently disabled), which was excluded from statistical analysis using the above-noted tests and professional judgement to flag and remove invalid data. As of the compilation of this technical report, at least two sensors are known to be experiencing data quality and/or transmission issues in addition to those sensors permanently disabled by accident or vandalism. As time goes on, the incidence of non-routine maintenance and replacement needs should be expected to increase, a fact which must be considered in program planning and budgeting in order to facilitate sustainable long-term operations.

Table 12. Data completeness—Days and hours of missing or omitted data by mode

Site #	Site Name	Pedestrians		Bicycles		All Users (Infrared Only)	
		% Days Omitted	% Hours Omitted	% Days Omitted	% Hours Omitted	% Days Omitted	% Hours Omitted
3	Norman Francis Parkway Trail	15.3%	15.0%	3.7%	3.7%	-	-
6	Algiers MRT*	-	-	-	-	4.7%	4.7%
12	Lafitte Greenway	18.8%	22.2%	1.2%	1.2%	-	-
20	Baronne St Bike Lane	-	-	20.0%	20.0%	-	-
25	Wisner Trail	8.0%	4.9%	2.5%	2.5%	-	-
39	Esplanade Ave Bike Lanes	-	-	6.4%	7.8%	-	-
40	Behrman Park Trail	11.2%	4.6%	0.0%	0.0%	-	-
41	Tammany Trace	16.4%	19.3%	1.0%	1.1%	-	-
42	Mandeville Lakefront Path	-	-	-	-	3.0%	1.4%
48	Rock Island Greenway - Ph 1	15.5%	15.5%	0.0%	0.0%	-	-
49	Rock Island Greenway - Ph 2	-	-	-	-	15.7%	7.2%
44	Dalrymple Drive Trail	4.8%	5.1%	1.4%	1.4%	-	-
45	Nicholson Drive Trail	12.3%	5.7%	0.0%	0.0%	-	-
46	Capital Heights Bike Lanes	-	-	29.7%	29.5%	-	-
47	Gardere Lane Sidewalk*	-	-	-	-	0.3%	0.1%

Site #	Site Name	Pedestrians		Bicycles		All Users (Infrared Only)	
		% Days Omitted	% Hours Omitted	% Days Omitted	% Hours Omitted	% Days Omitted	% Hours Omitted
43	Baton Rouge MRT (Casino)	-	-	-	-	0.0%	0.0%
56	Baton Rouge MRT (Water Campus)	3.4%	3.5%	3.4%	3.5%	-	-
57	Government St Bike Lanes	-	-	0.0%	0.0%	-	-

* Data completeness rate excludes dates within study period following sensor destruction/removal

As data availability expands and confidence in parameters for a given site increases, data processing may be primarily automated. However, some targeted manual review is still required, particularly if data is being used to develop expansion factors or for use in advanced analytic applications where errors may significantly impact outcomes [1].

If the primary purpose of data reporting is to track longitudinal trends, imputing values in place of omitted hours or days may be necessary. This may be done by calculating averages based on 4 weeks of same time of week counts (e.g., Thursdays from 2-3 p.m.) surrounding the missing value and inserting this average to smooth out summary figures. Imputed values, if used, should always be flagged and a copy of unaltered data preserved.

As statewide count data expands, protocols for data review should be revisited and refined. Quality control parameters should become more stringent as data availability from which to determine appropriate criteria for a range of situations expands, and be codified and disseminated to all agencies involved in monitoring activities.

Preliminary Data Review and Summary Findings

Following collection of at least 12 months of data[2] (excluding early months of COVID-19 later determined to be non-representative of typical travel volumes and patterns, as discussed below, and cleaning of data discussed above), the following key outputs were calculated for each count location:

- Overall mean and median daily users by mode
- Standard deviation and interquartile range by mode
- Average users by month, day of week, and hour of day (weekend vs. weekday)
- Peak hour average (variable by site), AM peak average (7–9 a.m.), mid-day peak average (11 a.m.–1 p.m.), and overnight (12 a.m.–5 a.m.) percentage of total
- Weekend and morning ratios and preliminary travel pattern group [13]

Overall, the average number of daily users across all count locations varies substantially, from a mean of 952 daily users (all modes) on the Lafitte Greenway, to a mean of 34 daily users on the (recently completed) Government Street bike lanes (bicycles only). Typically, median user volumes are somewhat lower than means due to the impact of special events and particularly high-activity days on overall averages (Table 13).

[2] Excluding installation sites damaged prior to completion of full data year, (i.e., Dalrymple Drive pedestrians, as well as Capital Heights, where battery and calibration issues resulted in the loss of four unique months of data).

Table 13. Mean and median daily user volumes, all count locations

Site #	Site Name	Mean Daily Users			Median Daily Users		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
3	Norman Francis Parkway Trail	337	420	765	337	418	770
6	Algiers MRT	-	-	577	-	-	574
12	Lafitte Greenway	346	618	952	339	622	961
20	Baronne St Bike Lane	-	133	-	-	132	-
25	Wisner Trail	234	169	389	227	153	377
39	Esplanade Ave Bike Lanes	-	396	-	-	389	-
40	Behrman Park Trail	80	27	106	58	25	84
41	Tammany Trace	129	227	367	110	192	318
42	Mandeville Lakefront Path	-	-	775	-	-	710
48	Rock Island Greenway - Phase 1	112	7	118	109	6	116
49	Rock Island Greenway - Phase 2	-	-	34	-	-	31
44	Dalrymple Drive Trail	312	111	436	312	103	430
45	Nicholson Drive Trail	28	22	49	24	19	44
46	Capital Heights Bike Lanes	-	59	-	-	56	-
47	Gardere Lane Sidewalk	-	-	95	-	-	93
43	Baton Rouge MRT (Casino)	-	-	396	-	-	380
56	Baton Rouge MRT (Water Campus)	125	123	248	117	111	236
57	Government St Bike Lanes	-	34	-	-	34	-

Site-specific standard deviations from the norm correspondingly range widely. Locations with very high standard deviations (e.g., Mandeville Lakefront Path, Algiers Mississippi River Trail [MRT]) tend to be those with strong recreational activity, which have greater seasonal variation and often tracks closely with periods of good weather and special events. Thus, analysis of data in such locations will often require more thorough manual review to assess apparent anomalies (Table 14).

Table 14. Standard deviation and interquartile range of daily user volumes

Site #	Site Name	Standard Deviation			Interquartile Range		
		Pedestrians	**Bicycles**	**All Users**	**Pedestrians**	**Bicycles**	**All Users**
3	Norman Francis Parkway Trail	98	151	-	135	202	
6	Algiers MRT	-	-	264	-	-	272
12	Lafitte Greenway	120	205		120	235	-
20	Baronne St Bike Lane	-	51	-	-	57	-
25	Wisner Trail	92	85	-	104	108	-
39	Esplanade Ave Bike Lanes	-	153	-	-	192	-
40	Behrman Park Trail	85	13	-	53	15	-
41	Tammany Trace	76	155	-	81	147	-
42	Mandeville Lakefront Path	-	-	433	-	-	468
48	Rock Island Greenway - Phase 1	48	5		51	8	
49	Rock Island Greenway - Phase 2	-	-	16	-	-	22
44	Dalrymple Drive Trail	111	51	-	163	55	-
45	Nicholson Drive Trail	19	14	-	19	14	-
46	Capital Heights Bike Lanes	-	25	-	-	33	-
47	Gardere Lane Sidewalk	-	-	24	-	-	30
43	Baton Rouge MRT (Casino)	-	-	204	-	-	195
56	Baton Rouge MRT (Water Campus)	59	66	-	54	74	-
57	Government St Bike Lanes	-	11	-	-	12	-

As an initial step (after data cleaning), daily data was re-charted for each study area to get a general sense of longitudinal trends. In New Orleans, gaps in data availability, the surge in active travel demand in spring of 2020, and pronounced dips associated with extreme weather events (including hurricanes and a freeze) are evident. In Mandeville, spikes in activity linked to special events and consistent weekly (weekend) elevated activity illustrated the high variability of recreation-oriented trails and spaces. Preliminary data from Ruston highlights how the first phase of the city's greenway network has developed robust daily use, but the newly opened second phase (separated from the first phase by downtown and lacking cohesive network connections to facilitate travel along the entire corridor) so far lags behind. Meanwhile in Baton Rouge, overlapping periods of activity at two count locations within close proximity on a corridor demonstrate similar usage volumes and patterns, while a lower-volume location shows steady or growing use over time with notable upticks in activity during special events, holidays, etc. For full time series data at all locations, as well as a summary of average daily users by day of week and month of year, see Appendix E.

One important lesson learned from preliminary analysis of the first 1-2 years of data was to ensure that automated data alerts are properly set within the web-based vendor software, if available. Several large gaps in data could have been avoided or mitigated sooner, if email notification alerting the research team to a potential problem with the sensor had been established at the time of installation.

The relationship between weekday and weekend traffic helps further illuminate overall activity patterns (Table 15). At most count locations in this study, activity is higher on weekends than on weekdays. On facilities which have pronounced increases in user volumes on the weekend, recreational usage can generally be inferred. Conversely, at locations where activity volumes are typically higher on weekdays (e.g., Baronne St. Bike Lane) commute-oriented patterns are implied. At some locations (e.g., Nicholson Drive Trail), higher activity days vary by mode, indicating that the facility is used differently by various user groups (e.g., students bicycling to campus on weekdays, but spikes in pedestrian volume linked to events at the nearby stadium on weekends).

Table 15. Weekend vs. weekday user volumes

Site Number	Site Name	% Difference, Weekend vs Weekday		
		Pedestrians	**Bicycles**	**All Users**
3	Norman Francis Parkway Trail	1.27%	12.87%	7.95%
6	Algiers MRT	-	-	21.16%
12	Lafitte Greenway	4.14%	18.79%	13.92%
20	Baronne St Bike Lane	-	-1.70%	-
25	Wisner Trail	17.91%	29.59%	23.11%
39	Esplanade Ave Bike Lanes	-	25.70%	-
40	Behrman Park Trail	19.09%	9.47%	16.82%
41	Tammany Trace	38.25%	57.55%	51.48%
42	Mandeville Lakefront Path	-	-	41.30%
48	Rock Island Greenway - Phase 1	1.11%	19.17%	2.29%
49	Rock Island Greenway - Phase 2	-	-	5.06%
44	Dalrymple Drive Trail	30.02%	29.69%	29.93%
45	Nicholson Drive Trail	23.80%	-11.47%	10.54%
46	Capital Heights Bike Lanes	-	29.70%	-
47	Gardere Lane Sidewalk	-	-	6.34%
43	Baton Rouge MRT (Casino)	-	-	38.30%
56	Baton Rouge MRT (Water Campus)	16.10%	47.87%	34.24%
57	Government St Bike Lanes	-	7.30%	-

The share of total users who were recorded during late night hours (midnight to 5:59 a.m.) is calculated (Table 16). Typically, this figure will represent a small minority of active users (less than 5%). In some locations, particularly those that serve late night destinations, service industry workers, and/or universities, elevated late-night usage may be observed (such as increased pedestrian activity on the Nicholson Drive trail near

LSU), particularly on weekends or during special events.[3] Overnight user volumes greater than 10% for any mode or period should be scrutinized (e.g., by reviewing hourly totals) to determine whether elevated activity can be explained by surrounding land use is a byproduct of low overall user volumes that magnify the impacts of one or more specific events and/or the result of sensor or contextual error.

Table 16. Overnight share of total users

Site #	Site Name	Overnight Share of Total Users					
		Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
3	Norman Francis Parkway Trail	1.28%	2.64%	2.01%	1.28%	3.99%	2.75%
6	Algiers MRT	2.72%	4.10%	3.43%	1.94%	3.13%	2.55%
12	Lafitte Greenway	6.72%	3.47%	4.69%	1.69%	5.28%	4.04%
20	Baronne	-	4.90%	-	-	7.30%	-
25	Wisner	1.61%	1.35%	1.55%	0.85%	1.23%	1.05%
39	Esplanade Ave	-	2.60%	-	-	4.30%	-
40	Behrman Park Trail	1.56%	3.08%	1.95%	3.69%	3.57%	3.68%
41	Tammany Trace	1.01%	0.52%	0.68%	0.66%	0.66%	0.64%
42	Mandeville Lakefront	-	-	0.78%	-	-	0.64%
48	RIG - 1	0.20%	0.41%	0.21%	0.08%	0.32%	0.10%
49	RIG - 2	-	-	4.61%	-	-	4.37%
44	Dalrymple Drive Trail	1.00%	0.75%	0.91%	0.41%	0.61%	0.45%
45	Nicholson Trail	6.84%	1.86%	4.79%	**27.55%**	2.93%	**17.21%**
46	Capital Heights	-	2.11%	-	-	-	1.90%

[3] Note that activity volumes on a few occasions at this location were so extremely outside of the range of typical values that these dates have been excluded from summary statistics in order to avoid misrepresenting typical conditions. For additional information and raw outlier data, see Appendix I.

		Overnight Share of Total Users					
Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
47	Gardere	-	-	3.10%	-	-	5.47%
43	BR MRT - Casino	-	-	3.12%	-	-	4.90%
56	BR MRT - Water Campus	0.97%	3.32%	2.14%	0.99%	2.19%	1.59%
57	Government St	-	5.65%	-	-	-	5.67%

Preliminary data analysis allows comparison of sites by region, facility type, and relative user volume, as well as evaluation of broad patterns in daily and seasonal usage. This foundational data may be used as a baseline input for plan and policy implementation to show impacts of network development over time, as well as to make inferences about short duration counts (discussed below). Full summary statistics and charts by site for all continuous count locations can be found in Appendix I.

Factor Group Classifications

Initial factor group classification followed the morning/weekend ratio method outlined by Johnstone et al. [13] as this provided a relatively straightforward means of calculating two dimensions of activity (day of week and hour of day). This approach defines the weekend ratio as peak hour weekend traffic/peak hour weekday traffic, where peak hour is the greatest volume during that day (rather than any specific pre-defined hour); and, the morning ratio as the average weekday hourly traffic from 7-9 a.m./average weekday hourly traffic from 11 a.m.–1 p.m. Table 17 summarizes the travel pattern estimated from these two metrics. Using this methodology, none of the continuous count locations indicate a primarily commute-oriented usage pattern. Several locations reflect multipurpose usage for pedestrians (Lafitte Greenway, Wisner trail, Rock Island Greenway Phase 1, and Baton Rouge MRT), bicyclists (Baronne St., Nicholson trail), or both (Norman Francis Parkway trail). Importantly, this method of calculating factor groups does not account for one-way facility types (e.g., Baronne St.) where usage is much higher during evening (outbound) commutes from the central business district (CBD) relative to morning (inbound commutes).

In some locations, limited data availability or low daily volumes inhibit the usefulness of these metrics (e.g., Government St., Rock Island Greenway Phase 2, Nicholson trail). In some cases (Algiers MRT, Tammany Trace, Dalrymple Drive trail), both the ratio calculations and direct observation corroborate primarily recreational usage activity. In other locations (Esplanade Avenue, Lafitte Greenway), consistent all-day usage without clearly pronounced daily or hourly peaks indicates a variety of users and uses, lending these sites particular suitability for use as overall network/trend indicators.

Table 17. Preliminary travel pattern by morning and weekend ratio

Site #	Site Name	Pedestrians/All Users			Bicycles		
		Weekend Ratio	Morning Ratio	Travel Pattern	Weekend Ratio	Morning Ratio	Travel Pattern
3	Norman Francis Parkway Trail	0.8	1.4	Multipurpose	0.9	0.9	Multipurpose
6	Algiers MRT	1.2	1.0	Non-Commute	-	-	-
12	Lafitte Greenway	0.5	1.4	Multipurpose	1.2	0.9	Non-Commute
20	Baronne St	-	-	-	0.8	0.7	Multipurpose
25	Wisner Trail	1.3	1.6	Multipurpose	1.2	1.1	Non-Commute
39	Esplanade Ave	-	-	-	1.3	0.8	Non-Commute
40	Behrman Park Trail	1.7	0.6	Non-Commute	1.2	0.7	Non-Commute
41	Tammany Trace	1.5	0.6	Non-Commute	2.5	0.5	Non-Commute
42	Mandeville Lakefront	1.6	0.8	Non-Commute	-	-	-
48	Rock Island Greenway - 1	0.8	1.1	Multipurpose	1.0	1.3	Non-Commute
49	Rock Island Greenway - 2	1.1	0.8	Non-Commute	-	-	-
44	Dalrymple Drive Trail	1.5	1.2	Non-Commute	1.3	1.0	Non-Commute
45	Nicholson Trail	1.9	0.7	Non-Commute	0.7	1.1	Multipurpose

Site #	Site Name	Pedestrians/All Users			Bicycles		
		Weekend Ratio	Morning Ratio	Travel Pattern	Weekend Ratio	Morning Ratio	Travel Pattern
46	Capital Heights	-	-	-	1.3	0.9	Non-Commute
47	Gardere Lane	1.1	0.8	Non-Commute	-	-	-
43	BR MRT - Casino	1.0	0.8	Non-Commute	-	-	-
56	BR MRT - Water Campus	0.9	0.7	Multipurpose	2.0	0.9	Non-Commute
57	Government St	-	-	-	1.3	1.0	Non-Commute

As noted above, travel patterns of active users at count locations in Louisiana have been found not to neatly fit within the three rough categories identified through this method (commute, multipurpose, and midday/non-commute). Most locations observed during both short- and long-duration counts were found to be classified as "non-commute," even when observation indicates clear evidence of utilitarian/transportation (i.e., non-recreational) usage. In part, this may be attributed to higher rates of bicycle usage for transportation to jobs and activities that do not align with a traditional 9-5 commute schedule as well as the smaller overall size of the communities monitored relative to national literature that has focused primarily on large metropolitan areas. In addition, during the 2020-2021 data collection period, many sectors experienced disruptions in activity patterns due to COVID-19. Finally, in areas with robust tourism/nightlife sectors such as New Orleans, heightened activity resulting from tour groups, social activities, etc. may occlude the visibility of active transportation commuters using the same facilities or corridors.

In addition to calculated ratios, simple analysis of temporal trends, normalized by overall user volumes, can help illuminate factor groupings by identifying outliers where hourly, daily, or seasonal variations deviate from comparable sites/datasets.

Among all pedestrian or mixed-user (infrared) sensors in New Orleans, for instance, only the Behrman Park trail location appears to experience anomalous seasonal variation, driven in this case by numerous events in an adjacent stadium. Among count locations specifically measuring bicyclists, a similar consistency is observed at most on- and off-street locations, with the exception of the Behrman Park trail, where bicyclist relative volumes track overall/pedestrian usage, and on Baronne Street, where elevated February activity reflects a boost in bicycling downtown during Mardi Gras season events.

The same assessment can be completed by day of week, with similar results. Again, for pedestrian/mixed user data streams in New Orleans, daily user patterns are similar across all sites excluding Behrman Park. For bicyclists, subtle variations in the proportion of weekday vs. weekend riders are evident, notably on Wisner Boulevard (higher weekend activity) and Baronne St. (lower weekend activity). Finally, hourly patterns (separated by weekday and weekend) further illuminate the extent to which activity at a set of sites within the geographic area align or deviate. Among pedestrian/mixed user sites, weekday patterns indicate nearly universal PM peak periods, but variable morning and mid-day volumes and peak times. On weekends, variation is much wider, with sharply elevated activity mornings on the Wisner trail and evenings in Behrman Park.

For bicyclists, lower activity on weekday late-evenings and an earlier activity start time further suggest commute-oriented trips on Baronne St., while simultaneously indicating the facility is also used as a connection for late night weekend trips into/out of downtown. Overall, comparison of relative volumes across sites within a jurisdiction is an important tool for defining factor groups and, in turn, deciding which site or sites are the best fit for extrapolating short-duration counts (discussed below).

In Mandeville and Ruston, seasonal trends indicate relatively higher activity during spring and autumn months as anticipated; although a limited number of sites, low to moderate user volumes, and/or data gaps inhibit development of clear factor group definition based on activity patterns alone. Similarities among sites and user groups are more pronounced at the hourly or daily level. In Mandeville, clear recreational user patterns emerge at both count locations; whereas, in Ruston, temporal variation between the two sites indicates distinct usage at each.

In Baton Rouge, seasonal activity associated with Louisiana State University (LSU) sporting events, a more pronounced dip in activity during summer months, and a notable pattern of late-night pedestrian activity sets the Nicholson Drive count location apart from its peers. However, only Gardere Lane reflects relatively stable activity every day of the week, compared to notable upticks in activity on weekends at all other locations observed, as well as a less pronounced PM peak on weekdays. A distinct pattern of elevated activity among both bicyclists and pedestrians on weekend mornings on the Baton Rouge MRT suggests that this is a "destination" facility for athletic training, while steady all-day weekend bicycle activity on Dalrymple Drive may indicate a more varied mix of trip types and users.

Tables and figures illustrating temporal variation for all count locations (grouped by geographic region) are provided in Appendix I.

Alternative variables to consider as part of factor identification include, as discussed above, land use factors; sociodemographic variables known to be associated with increased active transportation demand; and built environment variables such as overall walkability. The Environmental Protection Agency's (EPA) Smart Location Database provides a useful resource for identification of such variables for locations where counts are collected (disaggregated to the block group level), including data on housing and employment density; socioeconomic factors associated with active transportation demand such as the percent of zero-vehicle households and low-wage workers; and walkability. Table 18 summarizes each of these factors for the 18 count sites. While most count locations (with the exception of Baronne Street in New Orleans CBD) occur in areas of relatively low housing and job density (median 2.6 and 2.5 per acre, respectively), several count locations (e.g., Lafitte Greenway, Baronne St., Behrman Park trail, Rock Island Greenway Phase 2, Nicholson Drive trail) are in block groups where zero-vehicle households represent at least ¼ of the total, and on average, 27% of residents in block groups where counters are located are low-wage earners. As defined by the EPA National Walkability Index, only two of the count locations (Norman Francis Parkway and Baronne St.) are in areas defined as "Most Walkable." The remaining five New Orleans count locations have above average walkability, while locations in Mandeville, Ruston, and Baton Rouge have a mix of above average and below average walkability.

Table 18. Count sites by land use context and EPA Smart Location Database variables

Site #	Site Name	Housing Density (units per acre)	Job Density (jobs/acre)	% Zero Vehicle HH	% Low Wage Workers	Walkability Index**
3	Norman Francis Parkway Trail	3.65	15.71	14%	31%	Most Walkable

Site #	Site Name	Housing Density (units per acre)	Job Density (jobs/acre)	% Zero Vehicle HH	% Low Wage Workers	Walkability Index**
6	Algiers MRT	6.42	2	0%	17%	Above Average
12	Lafitte Greenway	7.09	3.7	52%	31%	Above Average
20	Baronne St Bike Lane	2.62	73.74	41%	18%	Most Walkable
25	Wisner Trail	8	3.2	8%	22%	Above Average
39	Esplanade Ave Bike Lanes	2.4	0.12	7%	30%	Above Average
40	Behrman Park Trail	3.4	0.03	29%	35%	Above Average
41	Tammany Trace	1.34	0.86	2%	24%	Above Average
42	Mandeville Lakefront Path	1.06	1.32	3%	25%	Below Average
48	Rock Island Greenway - Phase 1	0.58	0.43	3%	26%	Below Average
49	Rock Island Greenway - Phase 2	1.32	1.353	24%	40%	Above Average
44	Dalrymple Drive Trail	2.49	2.98	3%	18%	Below Average
45	Nicholson Drive Trail	0.59	9.87	34%	39%	Below Average
46	Capital Heights Bike Lanes	3.58	4.26	0%	20%	Above Average
47	Gardere Lane Sidewalk	4.3	1.24	2%	28%	Below Average
43	Baton Rouge MRT (Casino)	1.46	18.5	15%	27%	Above Average
56	Baton Rouge MRT (Water Campus)	1.46	18.5	15%	27%	Above Average
57	Government St Bike Lanes	4.16	1.44	14%	29%	Above Average

Notes: EPA Smart Location Database https://www.epa.gov/smartgrowth/smart-location-database-technical-documentation-and-user-guide

** EPA National Walkability Index https://www.epa.gov/smartgrowth/national-walkability-index-user-guide-and-methodology

Ultimately, overall volume level and the percentage of users active on weekend days (indicating primarily recreational activity) are found to be the most useful basic indicators defining preliminary factor groups from this initial data analysis. Figure 8 combines these key variables with general facility type to derive a composite proposed factor group representing facility category and observed usage pattern (1-4) and volume (a-c) (see also Table 19). As data expands, additional factors should be integrated into overall organization and grouping of count locations (particularly for on-street bikeways and non-trail pedestrian facilities such as sidewalks) to determine which permanent count site or group of sites is the best overall fit for interpreting short-duration data based on proximity, character, facility type, volume, etc.

Figure 8: Louisiana factor group description chart

	1 –Multi-Use Regional Connector	2 –Primarily Recreational "Destination" Trail	3 – Utilitarian/ Mixed Use On-Street Bikeway	4 – Mixed/Other: irregular, land-use driven activity
Key Characteristics:	*7-day activity, moderate PM peaks, observed mix of user types*	*pronounced weekend activity, sharp weekday PM/weekend AM peaks, exercise-focused uses prevalent*	*Mix of user types; hourly activity may vary by day of week*	*High volume variability linked to activity in surrounding neighborhood/land use and/or irregular patterns observed*
A – High Volume (>300/day mixed, >200 per mode)	1A • Norman Francis Parkway Trail • Lafitte Greenway	2A • Algiers MRT • Wisner Trail (peds) • Tammany Trace (bikes) • Dalrymple Drive (Peds) • Baton Rouge MRT (Casino)	3A • Esplanade Avenue Bike Lanes	4A • Mandeville Lakefront Path
B – Medium Volume (100-300/day mixed, >50 per mode)	1B • Dalrymple Drive (bikes)	2B • Wisner Trail (bikes) • Behrman Park Trail (peds) • Tammany Trace (peds) • Rock Island Greenway Phase 1 (peds) • Baton Rouge MRT (Water Campus)	3B • Baronne St Bike Lane • Capital Heights Bike Lane	4B
C – Low Volume (<100/day, <50 per mode)	1C • Rock Island Greenway Phase 2	2C • Behrman Park Trail (bikes) • Rock Island Greenway Phase 2 (bikes)	3C • Government St Bike Lane	4C • Nicholson Drive Trail

Table 19. Composite Louisiana proposed initial factor groups

Site #	Site Name	Composite Factor Group	Description
New Orleans			
3	Norman Francis Parkway Trail	1a	High volume regional off-street multi-use connection
12	Lafitte Greenway	1a	High volume regional off-street multi-use connection
6	Algiers MRT	2a	High volume off-street facility, primarily recreational
25	Wisner Trail	2a (Peds) 2b (Bikes)	High/medium volume off-street facility, primarily recreational
40	Behrman Park Trail	2b (Peds) 2c (Bikes)	Low/Medium volume off-street facility, primarily recreational
39	Esplanade Ave Bike Lanes	3a	High volume on-street bikeway - 2 way
20	Baronne St Bike Lane	3b	Medium volume on-street bikeway - 1 way
Mandeville			
41	Tammany Trace	2b (Peds) 2a (Bikes)	Medium/High volume off-street facility, primarily recreational
42	Mandeville Lakefront Path	4a	High volume off-street facility - multipurpose
Ruston			
48	Rock Island Greenway - Phase 1	2b (Peds) 2c (Bikes)	Medium/low volume off-street facility, primarily recreational
49	Rock Island Greenway - Phase 2	1c	Low volume off-street facility, multipurpose
Baton Rouge			
44	Dalrymple Drive Trail	2a (Peds) 1b (Bikes)	High/medium volume off-street facility, primarily recreational
43	Baton Rouge MRT (Casino)	2a	High volume off-street facility, primarily recreational
56	Baton Rouge MRT (Water Campus)	2b	Medium volume off-street facility, primarily recreational

Site #	Site Name	Composite Factor Group	Description
46	Capital Heights Bike Lanes	3b	Medium volume on-street bikeway - 2 way
57	Government St Bike Lanes	3c	Low volume on-street bikeway - 2 way
45	Nicholson Drive Trail	4c	Low volume off street facility, multi-purpose/University
47	Gardere Lane Sidewalk	4b	Medium/Low volume off street facility, multi-purpose/University

Weather Impact Analysis

As a final element of basic data analysis, the research team collected daily weather data (including low, average, and high temperatures, average and maximum percent humidity, and precipitation) from wunderground.com for the historical data site closest to each of the four count regions (Louis Armstrong New Orleans International Airport Station for New Orleans and Mandeville, Monroe Regional Airport Station for Ruston, and Baton Rouge Metropolitan Airport Station for Baton Rouge). This data was reviewed to assess whether, and to what extent, counts correlated to or varied depending on weather factors suspected to impact volume, as well as to analyze whether recurring data errors (discussed above) corresponded to specific environmental conditions, notably extreme heat or humidity.

Preliminary analysis suggests, as anticipated, that significant precipitation (defined here as greater than .5 inches) on a given day negatively impacts both pedestrian and bicycle activity with more pronounced impacts likely to be observed among bicyclists at most locations (Table 20). Similarly, while high temperature days (with highs above 90 degrees) in most cases correspond to overall lower user volumes for both pedestrians and bicycles, this effect is not consistent across locations with some recreation-oriented locations (e.g., Behrman Park trail, Tammany Trace) experiencing higher than average volumes during the hottest days of the year. Conversely, low temperatures (defined here as days with a high temperature below 50 degrees) appear to result in almost universally lower user volumes, with pronounced drops in activity among pedestrians and to an even greater extent bicyclists on cold days within the study period. This suggests that, contrasting with cities in colder climates, Louisiana pedestrians and cyclists are more sensitive to cold weather than to very warm temperatures. Future analysis is recommended to further test whether these variations are statistically significant and to refine the upper and lower thresholds beyond which user volume may be expected to decline.

Table 20. Impacts of weather conditions on average daily users

Site #	Site Name	Pedestrians			Bicycles			All Users		
		% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days	% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days	% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days
3	Norman Francis Parkway Trail	-5%	-18%	-38%	-20%	-20%	-59%	-13%	-19%	-50%
6	Algiers MRT							-21%	7%	-56%
12	Lafitte Greenway	-11%	-11%	-29%	-22%	-4%	-36%	-18%	-5%	-32%
20	Baronne				-13%	-6%	-4%			
25	Wisner	-20%	12%	-45%	-17%	10%	-65%	-19%	15%	-52%
39	Esplanade Ave				-25%	-6%	-49%			
40	Behrman Park Trail	-23%	30%	-35%	-9%	26%	-44%	-19%	30%	-37%
42	Tammany Trace	-5%	6%	-56%	-24%	0%	-82%	-16%	-1%	-73%
42	Mandeville Lakefront							-40%	-16%	-55%
43	BR MRT - Casino							-33%	24%	-79%
44	Dalrymple Drive Trail	-30%	-8%		-20%	-6%	3%			
45	Nicholson Trail	-8%	-13%	-32%	-41%	-6%	-63%	-21%	-7%	-44%
46	Capital Heights				-15%	-8%				
47	Gardere							-7%	1%	-17%
48	RIG - 1	-6%	-7%	-76%	-36%	14%	-80%	-20%	4%	-78%
49	RIG - 2				-2%	-24%	-49%			

Site #	Site Name	Pedestrians			Bicycles			All Users		
		% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days	% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days	% Difference, Precipitation vs. Dry	% difference, high temp days	% difference, low temp days
56	BR MRT - Water Campus	*-24%*	*0%*	*-45%*	*-12%*	*5%*	*-52%*	*-24%*	*0%*	*-45%*
57	Government St							*-23%*	*16%*	*-39%*

Weather factors were also used to preliminarily test whether heat or humidity is associated with suspected erroneous infrared sensor data detected through QA/QC review processes and not explained by mechanical issues or other described events. A simple formula was set up to calculate the average daily minimum; average and maximum temperatures; and average and maximum humidity and precipitation total on days where data errors were detected, versus days where no errors were identified at seven count locations where pedestrian data was omitted from analysis on numerous occasions. The difference (in terms of degrees, percentage, or precipitation volume) between error-days and no-error days provides an initial indication of the complex relationship (or lack thereof) of weather to data quality (Table 21). Differences in temperature of greater than 10 degrees are observed at four of the count locations; however, the direction of this relationship varies, with higher temperatures associated with data errors at Lafitte Greenway, Wisner Trail, and Nicholson Drive but lower temperatures associated with data issues at Mandeville Lakefront. No apparent relationship is observed between data quality and humidity or precipitation.

Table 21. Weather factors and data quality initial review

		Total Number of Data Points	Temperature (°F)			Humidity (%)		Precipitation (in)
Site			Max	Avg	Min	Max	Avg	Total
40-Behrman Park	No Errors	566	76.6	66.8	57.7	89.6	72.2	0.2
	Data Errors	67	83.8	75.5	67.1	86.8	68.9	0.3
	Difference		*7.2*	*8.7*	*9.4*	*-2.9*	*-3.4*	*0.1*

		Total Number of Data Points	Temperature (°F)			Humidity (%)		Precipitation (in)
Site			Max	Avg	Min	Max	Avg	Total
12-Lafitte Greenway	No Errors	636	80.7	72.2	64.6	88.5	71.9	0.2
	Data Errors	116	90.8	77.4	63.0	91.0	69.4	0.1
	Difference		*10.2*	*5.2*	*-1.6*	*2.5*	*-2.5*	*-0.1*
25-Wisner	No Errors	814	79.9	71.2	63.2	88.6	71.8	0.2
	Data Errors	42	90.8	77.4	63.0	91.0	69.4	0.1
	Difference		*10.9*	*6.2*	*-0.2*	*2.4*	*-2.5*	*-0.1*
42- Mandeville Lake	No Errors	638	77.3	68.0	59.4	89.2	72.4	0.2
	Data Errors	25	65.5	55.2	45.4	85.8	63.0	0.0
	Difference		*-11.8*	*-12.8*	*-14.0*	*-3.5*	*-9.3*	*-0.2*
41 - Tammany Trace	No Errors	456	78.2	69.5	61.5	88.5	72.2	0.2
	Data Errors	25	90.7	76.5	62.0	89.8	65.6	0.0
	Difference		*12.5*	*6.9*	*0.5*	*1.3*	*-6.6*	*-0.2*
45-Nicholson	No Errors	378	78.8	68.6	59.3	94.0	76.4	0.2
	Data Errors	131	84.0	72.9	63.1	96.2	77.6	0.2
	Difference		*5.2*	*4.3*	*3.8*	*2.1*	*1.2*	*0.0*
49 - RIG Phase 2	No Errors	389	78.7	66.9	56.7	94.3	75.3	0.1
	Data Errors	113	84.0	71.3	60.4	94.1	73.4	0.2
	Difference		*5.3*	*4.4*	*3.7*	*-0.1*	*-1.9*	*0.0*

To test the significance of these initial findings, an unpaired t-test (two-tailed P-value) was run for each the four locations with the greatest number of days where erroneous data was suspected (Table 22). This test supports the finding that high temperature days are associated with a greater likelihood of erroneous data.

Table 22. Comparison of means, error vs. no-error days

	P Value	Mean of errors minus no errors	Confidence Interval (95%)	t	df	Standard Error of Difference	Significant (<.05)
Lafitte Greenway							
Max Temp	<0.0001	-12.33	-14.62 to -10.04	10.5780	749	1.166	Yes
Humidity	0.1561	-1.669	-3.978 to 0.640	1.4198	749	1.175	No
Precipitation	0.0555	-0.1186	-0.2401 to 0.0029	1.9176	749	0.062	No
Nicholson Drive							
Max Temp	less than 0.0001	5.15	3.01 - 7.30	4.7159	507	1.092	Yes
Humidity	0.2841	1.234	-1.027 to 3.494	1.0723	507	1.151	No
Precipitation	0.6003	0.0269	-0.0738 to 0.1276	0.5242	507		No
Rock Island Greenway Phase 2							
Max Temp	0.0002	5.33	2.50 to 8.16	3.6997	500	1.44	Yes
Humidity	0.104	-1.933	-4.265 to 0.399	1.6289	500	1.187	No
Precipitation	0.2629	0.0428	-0.0322 to 0.1179	1.1208	500	0.038	No
Wisner Trail							
Max Temp	less than 0.0001	10.94	7.24 to 14.65	5.8037	853	1.886	Yes
Humidity	0.1681	-2.486	-6.026 to 1.054	1.3797	853	1.802	No
Precipitation	0.5311	-0.0576	-0.2382 to 0.1230	0.6266	853	0.092	No

Importantly, these findings are preliminary and do not fully explain variation suspected to be linked to environmental conditions (e.g., angle of sunlight, stormy conditions during specific hours of the day impacted, increased likelihood of impacts from insects during certain parts of the year, etc.). Additional scrutiny should be applied to infrared sensor data collected in Louisiana to attempt to identify and adjust for these sensitivities. For additional details and full historical weather data for each count region, see Appendix I.

Data Adjustment and Expansion

The first facet of data adjustment is to use manual observations (i.e., validation counts) to estimate total user volume more accurately at a given location by developing a site correction factor. These multipliers (Table 23) are calculated to account for net sensor errors (sensor correction factor) as well as (optional, depending on data purpose) contextual errors (context correction factor) to derive an overall site-specific correction factor intended to estimate total pedestrian and/or bicycle usage within the right-of-way.

Table 23. Site-specific correction factors

Site #	Site Name	Sensor Correction Factor			Context Correction Factor			Overall Site-Specific Correction Factor		
		Bikes	Peds	All	Bikes	Peds	All	Bikes	Peds	All
3	Norman Francis Parkway Trail	1.08	1.06	1.07	0.09	0.18	0.14	1.18	1.25	1.21
6	Algiers MRT			1.02			0.01			1.02
12	Lafitte Greenway	1.05	1.09	1.06	0.06	0.07	0.06	1.11	1.17	1.13
20	Baronne St.	1.03			0.28			1.32		
25	Wisner Trail	1.11	0.88	1.01	0.01	0.00	0.01	1.12	0.88	1.02
39	Esplanade Ave	1.08			0.03			1.11		
40	Behrman Park Trail	1.35	0.97	1.04	0.00	0.03	0.02	1.35	1.00	1.07
42	Tammany Trace	1.05	1.03	1.04	0.20	0.12	0.17	1.26	1.15	1.22
42	Mandeville Lakefront			1.01			0.03			1.05
43	BR MRT - Casino			1.00			0.03			1.03
44	Dalrymple Drive Trail	1.01	1.03	1.02	0.12	0.03	0.07	1.13	1.06	1.09

Site #	Site Name	Sensor Correction Factor			Context Correction Factor			Overall Site-Specific Correction Factor		
		Bikes	Peds	All	Bikes	Peds	All	Bikes	Peds	All
45	Nicholson Trail	1.05	0.92	0.97	0.05	0.03	0.04	1.11	0.95	1.00
46	Capital Heights	0.99			0.00			0.99		
47	Gardere			1.05			0.31			1.38
48	RIG - 1	1.00	1.04	1.03	0.00	0.00	0.00	1.00	1.04	1.03
49	RIG - 2			1.00			0.14			1.14
56	BR MRT - Water Campus	1.03	1.08	1.06	0.08	0.02	0.04	1.10	1.10	1.10
57	Government St	1.00			0.10			1.10		

A key objective of primary continuous data collection is to develop expansion factors from which to adjust short-duration counts (e.g., counts collected before and after a project is completed, or annual/seasonal counts for broader network monitoring). This section summarizes basic temporal adjustment and expansion factors for sites with 12 months or more of cleaned data only from which AADT estimates may be derived for counts collected at any time of year (excluding during extreme weather events, which should be avoided) for sites with similar characteristics.

To develop basic expansion factors for each site, the research team first calculated the percentage of average total volume by hour of day, day of week, and month of year. Monthly values facilitate simple expansion of short-duration counts (1-4 weeks of data) to annual daily volumes (Table 24-26).

Table 24. Monthly (seasonal) adjustment factors (preliminary)—New Orleans

	Norman Francis Pkwy Trail (July 2020-July 2022)		Algiers MRT July 2020 - March 2022	Lafitte Greenway July 2020 - July 2022		Baronne St (July 2020 - July 2022)	Wisner Trail July 2020 - July 2022		Esplanade Avenue (July 2020 - July 2022)	Behrman Park Trail (November 2020 - June 2022)	
	Pedestrians	***Bicyclists***	***All Users***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***
Jan	0.94	1.20	1.24	1.03	1.21	1.48	1.05	1.16	1.34	1.58	1.50
Feb	1.01	1.19	1.40	0.98	1.05	0.77	1.14	1.36	1.16	1.57	1.45
Mar	0.95	0.92	0.94	0.85	0.93	0.88	0.98	1.06	0.90	1.10	1.18
Apr	0.86	0.84	0.85	0.86	0.81	0.84	0.94	0.98	0.85	0.92	1.01
May	0.89	0.84	0.75	0.97	0.87	0.84	0.93	0.92	0.80	0.73	0.82
Jun	1.38	1.23	1.04	1.12	1.06	0.89	0.98	1.19	1.12	1.18	0.98
Jul	1.08	1.18	0.96	1.20	1.11	1.11	0.91	0.94	1.07	0.78	0.84
Aug	1.12	1.05	1.01	1.21	1.13	1.16	0.97	0.81	1.02	0.83	0.91
Sep	1.07	1.07	1.06	1.14	1.16	1.12	1.06	0.89	1.08	1.25	0.99
Oct	0.89	0.78	0.89	0.88	0.84	0.90	0.88	0.77	0.81	0.60	0.58
Nov	0.91	0.90	1.07	0.89	0.94	1.06	1.10	1.02	0.96	1.21	1.18
Dec	1.09	1.09	1.11	1.04	1.09	1.49	1.13	1.22	1.19	1.31	1.40

Table 25. Monthly (seasonal) adjustment factors (preliminary)—Mandeville and Ruston

	Tammany Trace (August 2020 - July 2022)		Mandeville Lakefront Path	Rock Island Greenway Phase 1 (August 2020 - July 2022		Rock Island Greenway Phase 2 (March 2021 - July 2022)
	Pedestrians	*Bicyclists*	*All Users*	*Pedestrians**	*Bicyclists*	*All Users*
Jan	1.09	1.09	1.14	1.12	1.46	1.17
Feb	1.46	1.47	1.12	1.25	1.39	1.21
Mar	1.33	0.90	0.84	0.80	0.88	1.02
Apr	0.77	0.86	0.77	0.91	0.84	1.09
May	0.69	0.84	0.88	1.13	0.90	1.05
Jun	1.11	0.99	1.12	1.17	0.93	0.91
Jul	0.79	0.97	1.35	1.11	0.94	0.80
Aug	0.90	1.02	1.22	0.97	1.18	1.06
Sep	1.03	0.99	1.11	0.77	0.77	0.73
Oct	1.00	0.77	0.82	0.81	1.03	0.89
Nov	1.21	1.12	0.90	1.04	0.88	1.12
Dec	1.22	1.40	1.09	1.25	1.32	1.28

Table 26. Monthly (seasonal) adjustment factors (preliminary)—Baton Rouge

	Dalrymple Drive (March 2021 - July 2022)	Nicholson Drive (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)	Baton Rouge MRT - Casino (July 2020 - July 2021)	Baton Rouge MRT - Water Campus (July 2021 - July 2022)		Government St Bike Lanes (July 2021 - July 2022)
	Bicyclists	*Pedestrians*	*Bicyclists*	*All Users*	*All Users*	*Pedestrians*	*Bicyclists*	*Bicyclists*
Jan	1.57	1.50	1.49	1.03	1.31	1.50	1.49	1.28
Feb	1.33	0.92	1.00	1.11	1.43	0.92	1.00	1.19
Mar	0.90	1.19	0.99	1.14	0.97	1.19	0.99	1.00
Apr	0.83	0.84	1.01	1.28	0.88	0.84	1.01	0.86
May	0.92	1.00	1.17	1.32	0.96	1.00	1.17	0.86
Jun	1.24	1.62	1.29	1.04	1.13	1.62	1.29	0.90
Jul	1.16	1.13	1.47	1.01	0.93	1.13	1.47	0.94
Aug	0.93	1.27	1.06	0.95	0.79	1.27	1.06	1.06
Sep	0.78	0.80	0.62	0.80	0.85	0.80	0.62	0.94
Oct	0.74	0.54	0.62	0.82	0.75	0.54	0.62	0.97
Nov	0.95	0.78	0.80	0.93	1.08	0.78	0.80	1.05
Dec	1.25	1.80	1.68	0.85	1.51	1.80	1.68	1.12

*Dalrymple Drive pedestrians and Capital Heights bicyclists omitted due to lack of complete 12-month data

In addition, day of week/daily (Table 27-29) and hourly adjustment factors (Appendix I) may be developed and applied to expand very short duration counts (less than one week), and to develop imputed values where gaps in days or hours of data exist. This is an optional step that may be valuable when comparisons between sites are needed in order to provide “apples to apples” volume estimates for a specific period. In all cases where imputed values are calculated, these should be clearly flagged in source datasets and noted in data reporting. Note that expansion factors for very low volume periods (e.g., overnight hours) should generally not be used as near-zero counts exaggerate the expansion factor and may result in unreliable estimates. A null or default value (e.g., 5% of ADT) may be substituted in cases where late night estimates are desired based on review of initial data patterns.

Table 27. Day of week adjustment for imputation—New Orleans

	Norman Francis Pkwy Trail (July 2020-July 2022)		**Algiers MRT July 2020 - March 2022**	**Lafitte Greenway July 2020 - July 2022**		**Baronne St (July 2020 - July 2022)**	**Wisner Trail July 2020 - July 2022**		**Esplanade Avenue July 2020 - July 2022**	**Behrman Park Trail (November 2020 - June 2022**	
	Pedestrians	***Bicyclists***	***All Users***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***
Monday	1.00	1.07	1.01	*0.94*	*1.10*	1.10	1.01	1.08	1.13	1.22	1.07
Tuesday	0.99	1.09	1.04	1.01	1.09	1.02	1.07	1.10	1.09	1.22	1.03
Wednesday	1.03	1.05	1.10	1.04	1.10	1.02	1.08	1.10	1.14	1.29	1.10
Thursday	0.95	0.97	1.09	0.98	1.00	0.95	0.99	1.08	1.01	1.13	1.03
Friday	1.06	1.03	1.15	1.11	1.03	0.91	1.16	1.22	1.04	0.74	0.94
Saturday	0.98	0.88	0.87	0.95	0.84	0.95	0.86	0.82	0.79	0.89	0.91
Sunday	1.00	1.20	0.83	0.99	1.09	1.08	0.89	0.95	0.82	0.84	1.71
Weekday - Average	1.00	1.04	1.08	1.01	1.06	1.00	1.06	1.12	1.08	1.07	1.03
Weekend - Average	0.99	0.91	0.85	0.97	0.86	1.01	.87	.79	0.80	0.86	0.93

Table 28. Day of week adjustment for imputation—Mandeville and Ruston

	Tammany Trace (August 2020 - July 2022)		Mandeville Lakefront Path	Rock Island Greenway Phase 1 (August 2020 - July 2022		Rock Island Greenway Phase 2 (March 2021 - July 2022)
	Pedestrians	*Bicyclists*	*All Users*	*Pedestrians**	*Bicyclists*	*All Users*
Monday	1.05	1.31	1.08	0.93	1.01	0.95
Tuesday	1.23	1.44	1.25	0.94	1.10	1.07
Wednesday	1.50	1.58	1.31	0.94	1.02	0.99
Thursday	1.07	1.33	1.18	1.06	1.08	1.02
Friday	1.13	1.31	1.19	1.20	1.15	1.08
Saturday	0.73	0.56	0.74	1.04	0.81	1.02
Sunday	0.73	0.78	0.67	0.94	0.89	0.90
Weekday - Average	1.18	1.39	0.77	1.02	0.04	0.03
Weekend - Average	0.73	0.59	0.45	0.63	0.02	0.02

Table 29. Day of week adjustment for imputation—Baton Rouge

	Dalrymple Drive (March 2021 - July 2022)*		Nicholson Drive (March 2021 - July 2022)		Capital Heights (March 2021 - July 2022)	Gardere Lane (March 2021 - March 2022)	Baton Rouge MRT - Casino (July 2020 - July 2021)	Baton Rouge MRT - Water Campus (July 2021 - July 2022)		Government St Bike Lanes (July 2021 - July 2022)
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*Pedestrians*	*Bicyclists*	*Bicyclists*
Monday	0.94	1.07	1.23	0.96	0.64	1.02	1.30	5.41	5.31	0.55
Tuesday	1.14	1.20	1.10	0.94	0.71	1.01	1.28	4.87	5.21	0.55
Wednesday	1.13	1.11	1.15	0.94	0.63	1.05	1.39	5.06	5.19	0.51
Thursday	1.07	1.13	1.02	0.99	0.66	1.03	1.37	4.49	5.49	0.49
Friday	1.45	1.18	0.97	1.04	0.64	0.98	1.39	4.29	5.74	0.47
Saturday	0.80	0.81	0.77	0.89	0.47	0.95	0.80	3.38	4.93	0.43
Sunday	0.77	1.04	0.90	2.32	0.84	0.96	0.85	3.95	2.32	1.08
Weekday - Average	1.12	1.12	1.09	0.97	0.66	0.69	1.34	1.05	1.26	0.51
Weekend - Average	0.79	0.79	0.83	1.08	0.46	0.65	.83	0.88	0.66	0.47

Where a minimum of 12 months of continuous data (with no gaps) is available, day of year expansion factors may be developed to adjust short-duration counts at similar sites during that same year. Researchers have found this method to provide greater overall accuracy [24] as the method inherently accounts for weather and other day-specific variables; however, its use is only feasible where robust data exists, and adjustment factors must be recalculated annually.

Conclusions

Continuous, long-term count data is a key foundation for safety analysis, planning, and policy or program evaluation, which aligns with a Safe Systems approach to Louisiana's transportation networks. This study has initiated ongoing, continuous data collection at 17 locations in Louisiana to pilot a bicycle and pedestrian count program that can serve as a model for sustainable and coordinated local and regional data collection across the state. The research team has achieved the three primary objectives of (1) installing the counters; (2) developing preliminary expansion factors and groups; and (3) supporting coordinated local and regional data collection.

The project has also substantially helped identify and resolve potential barriers to continued expansion of multimodal data collection. In recent years, more states have begun to standardize their efforts and evolve pilot programs with guidebooks, technical assistance contracts, and public-facing dashboards through which to share data. During this research, challenges similar to those identified in other regions of the country by peers conducting similar work were encountered, including challenges with weather, procurement and contracting, vandalism, development of partner MOUs, and the COVID-19 pandemic. In addition, the research team experienced additional challenges to uninterrupted data collection including extreme weather conditions (e.g., hurricanes), behavioral issues (e.g., equipment being run into in road departure crashes or otherwise destroyed), and periodic sensor/data quality issues which were not able to be fully diagnosed or explained even with support from equipment vendors.

Ongoing monitoring and maintenance of the counter network to resolve persistent issues and detect sporadic errors is essential. In particular, although performance of inductive loop sensors has been robust and reliable, a myriad of issues have affected the performance of infrared sensors to detect pedestrians or mixed non-motorized users, requiring additional field validation, data cleaning and post-processing, and/or loss of days, weeks, or even months of data. For this reason, continued expansion of use of this sensor type is recommended only where installation and operation conditions are optimal or alternative methods are infeasible.

Despite these challenges, this study has resulted in a robust preliminary database from which summary findings and trends have been synthesized, and which future data collection efforts may build upon and draw from to contextualize and adjust shorter duration counts. Increasingly, the development of improved data for understanding bicycle and pedestrian demand is expected to be an integral component of both area and project planning and a criterion for both funding and evaluating transportation investments. Multimodal demand data can be derived from a variety of direct and secondary sources; however, the establishment of continuous, permanent counters on strategically identified network links continues to be a critical keystone of data analysis, facilitating calibration of indirect or sample-based data sources and robust longitudinal trend analysis.

Tensions exist between what data is easy and cost-effective to collect (e.g., multimodal counts on off-road trail facilities) and where data is most needed (e.g., on streets and roads where serious crashes are occurring). Similarly, despite a clear benefit to maximizing automation of data collection (e.g., automatic data transfer, pre-defined QA/QC rules and parameters, and standardized reporting templates), there is also no substitute for on-the-ground observation and local knowledge in assessing data reliability and quality. For this reason, an entirely state DOT-driven and/or privately contracted program is not recommended at this time. While this research positions Louisiana as a relatively early adopter of coordinated statewide active transportation counts, the suite of count locations is still small, and preliminary factor groups represent a limited share of contexts. Moreover, low user volumes in many areas of the state inhibit the development of inferences based on limited data to-date (though confidence is higher in urban areas where several count units on similar facilities show similar results).

This research has also resulted in the development of a suite of guidance documents, templates, and resources, and identified paths toward program expansion under local and regional management. The research team recommends a coordinated but decentralized model of count program growth, wherein DOTD plays a key supporting role in providing guidance to ensure data compatibility, support best practice implementation, and disseminate results. Already, the output data of this research is being integrated into MPO long-range transportation plan and pedestrian and bicycle plan update or development processes, including use in the analysis of potential emissions impacts of active transportation mode share growth. In addition, AADT outputs have been adopted as a metric for evaluating local Complete Streets policy performance in New Orleans. Additional guidance from the federal government about multimodal data collection and use is anticipated, pending ongoing research and implementation of the IIJA. Strategically initiating direct pedestrian and bicycle counts helps position the state to align with advances in federal policy and funding guidelines and stay competitive to address pressing needs for vulnerable road users throughout the state, resulting in safer, more accessible, and more equitable transportation networks for all.

Recommendations

This section outlines preliminary recommendations for continued advancement of the state of the practice in multimodal data collection.

Future Research and Analysis

- Future research should use the data resulting from this effort as an input in model outputs; a calibration factor for research on surrogate mobility data (e.g., GPS records, third party datasets); and a foundation for advanced analysis of key determinants and outcomes of active transportation facility use as well as factors impacting data quality (e.g., multivariate regression to isolate statistically significant factors and confirm or disprove preliminary findings and/or predict and reduce erroneous data in the future).
- Use results from this study directly (where count stations exist) or indirectly by collecting and adjusting short-duration counts on project outcome evaluations such as to account for potential growth in activity when analyzing crash outcomes.
- Integrate results into future analysis of mobility patterns using GPS-based data to validate purported or inferred user volumes and/or calibrate current active mode share/demand.
- Although mechanical options still dominate the field, artificial intelligence (AI) and video-based count technology continues to advance. As this data source emerges, researchers and practitioners should ensure that its outputs are compatible with the same basic data output formats developed for mechanical options (e.g., hourly "bins," directional data where feasible), so that data from all types of sensors can be organized and used similarly.
- Using the methodology described by Turner et al. [33], update the SCRAM areawide exposure analysis tool with 2017 NHTS data and more recent ACS data to track long-term shifts at state and MSA levels.

- Track pending U.S. DOT research on state DOT use of multimodal data (anticipated through NCHRP 07-31—*State DOT Usage of Bicycle and Pedestrian Data: Practices, Sources, Needs, and Gaps*).
- Consider implementation of a statewide travel survey (e.g., linked to DOTD Long Range Transportation Plan update) and/or encouraging local and regional household travel surveys (and the coordination of their content) as an additional input for improving exposure evaluation, especially considering post-COVID-19 travel behavior shifts to address the limitations of ACS data for active transportation analysis due to small sample sizes.

Count Program Implementation and Expansion

- Considered as part of overall project cost, data collection can be a very small line-item with big long-term impacts. Integrate new counter installation into Complete Streets-oriented road projects as well as recreational trails projects by including count equipment and installation (particularly inductive loop bicycle counters) in project budget and including installation and use of counters as part of MOUs with local agencies (where applicable). This may require the development of DOTD construction specifications in order to facilitate integration into project delivery (design phase). Provide technical assistance to plan and initiate count devices use.
- Define a standard process, protocol, and point person(s) for future counter installation on levee trails. These are important assets within Louisiana's active transportation network, yet are among the most complicated on which to coordinate data collection. Establishment of standardized parameters/minimum requirements for permit approval, a process for integrating new count stations into construction of new levee trail segments, and creating a clear point of contact to facilitate coordination and authorization of monitoring sites would help reduce friction and optimize the planning and research value of these keystone facilities.
- Expand capacity for local installation of count equipment. Procuring contracted support for inductive loop installation was identified as a logistical and cost barrier, and only one vendor was ultimately identified throughout the course of this research as willing and able to complete the work. This project has supported initial outreach to the contractor community to introduce multimodal count concepts and techniques;

such training opportunities could be expanded to highlight opportunities for small firms (especially DBEs) to expand their portfolio of services and offer permanent counter installation. Simultaneously, consider developing training resources for local agency staff to facilitate more of this work in-house.

- Include evidence of demand as a criterion in competitive funding applications and prioritize projects that include an evaluation/data collection component. In addition, promote funding programs for which count collection activities or equipment are eligible expenses.
- Require collection of multimodal counts (and/or latent demand analysis as appropriate) as part of Stage 0/feasibility studies for all projects involving facilities subject to Complete Streets policy. Where applicable, use expansion factors for comparable facilities provided in this report to estimate AADT for pedestrians and/or bicyclists.
- Require consultants engaged in work (planning, engineering, construction) to be trained in multimodal data collection and/or count equipment installation and use, and provide cost-shared support (where applicable) and technical assistance for continuous monitoring activities and collection and interpretation of short-duration counts.
- Prioritize expansion of continuous count station network on underrepresented facility types and in underrepresented communities (e.g., on-street bikeways, pedestrian facilities in commercial districts, and in low-income and minority communities where commute/usage patterns are likely to differ from current count sites). Consider equity as an explicit component of future monitoring expansion.

Data Reporting and Publication

- Develop a data dashboard, portal, or page to disseminate data both internally and externally. At the state level, this should include, at a minimum, identifying a coordinator to compile data from local/regional partners, maintaining a tabular database of daily and hourly count data for internal use, and preparing a map/shapefile indicating the locations and summary statistics associated with all counters as well as publicizing key updates/findings on an annual basis. At the local or regional level, this should include regular (e.g., quarterly) review and cleaning of data, development of summary statistics, and publication of data (including sharing with state coordinator).

- Develop and use count data in economic impact analyses to show the business case for active transportation infrastructure.

Acronyms, Abbreviations, and Symbols

Term	Description
AADBT	Annual Average daily bicycle traffic
AADNT	Annual Average daily non-motorized traffic
AADT	Annual Average daily traffic
AASHTO	American Association of State Highway and Transportation Officials
ACS	American Community Survey
BMP	Bicycle Miles Traveled
BREC	East Baton Rouge Recreation and Park Commission
CAT	Council on Active Transportation
CBD	Central Business District
CPRA	Coastal Protection and Restoration Authority
CRPC	Capital Regional Planning Commission
DBE	Disadvantaged Business Enterprise
DOT	Department of Transportation
DOTD	Department of Transportation and Development
EPA	Environmental Protection Agency
FARS	Fatality Analysis Reporting System
FTA	Federal Transit Administration
FHWA	Federal Highway Administration
GIS	Geographic Information System
IIJA	Infrastructure Investment and Jobs Act
ITRE	Institute for Transportation Research and Education
LSU	Louisiana State University
LTRC	Louisiana Transportation Research Center
MOU	Memorandum of Understanding
MPO	Metropolitan Planning Organization
MRT	Mississippi River Trail
MSA	Metropolitan Statistical Area
NCDOT	North Carolina Department of Transportation
NCHRP	National Cooperative Highway Research Program

Term	Description
NHTS	National Household Travel Survey
PI	Principal Investigator
PMT	Pedestrian Miles Traveled
POI	Point-of-interest
PRC	Project Review Committee
TDOT	Tennessee Department of Transportation
QA/QC	Quality Assurance/Quality Control
RFP	Request for Proposal
RFQ	Request for Qualifications
RPC	Regional Planning Commission
SCRAM	Scalable Risk Assessment Model
SSPF	Safer Streets Priority Finder
UNO	University of New Orleans
USACE	U.S. Army Corps of Engineers
VDOT	Virginia Department of Transportation
VMT	Vehicle Miles Traveled

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Appendix

A. Count Technology & Vendor Inventory

[see attached Excel Workbook]

B. Count Program Inventory

[see attached Excel Workbook]

C. Site Selection and Testing Framework and Outputs

Site Selection and Testing Framework Template

Key Questions and Test Count Objectives

- Are people using this facility/corridor for walking and/or bicycling?
- How many bicyclists/peds/users per day:
  - — Weekdays
  - — Weekends
- Ratio of bikes to peds, where applicable (use manual validations)
- Directionality: Ratio of In to Out and what that means (i.e., reflecting commute patterns?)
- Usage by hour:
  - — Weekdays
  - — Weekends
- Overall pattern
  - — Commute (distinct AM/PM weekday peaks)
  - — Recreational (high weekend usage, less pronounced peaks)

- Utilitarian/Mixed (consistent usage across days, time of day, may have moderate peaks)
- Insufficient information/limited use
- Other (anything distinctive such as spikes in use on a particular time/day, anything that might suggest an unusual event)

- Overall suitability as a count location: What factor group does this location represent, and are there major limitations/considerations with proceeding with this location as a permanent count site?

Recommended Charts and Tables to Prepare

- Summary table and chart of daily usage
  - Stacked column to show IN/OUT
  - Columns to show two related count locations where applicable
- Summary table/chart by day of week (stacked columns for IN/OUT)
- Hourly table—average hourly users
- Hourly charts—line charts, show average usage over a 24-hour period,
  - Separating in/out where appropriate
  - Differentiate weekday vs weekend

Proposed Count Locations

[see attached Excel Workbook, C1]

Short-Duration Test Count Workbook

[see attached Excel Workbook, C2]

Short-Duration Test Count Summary Statistics

Table 30. Short-duration test count summary results

Count Location Name	ADT (unadjusted)	Weekend Ratio	Morning Ratio	General Travel Pattern
Westbank MRT	284	1.1	1.57	Multipurpose
Newton Street	6	0.77	19	Commute
Wisner Trail	121	1.27	1.55	Multipurpose
Wisner Trail	170	0.85	2.78	Commute
Capital Heights Ave	68	0.77	0.96	Multipurpose
Downtown Greenway	14	0.74	1	Multipurpose
Downtown Greenway	43	0.42	1.11	Multipurpose
Mississippi River Trail	33	n/a	0.44	Non-Commute
Mississippi River Trail	384	0.23	0.09	Multipurpose
BREC I-110 Trails - Scotlandville	2	1	n/a	Multipurpose
BREC I-110 Trails - Scotlandville	17	0.8	0.17	Multipurpose
BREC I-110 Trails - Airline Terrace	3	1.14	0.53	Non-Commute
BREC I-110 Trails - Airline Terrace	26	0.57	4.72	Commute
E Thomas St (Hwy 190)	552	1.23	0.33	Non-Commute
E Thomas St (Hwy 190)	334	0.94	0.51	Multipurpose
Dalrymple Dr	387	2.51	1.31	Non-Commute
Gardere Ln	108	1.25	1.13	Non-Commute
Nicholson Dr	48	1.32	1.43	Non-Commute

Table 31. Previously collected short and long-duration count locations and summary statistics

Count Location Name	Count Location Cross Street	Facility Type	City	Sensor Type	User Type	ADT	ADT Period	Weekend Ratio	Morning Ratio	General Travel Pattern
Norman Francis Parkway Trail	Conti (South)	Shared-Use Trail	New Orleans	EcoMulti	Bicycles	518	3/29/18 - 3/28/19	0.92	1.01	Multipurpose
Norman Francis Parkway Trail	Conti (South)	Shared-Use Trail	New Orleans	EcoMulti	Peds	430	5/13/16 - 5/12/17	1.06	1.2	Non-Commute
Tammany Trace	Koop Drive Trailhead	Shared-Use Trail	Mandeville	EcoMulti	Bicycles	155	10/1/15 - 9/30/16	4.08	0.7	Non-Commute
Tammany Trace	Koop Drive Trailhead	Shared-Use Trail	Mandeville	EcoMulti	Peds	58	10/1/15 - 9/30/16	1.12	0.55	Non-Commute
Westbank MRT	Lavergne St	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	347	6/26/14 - 10/9/14	0.59	1.28	Multipurpose
Westbank MRT	Lavergne St	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	616	6/12/19 - 6/24/19	0.67	1.52	Commute
Wisner Trail	Harrison Ave	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	277	6/20/15 - 8/26/15	1.41	1.52	Multipurpose
Lafitte Greenway	N Galvez St	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	911	11/23/17 - 11/22/18	0.93	1.14	Multipurpose
Lafitte Greenway	Jeff Davis Pkwy	Shared-Use Trail	New Orleans	EcoPyro	Mixed Bike/Ped	872	1/1/18 - 12/31/18	0.97	1.97	Commute
Tulane Avenue	S Dorgenois (North)	Bike Lane	New Orleans	EcoTUBES	Bicycles	65	6/11/17 - 7/17/17	0.5	0.75	Multipurpose

Count Location Name	Count Location Cross Street	Facility Type	City	Sensor Type	User Type	ADT	ADT Period	Weekend Ratio	Morning Ratio	General Travel Pattern
Tulane Avenue	S Dorgenois (South)	Bike Lane	New Orleans	EcoTUBES	Bicycles	104	6/11/17 - 7/17/17	0.49	1.69	Commute
Tulane Avenue	S Dorgenois (North)	Sidewalk	New Orleans	EcoPyro	Peds	249	6/11/17 - 7/17/17	0.33	0.78	Multipurpose
Tulane Avenue	S Dorgenois (South)	Sidewalk	New Orleans	EcoPyro	Peds	237	6/11/17 - 7/17/17	0.61	0.84	Multipurpose
Esplanade Avenue	N Gayoso (North)	Bike Lane	New Orleans	EcoTUBES	Bicycles	217	9/8/17 - 9/26/17	1.06	0.85	Non-Commute
Esplanade Avenue	N Gayoso (South)	Bike Lane	New Orleans	EcoTUBES	Bicycles	211	8/19/17 - 9/26/17	1.08	0.85	Non-Commute
Esplanade Avenue	N Gayoso (North)	Sidewalk	New Orleans	EcoPyro	Peds	119	8/19/17 - 9/26/17	0.91	1.02	Multipurpose
Esplanade Avenue	N Gayoso (South)	Sidewalk	New Orleans	EcoPyro	Peds	145	8/19/17 - 9/26/17	1.09	1.23	Non-Commute
Government Street	Evergreen Dr (North)	Shared lane (on-street)	Baton Rouge	EcoTUBES	Bicycles	35	10/5/17 - 10/22/17	0.51	2.53	Commute
Government Street	Evergreen Dr (South)	Shared lane (on-street)	Baton Rouge	EcoTUBES	Bicycles	7	10/5/17 - 11/7/17	0.28	0.96	Multipurpose
Government Street	Evergreen Dr (North)	Sidewalk	Baton Rouge	EcoPyro	Peds	52	10/5/17 - 11/7/17	0.8	0.44	Multipurpose
Government Street	Evergreen Dr (South)	Sidewalk	Baton Rouge	EcoPyro	Peds	38	10/5/17 - 11/7/17	0.64	0.68	Multipurpose

Count Location Name	Count Location Cross Street	Facility Type	City	Sensor Type	User Type	ADT	ADT Period	Weekend Ratio	Morning Ratio	General Travel Pattern
Baronne Street	Howard Avenue	Protected Bike Lane	New Orleans	EcoTUBES	Bicycles	365	1/1/19-12/31/19	0.57	0.77	Multipurpose
Basin Street	St Louis St	Protected 2-way Cycletrack	New Orleans	EcoTUBES	Bicycles	318	6/29/18 - 10/31/18	0.71	1.49	Multipurpose

Short-Duration Counts Collected by External Entities, 2016-2019

Table 32. CRPC pneumatic tube bicycle counts

Count Location	Daily Average Bicycle Volume (unadjusted)	Dates
Perkins Road Park Bike Trail	43	12/31/16 - 2/20/17
Mississippi Levee at Florida Boulevard	89	7/30/15 - 9/13/15
Mississippi Levee at Skip Bertman Drive	90	10/29/15 - 12/1/15
Mississippi Levee at South Boulevard	199	2/17/17 - 3/2/17
Dalrymple Drive near Harrison Street	81	12/14/15 - 1/22/17
East Lakeshore Drive near Cedardale Avenue	128	5/5/16 - 5/19/16
Stanford Avenue near South Lakeshore Drive	85	5/5/16 - 5/20/16
May Street Between South and East Lakeshore Drive	24	1/25/16 - 2/22/16
Milford Wampold Memorial Park	204	9/14/16 - 10/22/16
Downtown Greenway (prior to 2016 rebuild)	8	4/7/16 - 4/27/16

Table 33. Bike Baton Rouge September 2017 manual counts

Location	Type	Tuesday 5-7pm Count Total	Saturday 12pm-1pm Count Total	Monday 10am-12pm Count Total
Swan Avenue @ Robert Smith Blvd	Intersection	4	0*	0
Robert Smith Blvd @ Swan Avenue	Intersection	4	0*	2
North Boulevard @ S 19th Street	Intersection	28	9	-
S 19th Street @ North Boulevard	Intersection	26	3	-
South Boulevard @ East Blvd	Intersection	14	14	-

Location	Type	Tuesday 5-7pm Count Total	Saturday 12pm-1pm Count Total	Monday 10am-12pm Count Total
East Blvd @ South Boulevard	Intersection	7	13	-
Bike Trail, Southwest side of Entrance to Park	Screenline	68	21	-
Kenilworth Parkway, on Dawson Creek Bridge	Screenline	25	5	-
Sherwood Blvd @ Goodwood Blvd	Intersection	6	3*	-
Goodwood Blvd @ Sherwood Blvd	Intersection	4	5*	-
Capital Heights Ave @ Glenmore Ave	Intersection	37	6	-
Glenmore Ave @ Capital Heights Ave	Intersection	13	1	-
Dalrymple Drive @ E State St	Intersection	88	28	-
E State St @ Dalrymple Drive	Intersection	17	4	-
Tower Drive, by clocktower	Screenline	77	19	148
N Acadian Thruway @ Gus Young Blvd	Intersection	16	14	-
Gus Young Blvd @ N Acadian Thruway	Intersection	6	4	-
** indicates 90 or 120 minute count duration*				

Figure 9. BREC trails counters daily averages by day of week, 2019

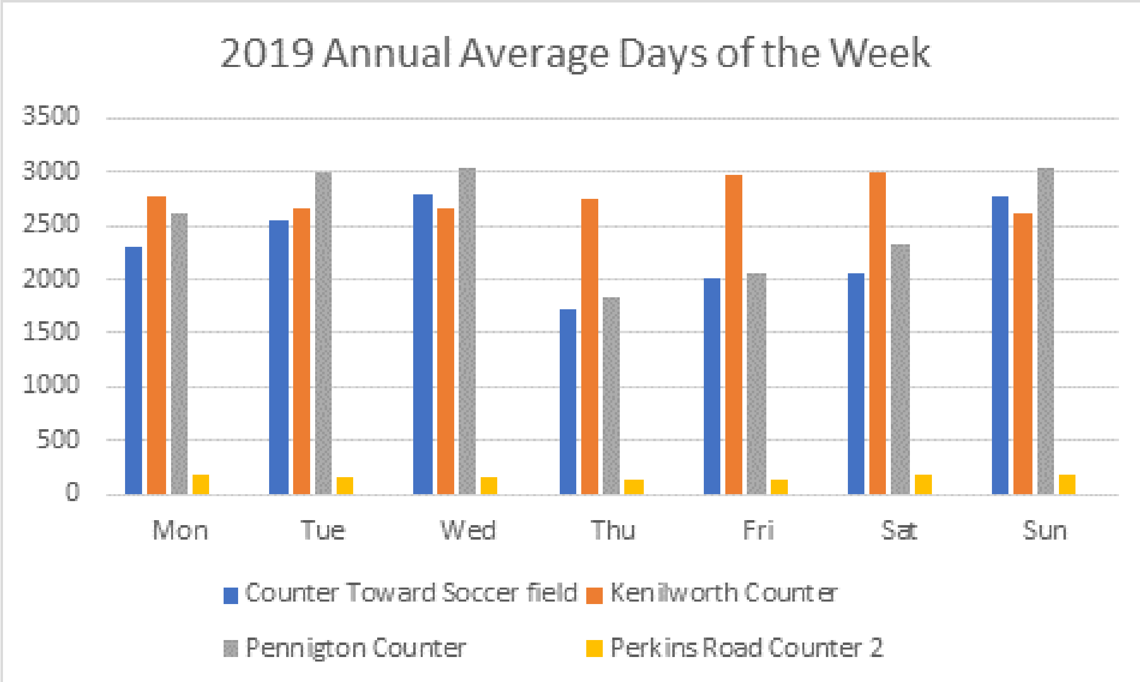


Table 34. LTRC 19-1SA study summary results - average daily bicycles and pedestrians (manual review)

Location	City	Data Collection Period	Average Daily Bicycles	Average Daily Pedestrians
Decatur St. & St. Peter St	New Orleans	March, 2019	368	21,371
Esplanade Ave & N Peters St	New Orleans	Feb/March, 2019	302	1,809
Howard Ave & Baronne St.	New Orleans	Feb-April, 2019	279	829
Louisiana State University – LSU	Baton Rouge	June/July, 2019	36	414
Baton Rouge Community College	Baton Rouge	May/June, 2019	32	46
City Plaza	Baton Rouge	July/August, 2019	65	527

D. Permitting, Installation, and Maintenance

Permitting and Installation Checklist

Stakeholder Outreach

- Identify facility jurisdiction and ownership, agency points of contact, data end users
    - Locally owned roadways or trails:
        - Municipal/Parish government (e.g., Public Works department)
        - Parks and Recreation department/agencies
        - Nonprofit “friends” groups, neighborhood associations, HOAs, etc.
        - Louisiana Recreational Trails Program (if applicable, especially new trails under development)
        - Downtown district authorities, institutional partners, etc.
    - State-owned roadways
        - DOTD (Recommended initial contacts)
            - Traffic Engineering Management—Chris Fakouri (Pedestrian, Bicycle, and Transit Design Expert)
            - Transportation Safety (Office of Planning) —Jessica DeVille
            - Data Collection and Management—Jason Chapman (Administrator)
    - Levee trails
        - US Army Corps of Engineers
            - New Orleans District: https://www.mvn.usace.army.mil/Missions/Regulatory/USACE-Permits_Permissions/; MVNLeveePermits@usace.army.mil
        - Coastal Protection and Restoration Authority
        - Local Flood Protection Authority
            - https://albl.org/wp-content/uploads/2018/02/Levee-District-Map.pdf
- Secure written permission for installation
    - Determine authorization type required (email confirmation, MOU, permit, etc.)
    - Provide site plans/documentation for stakeholder agencies
    - Follow agency guidance for formal permitting processes, including traffic management plan

Site Planning and Preparation

- Conduct virtual/field visit(s) to define preliminary suitable installation location (multiple alternatives should be considered in most cases)
- Collect measurements for sensor configuration: facility width(s), distance to potential sources of interference, etc.
- Develop site diagrams for use in equipment configuration planning, permitting, contractor scope of work
- Call for utilities marking
- Conduct final site visit with contractor (if applicable) and mark installation points/cuts
- For levee trails, the following additional considerations should be noted:
    - Define plan of abandonment after equipment useful life
    - Acquire Levee Pages from local flood authority to identify precise location and jurisdiction
    - Specify backfill protocol, if not all backfill is existing material: *All excavations are backfilled with clay that meets the following criteria. Fill must have an organic content of no greater than 9%, as determined by ASTM D2974, Method C. The plasticity index of the new fill must be 10 or more by Atterberg Limits by ASTM D4318, and the material is classified as either a CH or CL by ASTM D2487, with less than 35% sand retained on the No. 200 sieve by ASTM D1140. Levee fill material is to be added in 6-inch lifts and compacted according to ASTM D698 (90% of maximum dry density).* (not relevant if all backfill is existing material)
    - Installations with expected life greater than 1 year may require additional scrutiny
    - Construction will not be authorized during high water periods
    - Confirm sealant type used for inductive loop installation is compatible with USACE standards
    - For on-crown installation, specialized equipment configurations that avoid excavation may be required (e.g. above-ground manhole, alternative mount for infrared sensor) - Maximum excavation of 18” below grade, if topsoil depth permits

Installation and Calibration

- Review manufacturer equipment specifications and installation guide
- Prepare all installation supplies and equipment
- Plan installation for off-peak period (early mornings at most locations)
- Bring bicycle to installation site (if applicable)
- Install equipment in accordance with manufacturer guidance, approved traffic plan, etc. (estimate 2-4 hours per unit, depending on complexity)
- Important: initialize sensor and conduct initial calibration test (at least 10 passes per mode) PRIOR to final seal/backfill of sensor/site
- If needed, adjust sensor settings, install foil cage around infrared sensor (to reduce interference), and/or make adjustments to physical alignment of loops or sensors to improve efficacy
- Finish installation, including sealing of inductive loops, replacement of turf, clean up, etc.
- Complete final initial calibration tests to ensure accurate sensor detection and classification

Table 35. Permanent count installation authorizations summary

Count Location	Primary Authority	Additional Stakeholders	Approval Type	Duration from Initiation to Final Approval
Norman Francis Pkwy Trail	City of New Orleans	Parks and Parkways	Email confirmation	< 1 month
Esplanade Avenue	City of New Orleans	Parks and Parkways	Email confirmation	< 1 month
Wisner Trail	City of New Orleans	Parks and Parkways	Email confirmation	< 1 month
Lafitte Greenway	New Orleans Recreation Department (NORD)	City of New Orleans, Friends of Lafitte Greenway	Email Confirmation	3 months
Algiers MRT	SLFPA-W	City of New Orleans	n/a - cancelled	-

Count Location	Primary Authority	Additional Stakeholders	Approval Type	Duration from Initiation to Final Approval
Dalrymple Trail	BREC	East Baton Rouge Parish	Signed MOU	6 months
River Road MRT	East Baton Rouge Parish	USACE New Orleans District, CPRA	Letter of No Objection, Letter Permit	16 months
Rock Island Greenway Ph. 1	City of Ruston		n/a - installed by local agency	6 months
Capital Heights	East Baton Rouge Parish		Email confirmation	9 months
Gardere Lane	East Baton Rouge Parish		Email confirmation	9 months
Nicholson Drive	East Baton Rouge Parish	DOTD (District 61)	Email confirmation	9 months
Tammany Trace	St. Tammany Parish		Email confirmation	2 months
Mandeville Lakefront Path PYRO	St. Tammany Parish		Email confirmation	2 months
Government St	DOTD (District 61)	East Baton Rouge Parish	Email confirmation; traffic plan	1 month

Installation Planning - Site Diagrams

Figure 10. Site installation diagram - Algiers MRT EcoMulti (proposed)

- Just downriver of ferry terminal
- 29.95378, -90.05503
- Post and manhole installed in soil
- 2 Inductive loops installed in asphalt

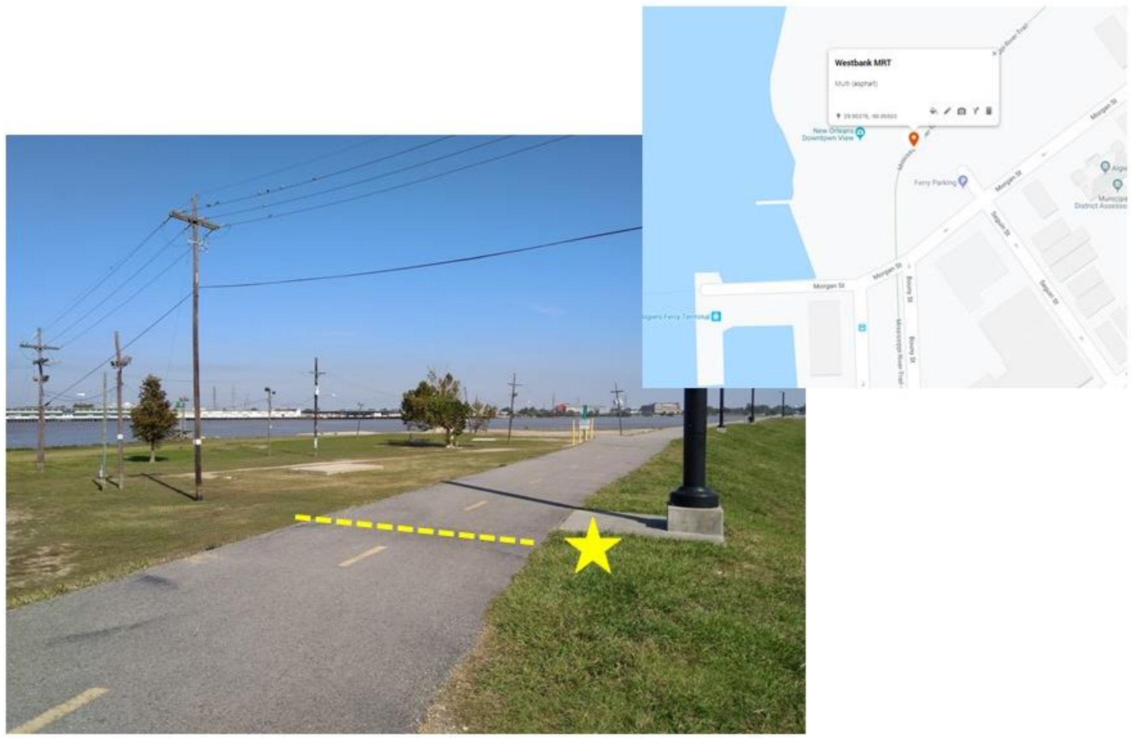


Figure 11. Site installation diagram - Lafitte Greenway

Figure 12. Site installation diagram - Norman Francis Parkway Trail

- Near Conti St
- 29.97252, -90.09202
- Post and manhole installed in soil
- 2 Inductive loops installed in concrete
- OLD equipment still in ground but presumed unusable; new installation to be nearby

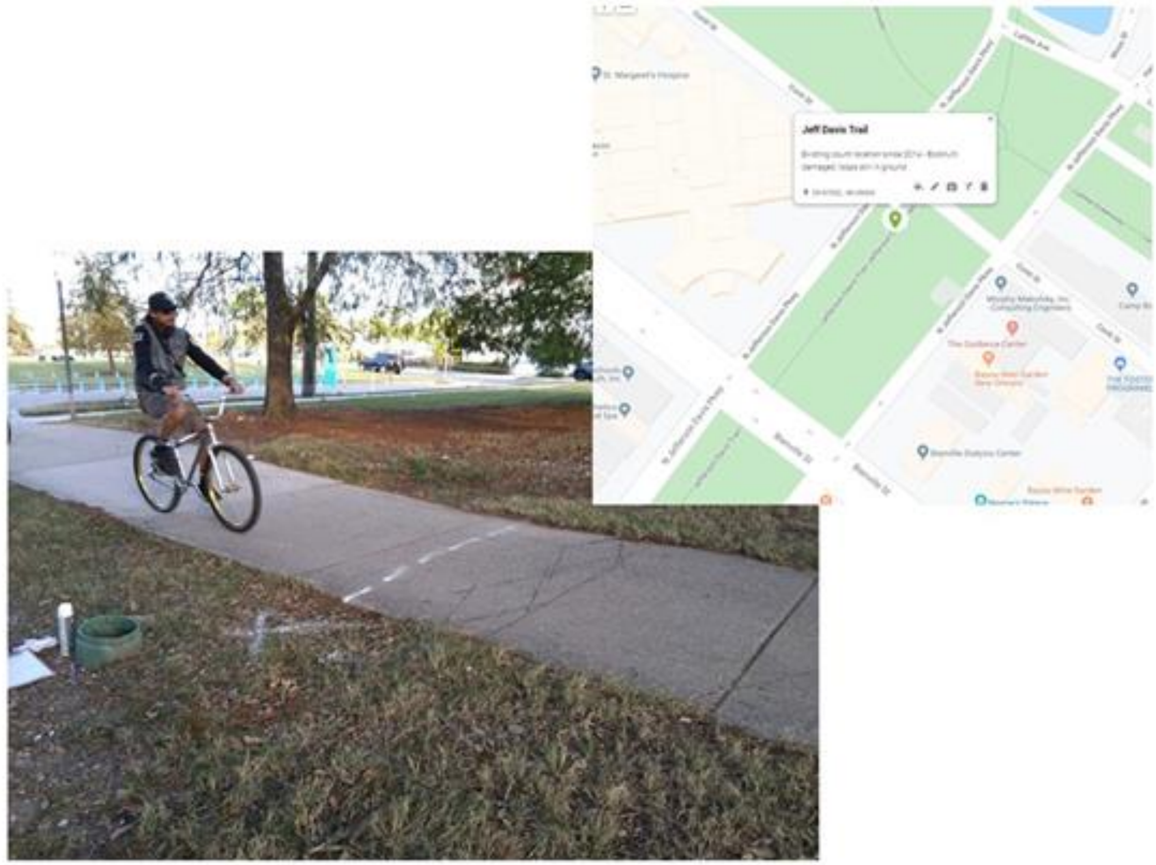


Figure 13. Site installation diagram - Wisner Trail

- Near Desaix
- 29.98998, -90.08751
- Post and manhole installed in soil
- 2 Inductive loops installed in concrete

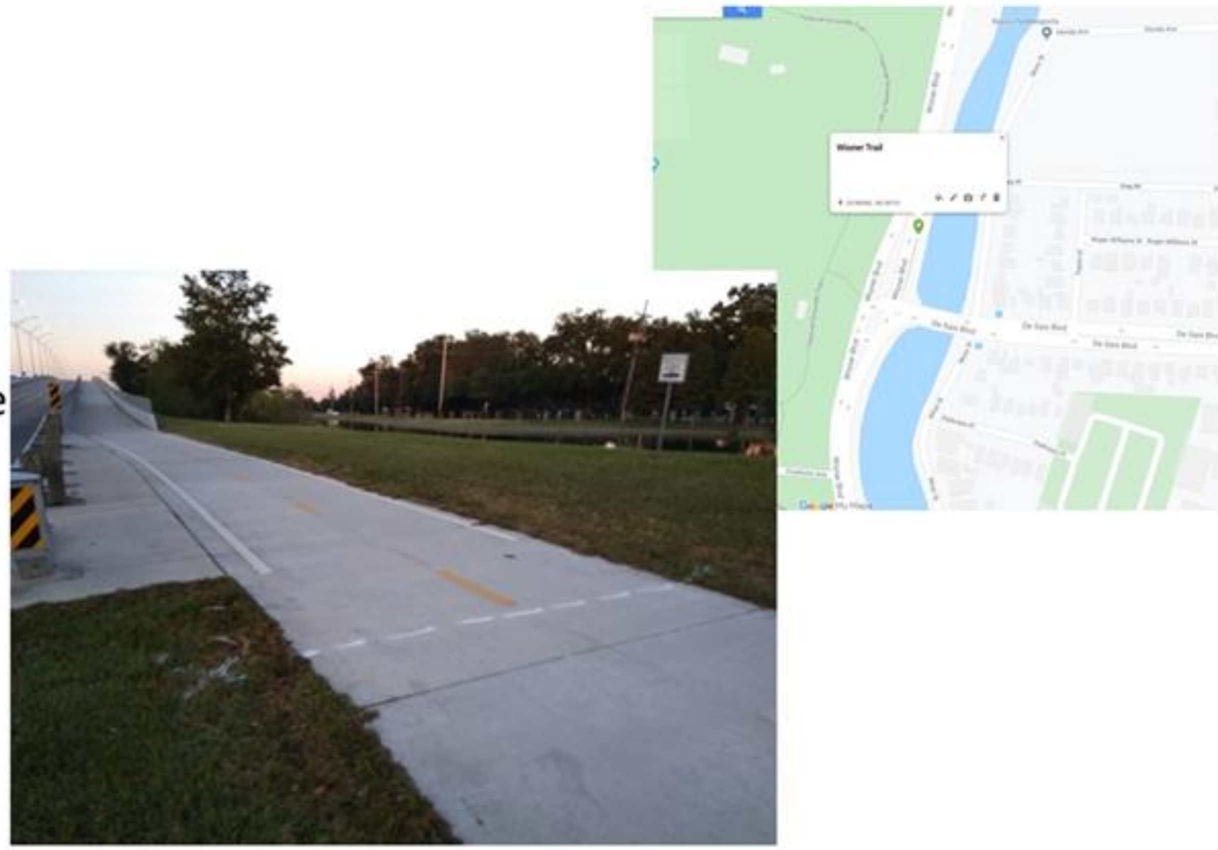
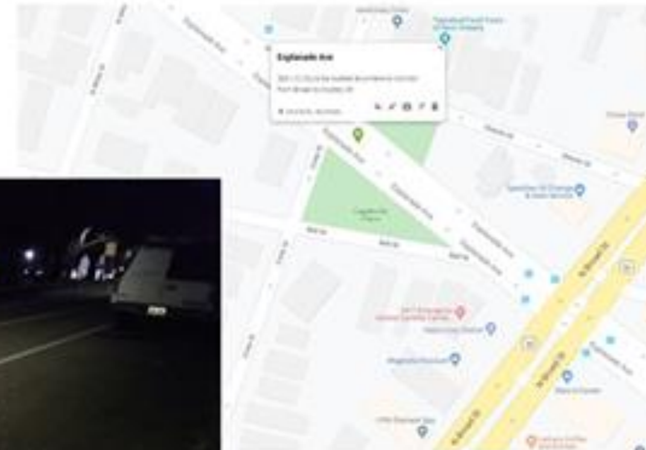


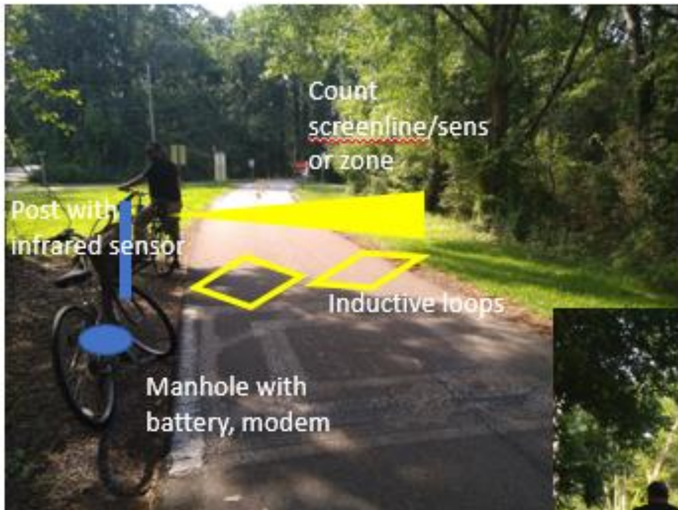
Figure 14. Site installation diagram - Esplanade Avenue

- Near Crete St
- 29.97678, -90.07934
- 2 Inductive loops installed in concrete PER SIDE
- Manhole installed in soil, each side (no post)



Sample only – precise location may shift according to DPW specifications

Figure 15. Site installation diagram - Tammany Trace (Options A and B)



Location:
Near Mandeville Trailhead

← Option A: near Coffee St (30.363313, -90.067860)

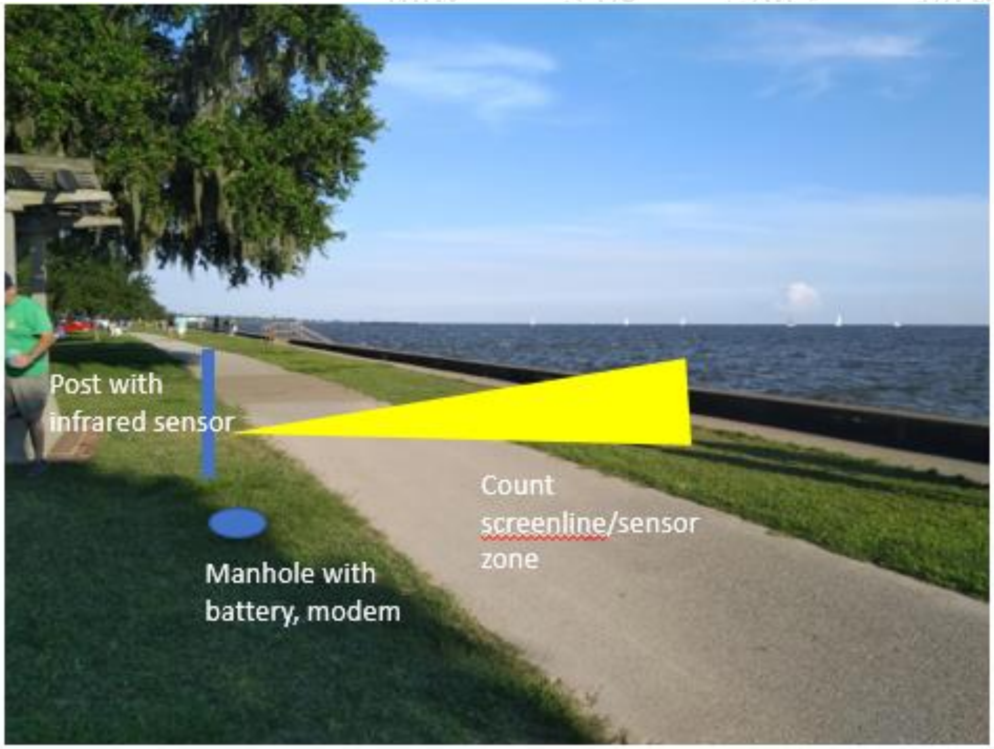
←Option B: Near Lamarque
(30.359221, -90.060241)

Description:

- Post and manhole installed in soil
- 2 Inductive loops installed in asphalt

ROW Ownership: St. Tammany Parish

Figure 16. Site installation diagram - Mandeville Lakefront Path



Location:
Lakefront walking path, near
Lafitte st
(30.353427, -90.070226)

Description:

- Post and manhole installed in soil (no loops)

ROW Ownership: St. Tammany Parish/City of Mandeville?

Figure 17. Site installation diagram - Dalrymple Drive Trail (Final)

Location:

Between March St and E Harrison (Just north of I-10)

30.427469 , -91.168442

Description:

- Post and manhole installed in soil
- 2 Inductive loops installed in concrete

ROW Ownership: BREC (MOU attached)

Figure 18. Dalrymple Drive - MOU Exhibit A

Figure 19. Dalrymple Drive - MOU Exhibit B

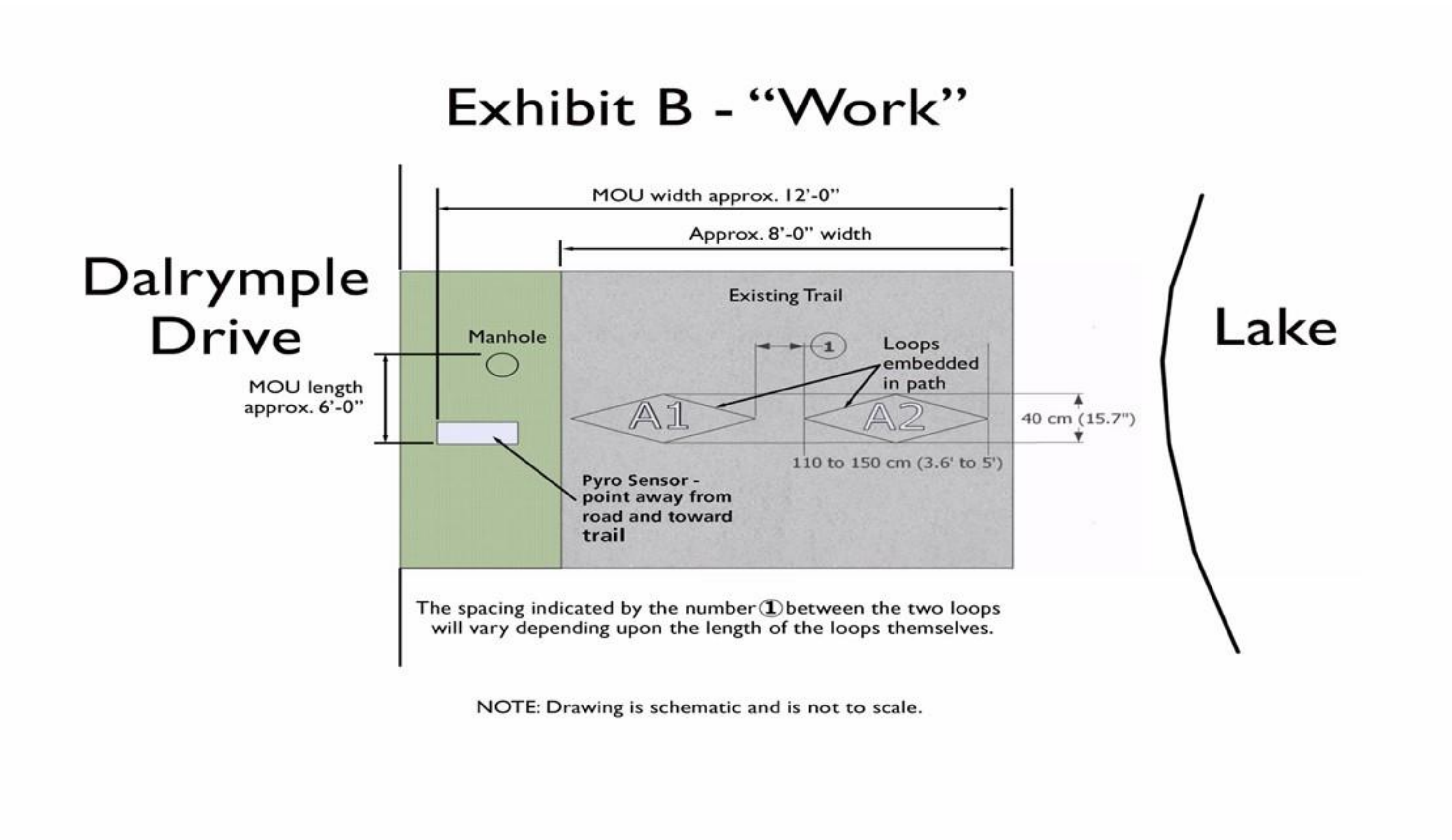


Figure 20. Site diagram - Capital Heights Avenue

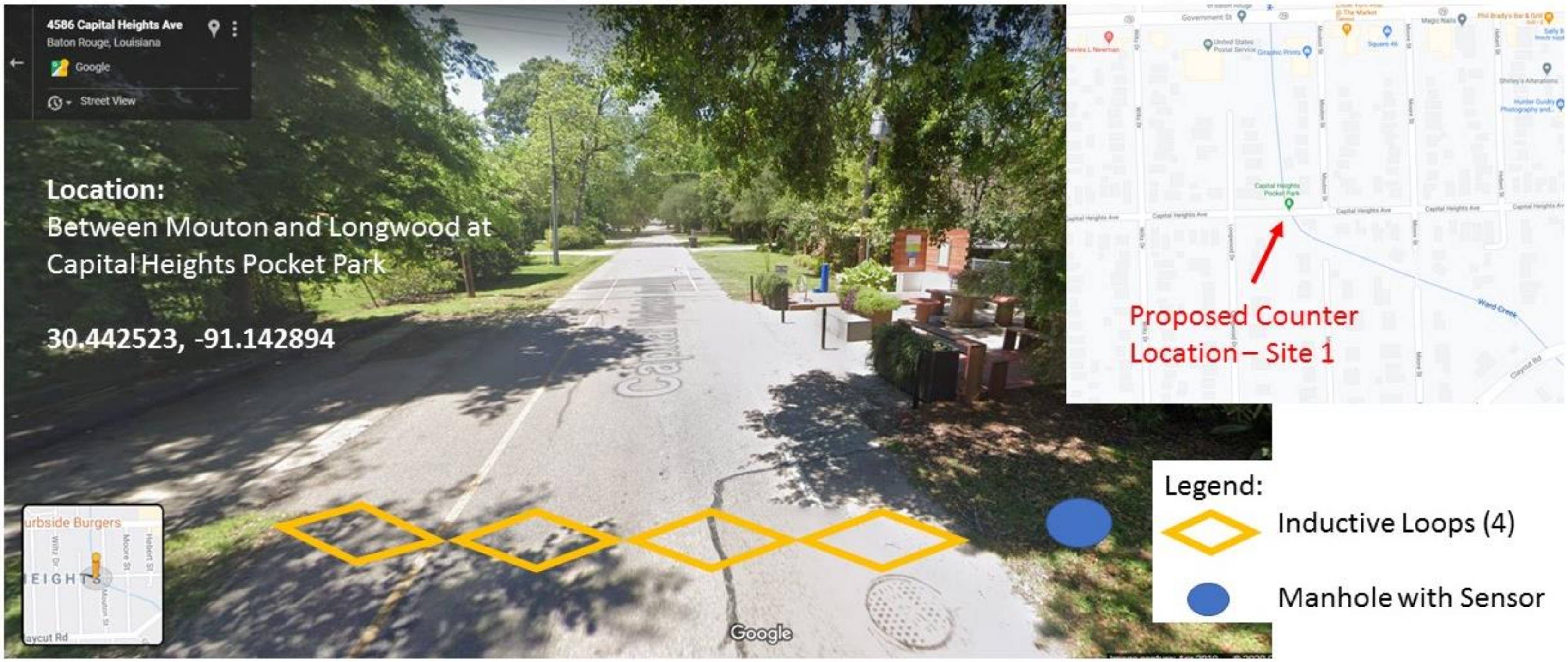


Figure 21. Site diagram - Capital Heights Avenue (Plan View)

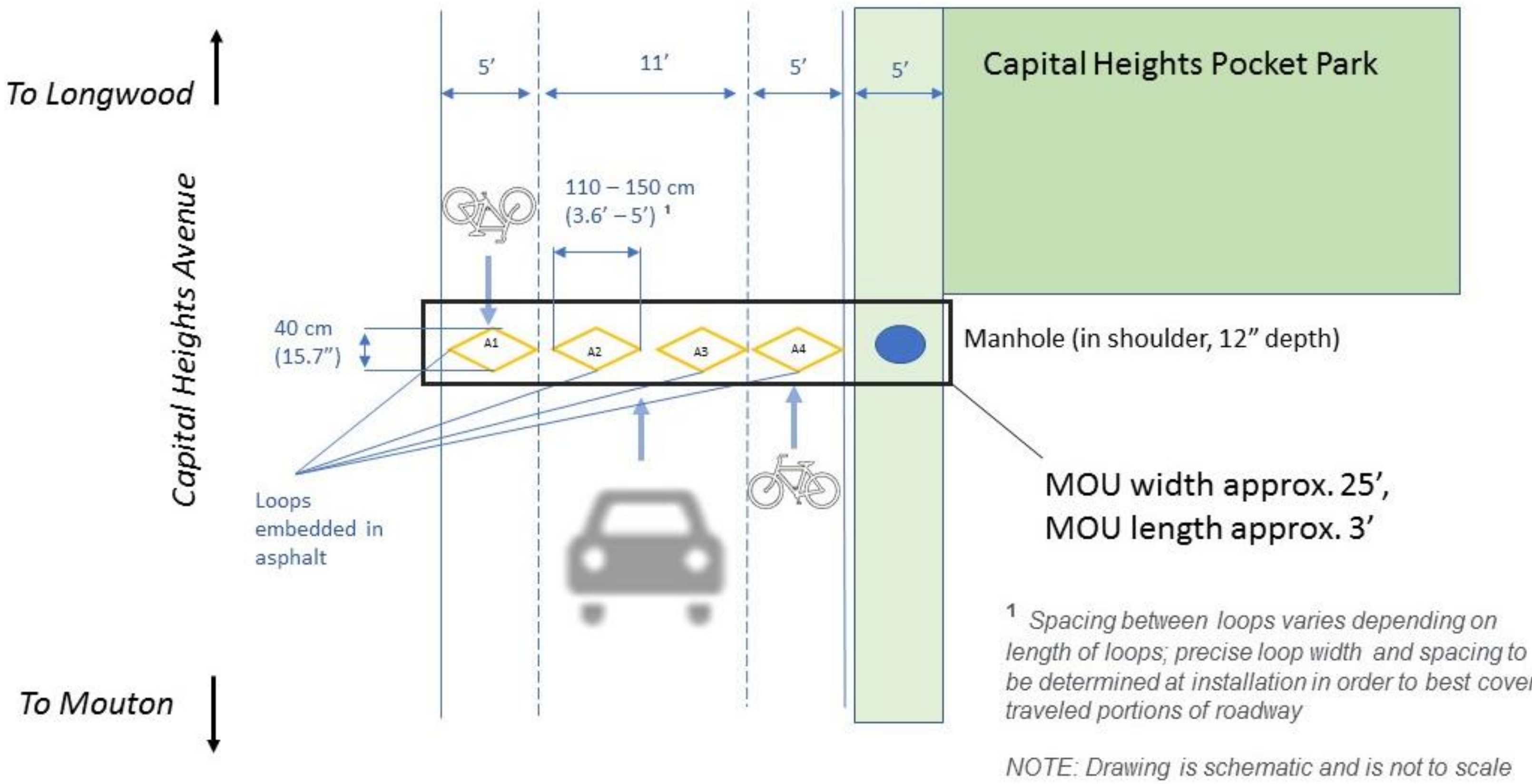


Figure 22. Site diagram - Gardere Lane

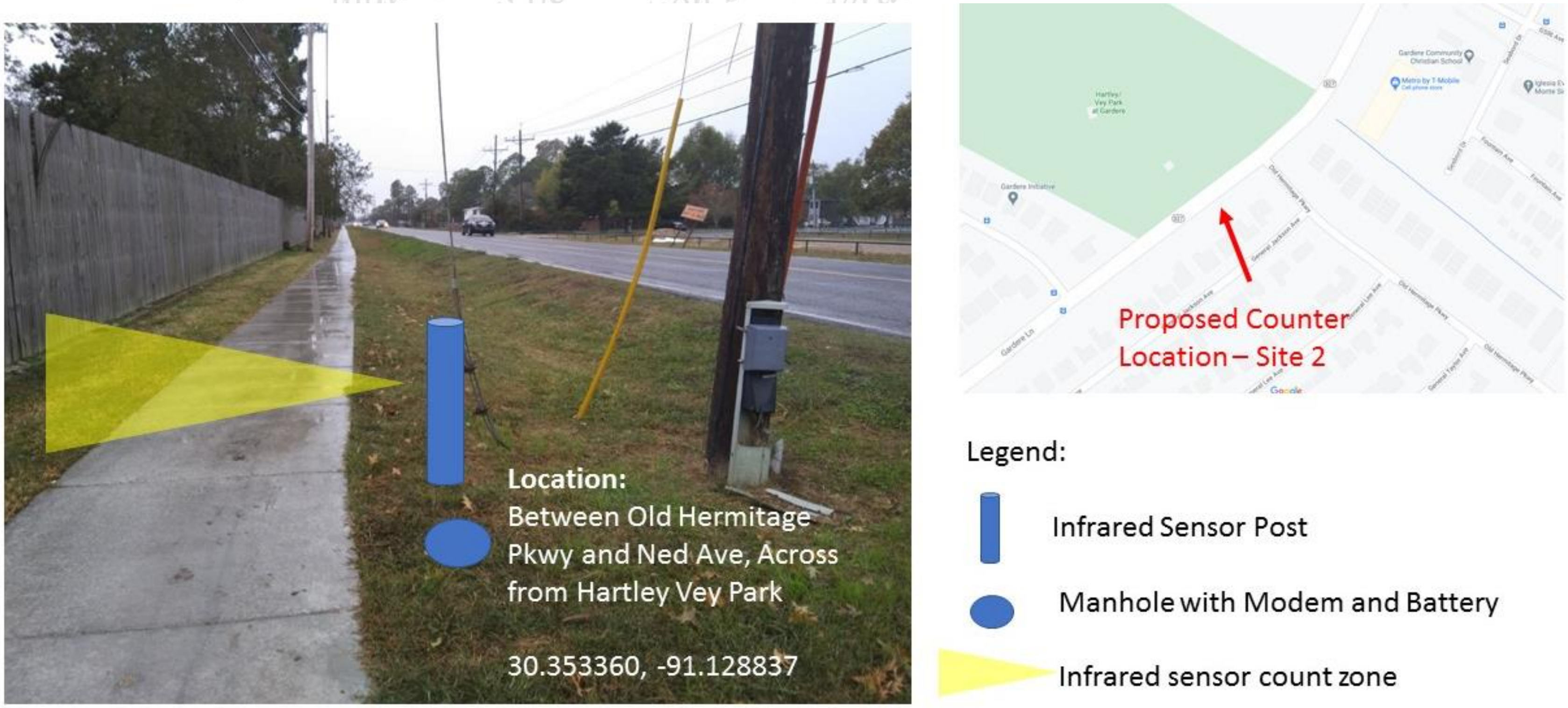


Figure 23. Site diagram - Gardere Lane (Plan View)

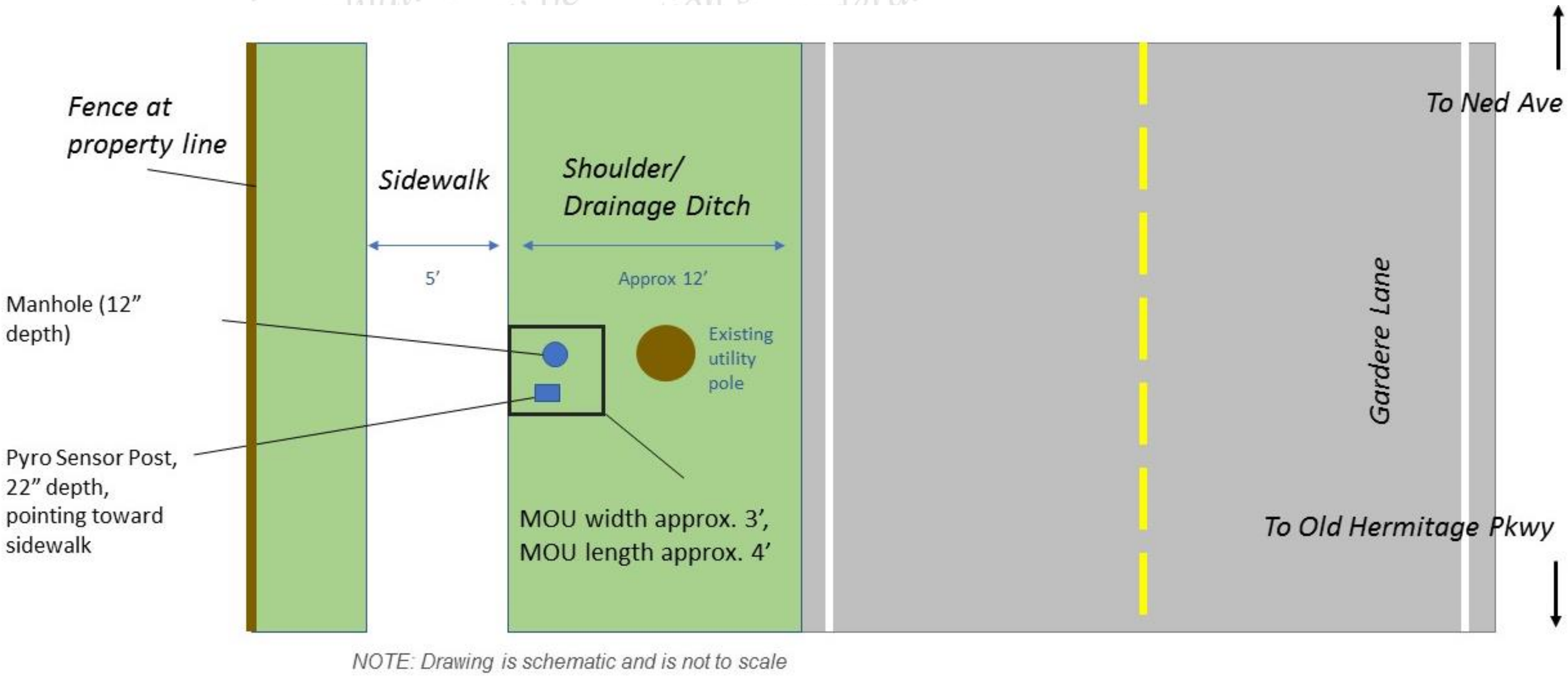


Figure 24. Site diagram - Nicholson Drive

Figure 25. Site diagram - Nicholson Drive (Plan View)

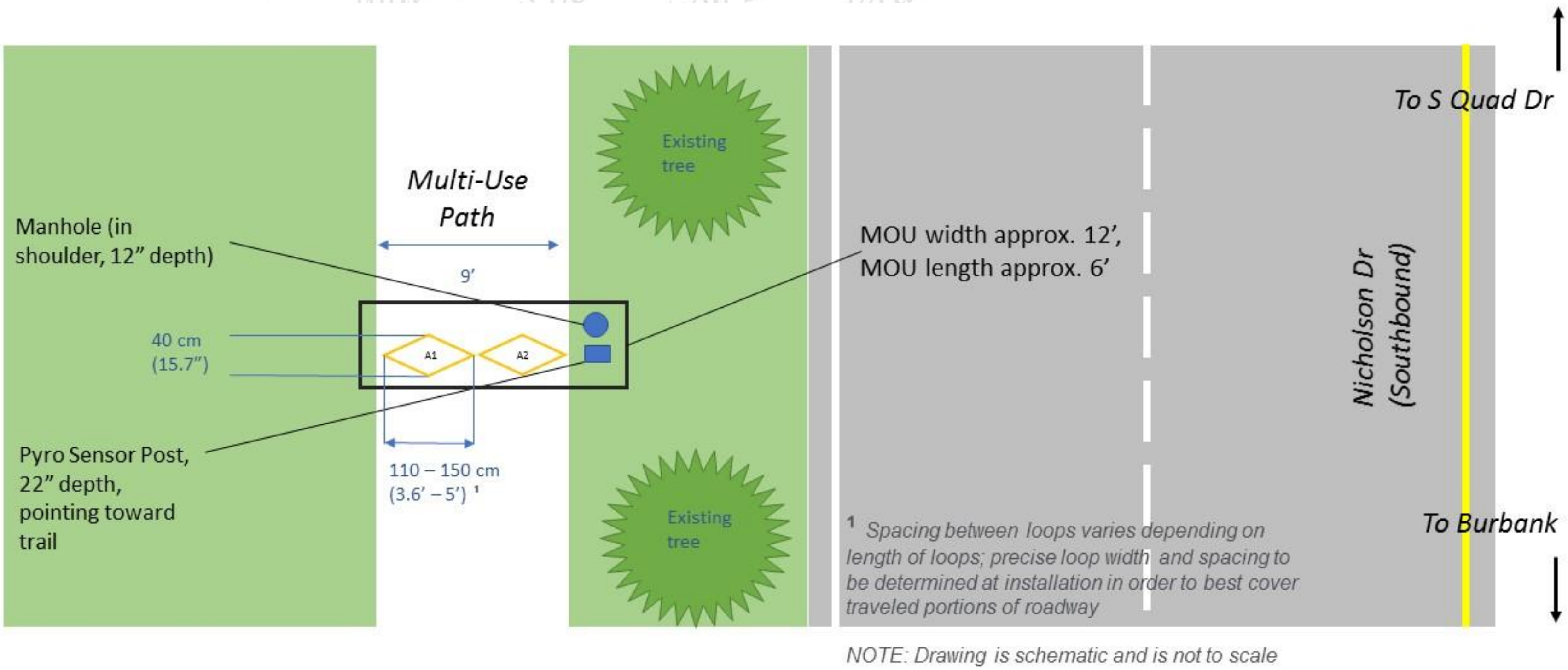


Figure 26. Baton Rouge MRT installation location - selected

Figure 27. Baton Rouge Levee Trail counter installation— final site plan perspective view

Figure 28. Baton Rouge Levee Trail counter installation— final site plan view

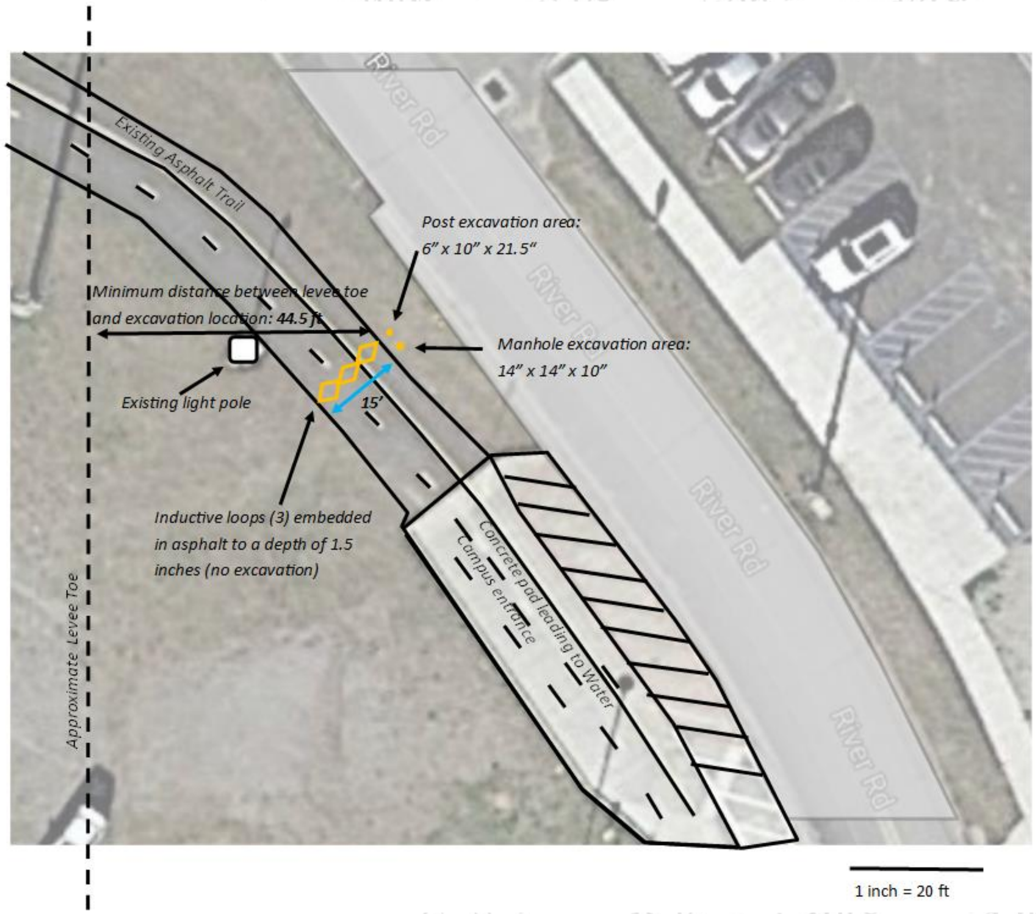


Figure 29. Baton Rouge Levee Trail counter installation cross section—location specific measurements

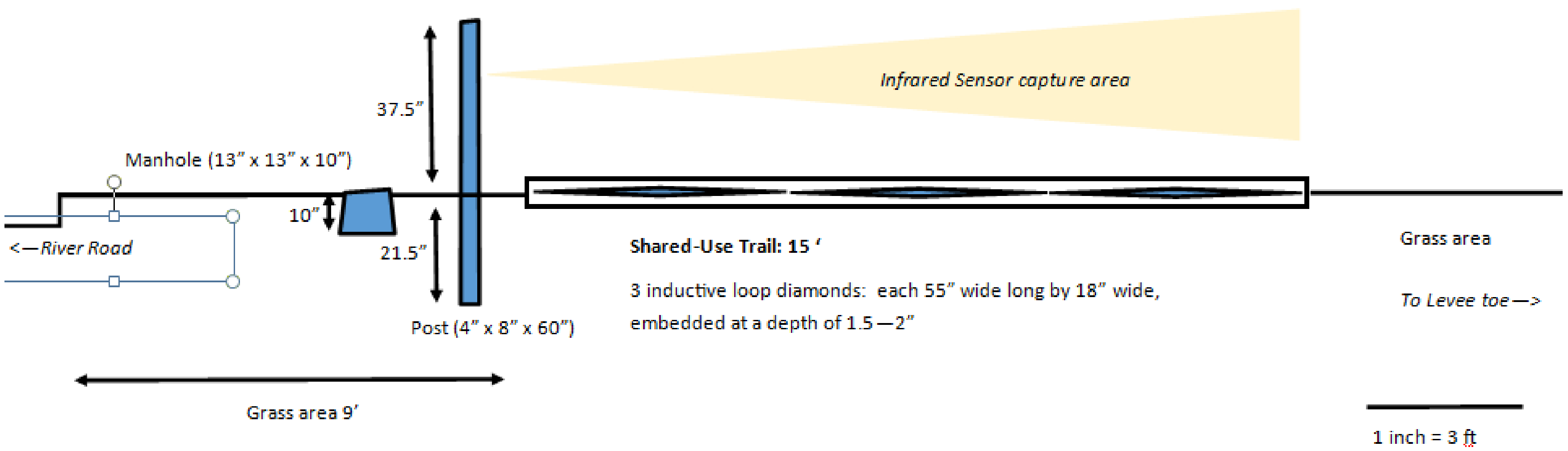


Figure 30. Government St. site diagram - Perspective View

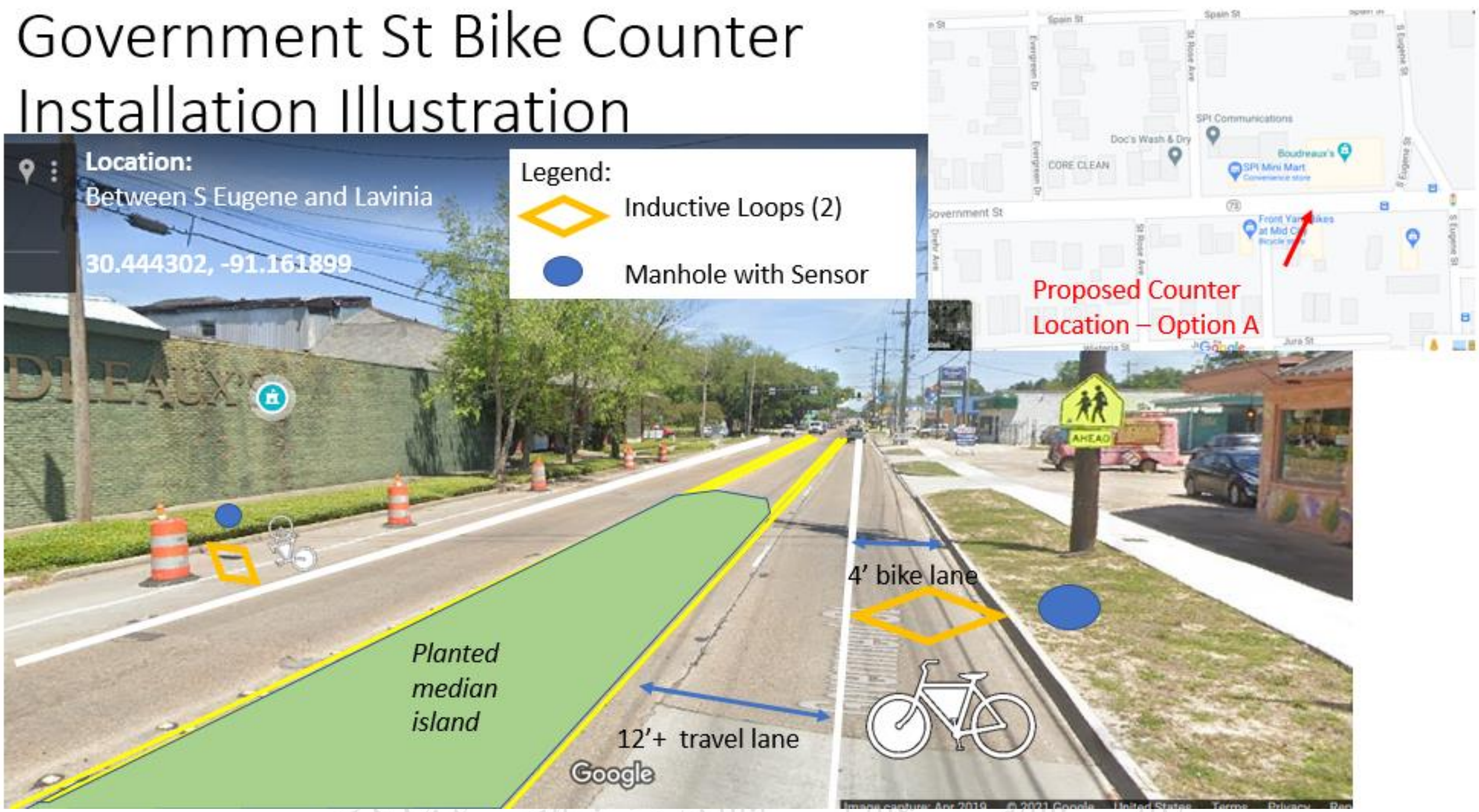
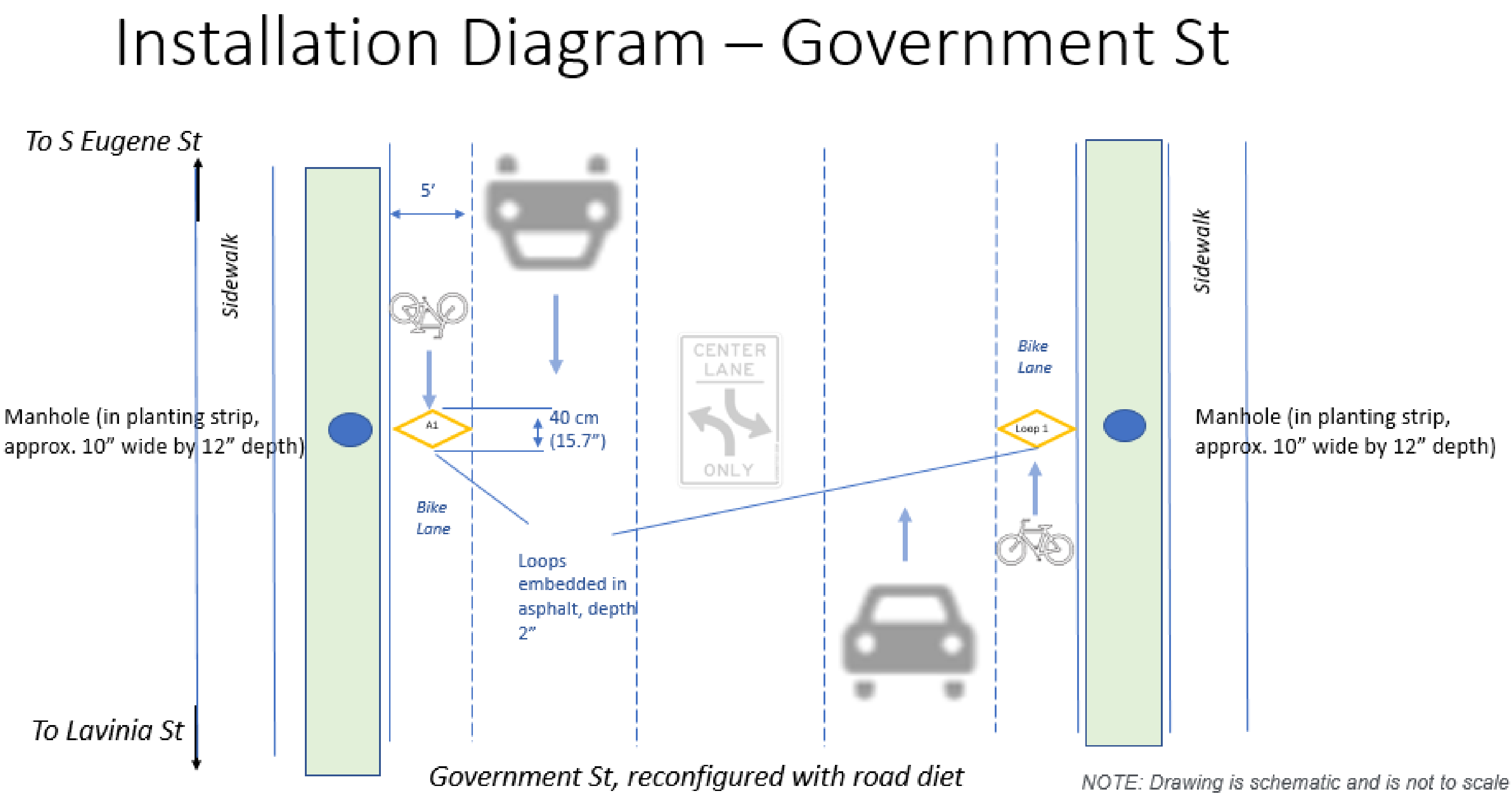


Figure 31. Government St. site diagram - Plan View



BREC Final Memorandum of Understanding (MOU)

EASEMENT AND RIGHT OF WAY AGREEMENT FOR INSTALLATION OF TRAIL MONITORING EQUIPMENT

FOR AND IN CONSIDERATION of the mutual covenants and agreements herein contained, the receipt and sufficiency of which are hereby acknowledged, This agreement is made and entered into this 14th day of August, 2020, by and between the **RECREATION AND PARK COMMISSION FOR THE PARISH OF EAST BATON ROUGE (BREC)**, whose mailing address is 6201 Florida Blvd., Baton Rouge, LA 70806 ("Grantor") hereby grants and conveys to, its successors and assigns, **The University of New Orleans (UNO)**, whose mailing address is 2000 Lakeshore Drive, New Orleans, LA 70148, ("Grantee") a non-exclusive right of way and easement ("Easement") in, under, upon, about, over, and through the property described on the attached Exhibit "A", hereto and incorporated herein by reference ("Property"). This agreement will be in force until UNO completes its contractual agreements with Louisiana Transportation Research Center (LTRC) to collect and monitor trail activity. At that time, BREC will take over ownership and maintenance of the counter unit, coils, and manhole, and will collect and monitor trail activity at this location as described below, from that point onward.

WHEREAS, Grantor owns certain real property located at 1515 Dalrymple Drive, Baton Rouge, LA 70808, and improvements situated thereon known as City Park, in East Baton Rouge Parish, State of Louisiana, as more particularly described on Exhibit A ("Property") attached hereto and by this reference made apart hereof.

WHEREAS, Grantee is desires, through its Contractor, Jack Harper Electrical (Baton Rouge, LA), to construct and install Trail Monitoring Equipment (consisting of embedded coils, a manhole containing the monitoring equipment, and vertical sensors) as shown on Exhibit B – the "Work" on Dalrymple Drive in City Park, Baton Rouge, Louisiana in the approximate location 30.427455, -91.168441.

WHEREAS, The Trail Monitoring Equipment Location is along the City Park recreational trail at City Park Lake. Its purpose is to provide data regarding the number of users and times and dates of use of the trail paralleling Dalrymple Drive in the City Park Lake area. BREC trail representatives will accompany the installation crew to inspect the location and installation of the proposed equipment to ensure public safety and continued stability of the trail amenity.

WHEREAS, UNO agrees to make, available upon BREC's request, data and access to the trail equipment from the commencement of this agreement until the expiration of UNO's contractual obligations with LTRC. During this time period, UNO will perform monthly physical inspections of the counters and monthly virtual checks on the data. Should BREC become aware of any damages to the equipment we will notify UNO so that they can respond and perform repairs. UNO will notify BREC within 60 days of contract expiration to allow time for transfer of responsibility. And that upon transfer of ownership and maintenance responsibility, UNO will provide BREC with all warranties, manuals, and software required to operate the equipment. BREC agrees that the equipment will remain in place at the permanent installation location for the remainder of its usable life (10 yrs. per mfr.) and provide DOTD with access to the data collected beyond the completion of contracted work with UNO. UNO will provide all guidance and materials necessary for maintenance and use of the equipment, as well as for the collection and management of the data in accordance with best practices developed as a result of the current research endeavor, for a period of 1 year beyond the expiration of UNO's contractual obligations with LTRC.

WHEREAS, Grantee desires to obtain certain easements and rights over the Property, and Grantor desires to grant such easements and rights, on the terms and conditions set forth herein.

AGREEMENT

NOW, THEREFORE, in consideration of the mutual obligations and covenants herein contained, and for other good and valuable consideration, the receipt and sufficiency of which are hereby mutually acknowledged, Grantor and Grantee (hereinafter "the Parties") hereby agree as follows:

1. **Grant of Easement**

1.1.1 Grant. Grantor does hereby grant and convey unto Grantee a temporary easement and right-of-way ("Easement") solely for the purpose of installing Recreational Trail Monitoring Equipment as shown on Exhibit B – the "Work" of Grantee, together with all fittings and all other equipment, devices, and appurtenances reasonably incidental to the construction, operation, and maintenance thereof, for the purpose of collecting data regarding use of recreational trails in the City Park Lake area.

1.1.2 Grantee shall have the right to ingress to and egress from the Easement over and across Easement Area or as agreed to by the Parties for the purpose of installing Recreational Trail Monitoring Equipment.

1.2 Width or Length of the Easement. The Easement shall be approximately twelve (12') in width by approximately by six (6') feet in length, as more particularly described in Exhibit B attached hereto and by this reference made a part hereof.

2. **Term of Easement.** The Easement shall commence on the effective date of this agreement and shall end at the expiration of UNO's contractual obligations with LTRC.

3. No Interference. Grantor shall not interfere with the Grantee's installation of trail counter equipment within the Easement.

4. Termination. This Easement shall be terminated at any time by an instrument executed for such purpose and signed by the parties.

5. Amendment. This Easement shall be amended only by a written and recorded instrument signed by the parties or the then current owner of the Property and the Easement.

6. No Dedication. Nothing contained in this Agreement will be deemed to constitute a gift, grant or dedication of any portion of the property to the general public or for any public purpose whatsoever, it being the intention of the Parties that this Agreement will be strictly limited for use of installing trail counter equipment. This Agreement is intended to benefit both parties and their respective successors, assigns and mortgagees and is not intended to constitute any person which is not a third-party beneficiary hereunder or to give any such person any rights hereunder.

7. No Partnership. Nothing contained in this Agreement and no action by the Grantor will be deemed or construed by the Grantors or by any third person to create the relationship of principal and agent, or a partnership, or a joint venture, or any other association between the Grantor and Grantee.

8. Miscellaneous. If any provision of this Agreement is, to any extent, declared by a court of competent jurisdiction to be invalid or unenforceable, the remainder of this Agreement (or the application of such provision to persons or circumstances other than those in respect of which the determination of invalidity or unenforceability was made) will not be affected thereby and each provision of this Agreement will be valid and enforceable to the fullest extent permitted by law. This Agreement will be construed in accordance with the laws of the State of Louisiana. BREC will be given access to the data obtained by UNO.

9. Hold Harmless. Grantee and its contractor agrees to indemnify and hold Grantor harmless against any and all claims and liability for damages to persons and property arising out of Grantee's use of the premises or conduct of business, or from any activity, work, or other thing done, permitted or suffered by the Grantee in or about the "Work". Where personal injury, death, or loss of, or damage to property, is the result of the concurrence of negligence, gross negligence, intentional and/or willful misconduct of Grantee and Grantor, Grantee's duty of indemnification shall be in proportion to its allocable share of fault. The parties hereto intend and agree that this indemnity shall be applied as a comparative fault indemnity, each party being responsible for its own negligence or other act or omission.

This Easement is declared to and does inure to the benefit of the public generally and shall be binding upon the successors in title to the lands herein described or any other part thereof, their mortgagees, lessees, heirs, administrators, executors, successors, and assigns.

The execution of this agreement grants no rights other than the above.

University of New Orleans
2000 Lakeshore Drive
New Orleans, LA 70148

8/4/20
Signature - Gloria J. Walker Date
Vice President of Business Affairs and CFO

Recreation and Park Commission for the Parish of East Baton Rouge
6201 Florida Blvd.
Baton Rouge, LA 70806
(225)273-6405

8/14/20
~~G.~~ Reed Richard Date
~~Assistant Superintendent, Planning~~ & Construction

Exhibit A - “Property”

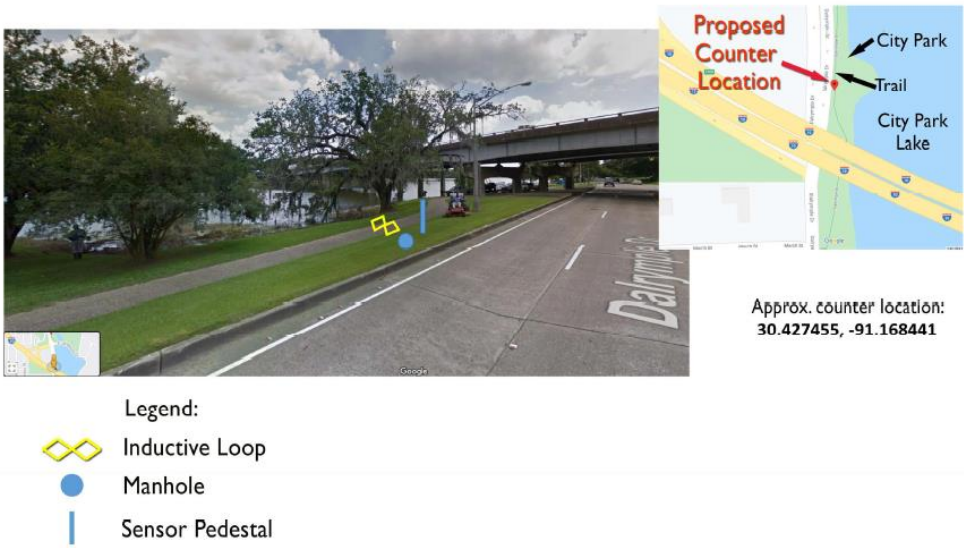
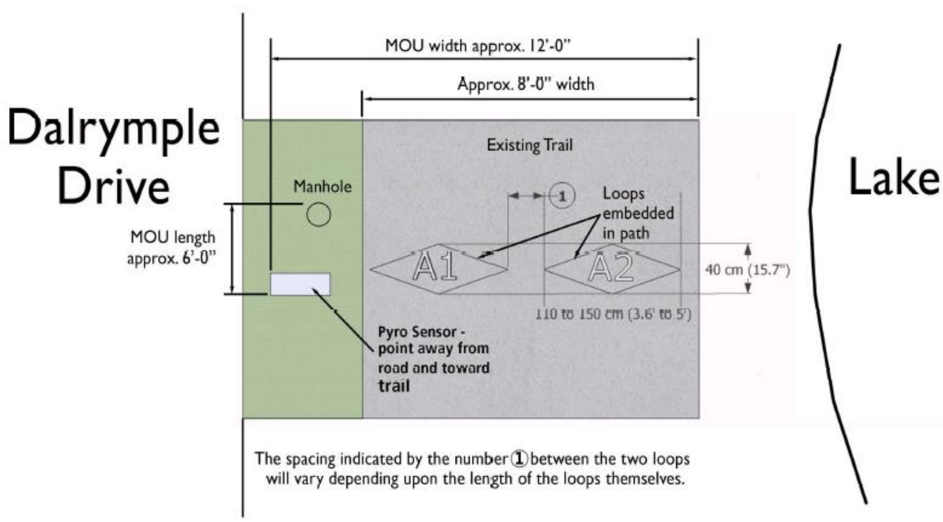


Exhibit B - “Work”



NOTE: Drawing is schematic and is not to scale.

Levee Facility Installation Permit Request

US Army Corps of Engineers - New Orleans District

Levee Permit Request: Pedestrian and Bicycle Count Device Installation

Attn: Mayra Flores, Civil Engineer, OD-W, USACOE; Alex Ramirez, Coastal Protection and Restoration Authority Operations Division

CC: Steven E. Johnson Jr., Certified Levee Inspector, Department of Transportation & Drainage, EBRP Dept. of Public Works

Submitted by: Tara Tolford, AICP, University of New Orleans Transportation Institute, 200 Milneburg Hall, 2000 Lakeshore Drive, New Orleans, LA, 70148 | 504.280.6516 | tmtolfor@uno.edu

Date: July 7, 2020

Description of Work

Installation of an Inductive loop and infrared pedestrian and bicycle counter in the surface of and adjacent to the Mississippi River Trail where it temporarily departs the levee crown near the Water Institute of the Gulf (Terrace Ave) at approximately 30.437270, -91.190428.

Figure 1: Sample EcoMulti Configuration

EXAMPLE OF A COMPLETED SYSTEM

System with PYRO Post and two ZELT Loops

The PYRO sensor faces the ZELT Loops

Purpose

The purpose of this work is to measure the volume of pedestrians and bicyclists utilizing the levee trail in service to Louisiana Transportation Research Center project 19-3SA Pedestrians and Bicyclists Count, Phase 2: Implementing and Applying Multimodal Demand Data. The purpose of this study is to implement key recommendations and address identified gaps in data availability from the LTRC 16-4SA project report, providing the Louisiana Department of Transportation and Development (DOTD) with a practical foundation for an efficient, cost-effective pedestrian and bicyclist count program.

Specifically, the objectives are to: (1) Install permanent counters at a set of pilot locations and collect one year of pedestrian and bicycle data representative of a variety of usage patterns and/or facility types; (2) develop roadway factor groups for Louisiana communities and preliminary expansion factors for adjusting short-duration multimodal counts; (3) identify, support, and inform opportunities for coordinated local and MPO-led data collection.

This proposed high-priority count location was developed in consultation with the Project Advisory Committee comprised of local, regional, and DOTD staff members in reflection of the levee trail's key role in the region's active transportation network and documented robust user volumes.

Plan

This work entails embedding an inductive loop in the surface of the trail at a depth of 1.5" - 2" using a thermal disk in accordance with manufacturer directions (see *Installation Guide - Multi for Pedestrians and Bicycles - Asphalt* attached). In addition, installation requires excavating a 12" x 12" hole in the soil adjacent to the trail facility (on the side furthest from the river) in which to install a Rainbird Manhole containing the sensor modem, battery, and logger device, as well as a narrow channel to connect the manhole to the inductive loops, and to the infrared sensor housing. Finally, a recycled plastic post is installed, with 21.5" of the post embedded in the soil. Note that, if necessary, it is possible to reduce the subsurface depth of the post by anchoring the post in concrete at least 12" in depth. Following installation, the inductive loop will be sealed with Chemque Q-Seal 290s as per DOTD guidelines, and disturbed soil and grass will be filled in around the manhole and post units. The work will be completed by Jack B Harper Electrical, in coordination with the project principal investigator.

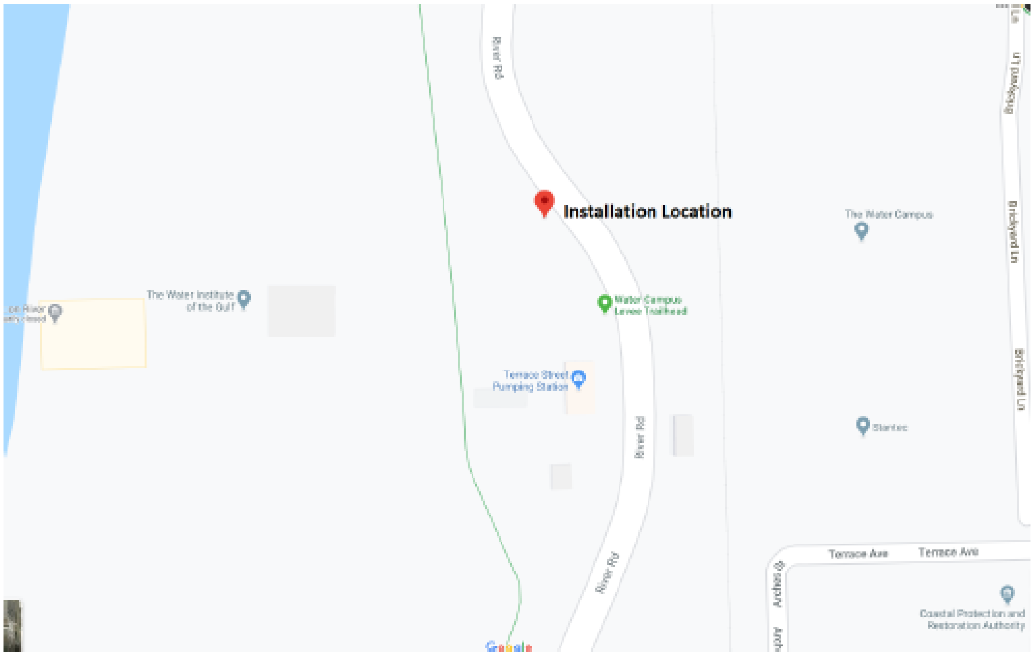
Vicinity Map:

The proposed installation site has been reviewed against the Metro Council of Baton Rouge's Levee Pages from the Plan and Profile of EBRP (Figure 2) for the area of river levee from STA. 0+22 to STA. 110+63 and we have determined that the proposed installation point proximate to the levee has no identified problems that might impact feasibility.

Figure 2: EBRP Levee Pages, STA 0+22 to STA 110+63 (Subject Area inset)

The proposed installation site (Figures 3 and 4) is outside the levee structure footprint, at grade, adjacent to River Road, just north of the Water Campus where the levee trail shifts from levee top to street level. The approximate coordinates of the installation location are: **30.437308, -91.190468**

Figure 3: Baton Rouge Levee Trail Counter Installation Vicinity Map - Map View



Plan View Drawing

Figure 5 indicates the existing and proposed facilities at the site at a scale of 1 inch equals 20 feet in order to effectively indicate the installation scope (which occupies, in total, an area of approximately 30 square feet). The estimated distance between the area of excavation (between the asphalt trail and River Road) and the levee toe is 44.5 feet. The levee stations are outside of the project area at this scale, as the proposed installation is distanced from the levee structure itself.

Cross Section Drawing

Figure 6 indicates the geometry of the proposed facilities at a scale of 1 inch = 3 feet in order to effectively indicate the installation scope (given small size of equipment elements), with measurements specific to this location and installation.

Figures 7 and 8 provide additional plan and cross-section details of the equipment per manufacturer installation guide specifications. Please note that at this location, a third inductive loop is planned to account for the 15' total trail facility width.

Figure 9 provides an overall diagram of the proposed installation configuration, at it would appear inn-situ.

Project Schedule and Abandonment Plan

Installation is to be scheduled within one month of receiving permit, pending contractor availability. Installation will take approximately 4 hours, during which time no more than 50% of the trail facility will be closed at a time.

The installation is intended to be semi-permanent with an anticipated 10 year minimum useful life. Following the termination of UNO's study with LTRC, we will transfer primary responsibility of the units to the Capital Region Planning Commission (staff members of whom serve on our advisory committee) to continue use for planning and evaluation purposes; the equipment itself is owned by LTRC/DOTD, and as such, would ultimately be removed by them at the end of its useful life if required.

Figure 2: EBRP Levee Pages, STA 0+22 to STA 110+63 (Subject Area inset)

Figure 4: Baton Rouge Levee Trail Counter Installation Vicinity Map - Satellite View

Figure 5: Baton Rouge Levee Trail Counter Installation—Plan View

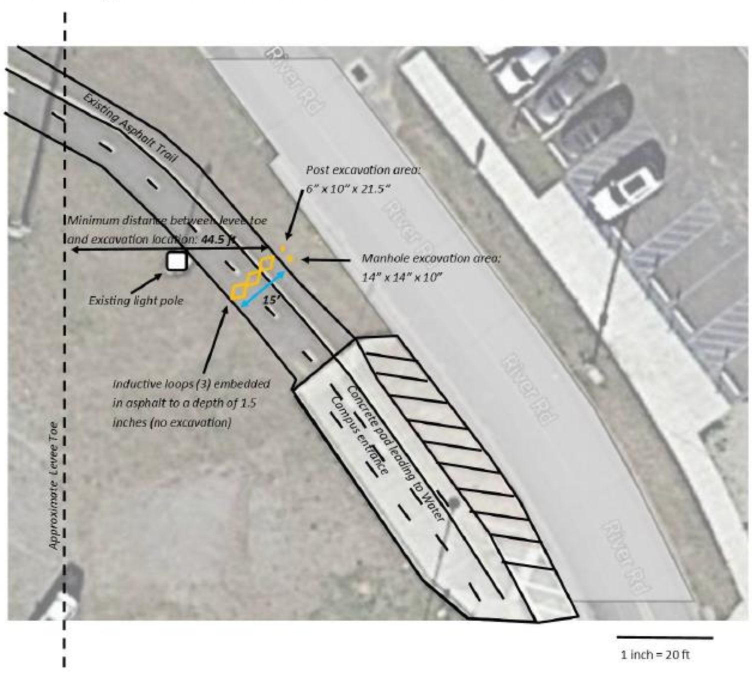


Figure 6: Cross Section— Location Specific Measurements

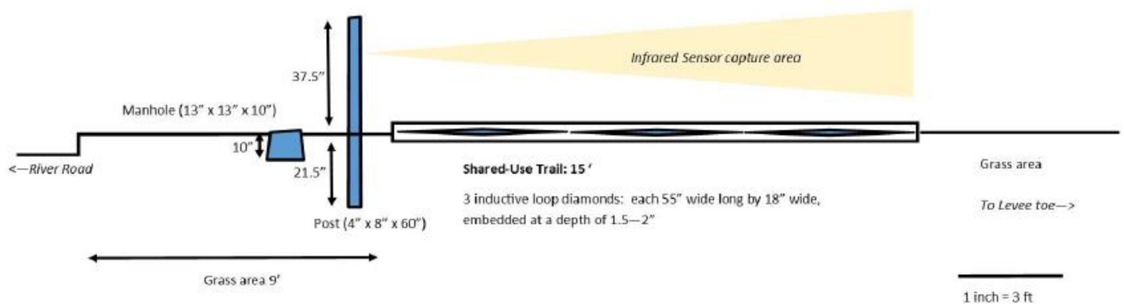


Figure 7: Manufacturer Installation Guide —Plan View Detail

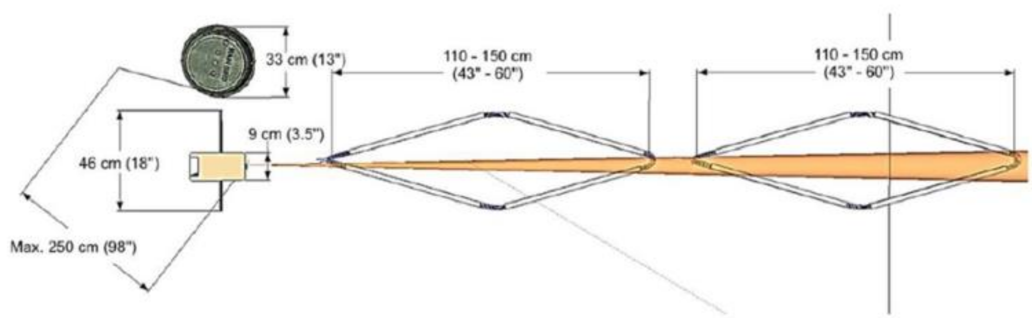


Figure 8: Manufacturer Installation Guide —Cross Section Detail

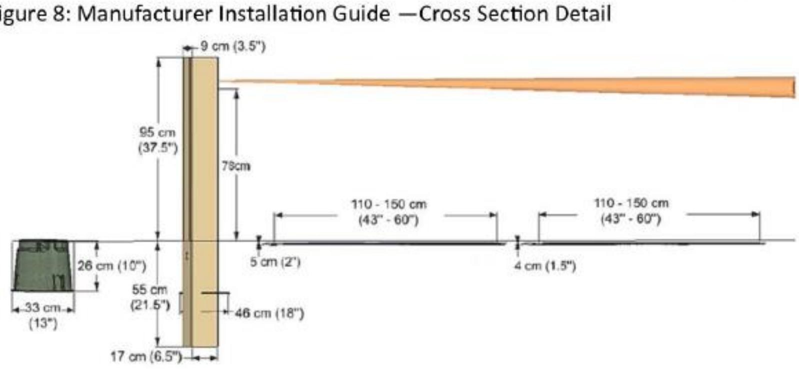


Figure 9: Baton Rouge Levee Trail Counter Installation—Perspective View Diagram

Baton Rouge MRT Levee Counter Permit

Department of Public Works
Engineering Division

City of Baton Rouge
Parish of East Baton Rouge
P.O. Box 1471
Baton Rouge, Louisiana 70821
(225) 389-3186

June 30, 2021

UNO Transportation Institute
200 Milnburg Hall
2000 Lakeshore Drive
New Orleans, LA 70148

Attn: Tara M. Tolford
Research Associate
Pedestrian & Bicycle Outreach Coordinator

Re: For Installation of an Inductive Loop
& Infrared Pedestrian/Bicycle Counter
Approx. (1) 30d 26' 14.310" N, 91d 11' 25.680" W
Near Second Order Levee Station 91+87
East Baton Rouge Parish

Levee Permit No. 20210630

Dear Ms. /Mrs. Tolford:

The Baton Rouge Department of Public Works is in receipt of:

1. An emailed LONO response from the New Orleans District, Corps of Engineers, dated March 29, 2021, and
2. A letter of no objection from the Coastal Protection and Restoration Authority, dated July 10, 2020

Both reference letters affirm your request to install a permanent bicycle and pedestrian counter on the Baton Rouge Mississippi River Trail for a one year study. This will involve installation of an inductive loop in the surface of the Trail at a depth of 1.5 to 2 inches, excavation of a 13-inch diameter by ten inch deep hole adjacent to the Trail for a Rainbird Manhole, excavation of a narrow channel to connect the inductive loops to the loggers in the hole, and embedment of a recycled plastic post 21.5-inches below grade to house the sensor. Please note that all of the stated work in your submitted request is within 1,500 feet of a landside portion of the Mississippi River levee, which the City of East Baton Rouge maintains. Hence, we stand to uphold all of the stipulations mentioned in both letters, regarding the performance of said work.

Therefore based upon the information provided, we have no objection to the performance of this work; if the work conforms to all terms and conditions stipulated in the above referenced letters. Further, be advised that any work that should require temporary roadway lane closures must be coordinated through our Traffic Engineering Division, at (225)389-3248.

Should you have any other questions regarding this response, please feel free to contact Steven Johnson at (225) 389-3186.

Sincerely,

Thomas A Stephens, P.E.
Chief Design Engineer
TAS

cc: Steven Johnson
Certified Levee Inspector

Equipment Inventory

Table 36. 19-3S count equipment inventory

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Norman Francis Pkwy Trail MULTI	Jeff Davis Parkway at Conti St	New Orleans	29.9725	-90.09212	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H19121781	51181	$5,455	Mar-20	Replaced March 2022
Esplanade Avenue ZELT - South	Esplanade Avenue at DeSoto St, South (Capdeville Place	New Orleans	29.976709	-90.079401	ZELT Selective Counter - No Direction - 2 loops; rainbird manhole for soil installation	X2H19121783	51177	$3,305	Mar-20	Replaced Feb 2022

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Esplanade Avenue ZELT - North	Esplanade Avenue at DeSoto St, North (Desoto Park)	New Orleans	29.976839	-90.07928	ZELT Selective Counter - No Direction - 2 loops; rainbird manhole for soil installation	X2H19121782	51176	$3,305	Mar-20	Replaced Feb 2022
Wisner Trail MULTI	Wisner Boulevard at Desaix	New Orleans	29.989501	-90.087658	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H19121786	51179	$5,455	Mar-20	Replaced Feb 2022
Dalrymple Trail MULTI	Dalrymple Drive at I-10	Baton Rouge	30.427469	-91.168441	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H19121784	51178	$5,455	Mar-21	Pedestrian Sensor removed due to breakage

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
River Road MRT MULTI	Baton Rouge MRT at Water Institute Campus	Baton Rouge	30.437308	-91.190468	MULTI Pedestrian/Cyclist counter - with direction - 3 loops, recycled post, rainbird manhole for soil installation	X2H19121785	51180	$5,705	Jul-21	Replaced March 2022
Rock Island Greenway MULTI	Rock Island Greenway	Ruston	32.54771	-92.648081	MULTI Pedestrian/Cyclist Counter - With Direcetion - 2 Loops (preformed loops for natural soils, recycled post, rainbird manhole or soil installation)	X2H20032347	51228	$5,595	Sep-20	Replacement battery sent to local partner
Capital Heights ZELT	Capital Heights Avenue at Mouton	Baton Rouge	30.442523	-91.142894	ZELT Selective Counter - No Direction - 4 independent loops; rainbird manhole for soil installation	X2H20052800	51461	$3,805	Mar-21	Battery replaced Nov 2021

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Gardere Lane PYRO	Gardere Lane at Old Hermitage Pkwy	Baton Rouge	30.35336	-91.128837	PYRO Counter - with direction - 4' range; recycled post; rainbird manhole for soil installation	X2H20052801	51460	$3,040	Mar-21	Removed – March 2022 (Vandalism)
Nicholson Drive MULTI	Nicholson Drive at Gourrier Ave	Baton Rouge	30.406903	-91.185658	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H20052802	51459	$5,455	Mar-21	
Tammany Trace MULTI	Tammany Trace at Coffee St	Mandeville	30.363174	-90.067705	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H20052803	51458	$5,455	Aug-20	Replaced April 2022

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Mandeville Lakefront Path PYRO	Lakeshore Drive at Lafitte St	Mandeville	30.353492	-90.070353	PYRO Counter - with direction - 15' range; recycled post; rainbird manhole for soil installation	X2H20052804	51457	$3,905	Aug-20	
Government St - South	Government St at S Eugene St	Baton Rouge	30.44401	-91.16086	ZELT Selective Counter - No Direction - 1 loop; rainbird manhole for soil installation	X2H21035591	52246	$2,588	Jul-21	
Government St - North	Government St at S Eugene St	Baton Rouge	30.44401	-91.16086	ZELT Selective Counter - No Direction - 1 loop; rainbird manhole for soil installation	X2H21035590	52245	$2,588	Jul-21	
NON-LTRC SUPPLEMENTAL LONG-TERM COUNT UNITS										

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Lafitte Greenway MULTI	Lafitte Greenway at N Galvez	New Orleans	30.438591	-91.19093	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H19111450	n/a	n/a	Mar-20	Replaced March 2021
Behrman Park MULTI	Behrman Park at Lawrence St	New Orleans	29.93831	-90.0304	MULTI Pedestrian/Cyclist counter - with direction - 2 loops, recycled post, rainbird manhole for soil installation	X2H19111449	n/a	n/a	Nov-20	
Baronne St EcoTUBES	Howard Avenue	New Orleans	29.94533	-90.07459	TUBES Bicycle Counter	Y2H17041919	n/a	n/a	Mobile unit, semi-permanently installed	Replaced 2020
Algiers MRT EcoPYRO (PfB Blue)	Algiers Ferry Terminal	New Orleans	29.95486	-90.05368	PYRObox People Counter, 15' range	YSH1910116	n/a	n/a		Mobile unit, semi-permanently installed

Reference Name	Location (description)	City	Latitude	Longitude	Equipment Description	Serial #	UNO Tag #	Total Purchase Cost (inclusive)	Installation Date	Battery Replacement Date/Notes
Rock Island Greenway Phase 2 - PYRO	RIG at California Avenue	Ruston	32.52194	-92.64415	PYRO Counter - with direction - 15' range; recycled post; rainbird manhole for soil installation	X2H20104336	052055	n/a	Apr-21	

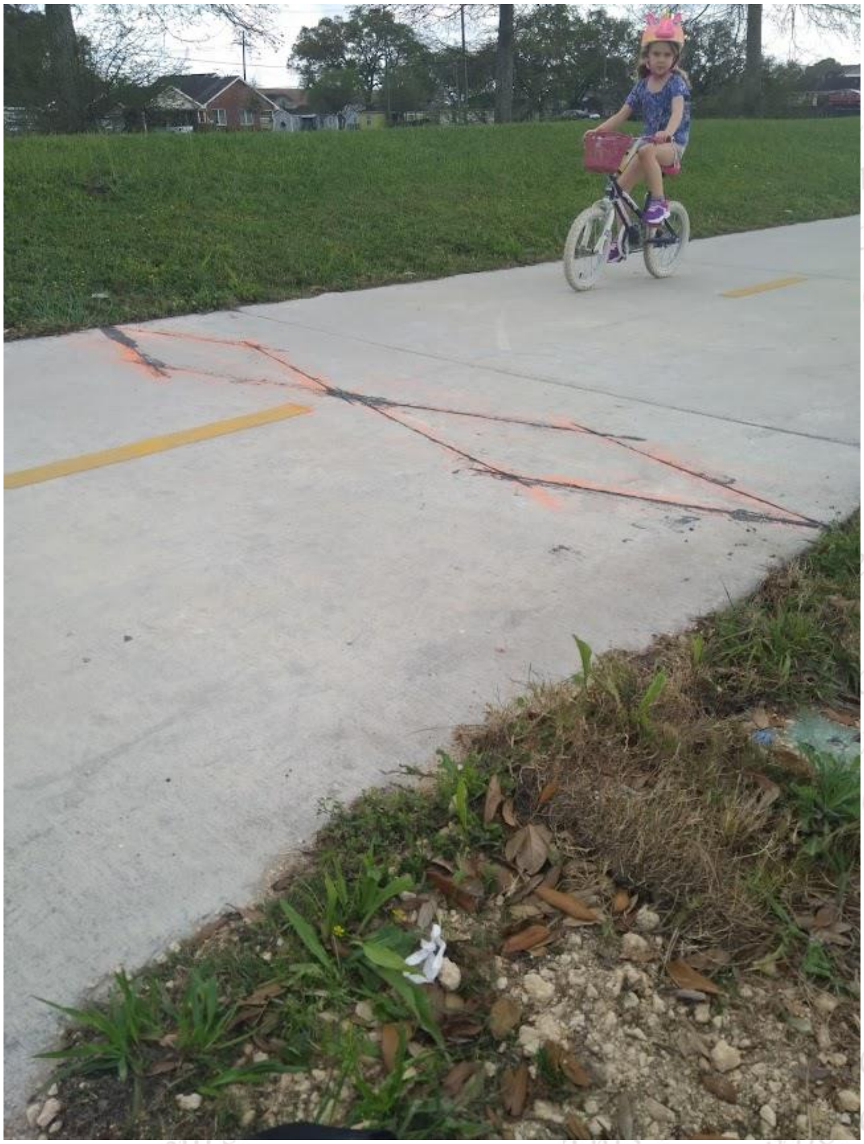
Site Photos - New Orleans

Norman Francis Parkway Trail


STOP

Lafitte Greenway

Wisner Trail



Esplanade Avenue

Baronne Street

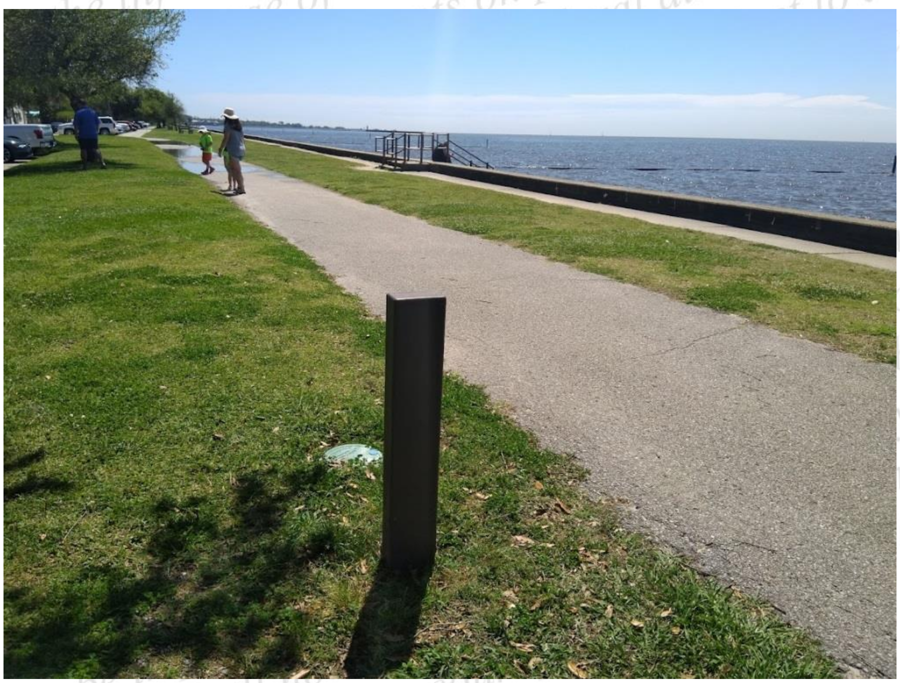
Behrman Park

Site Photos - Mandeville

Tammany Trace

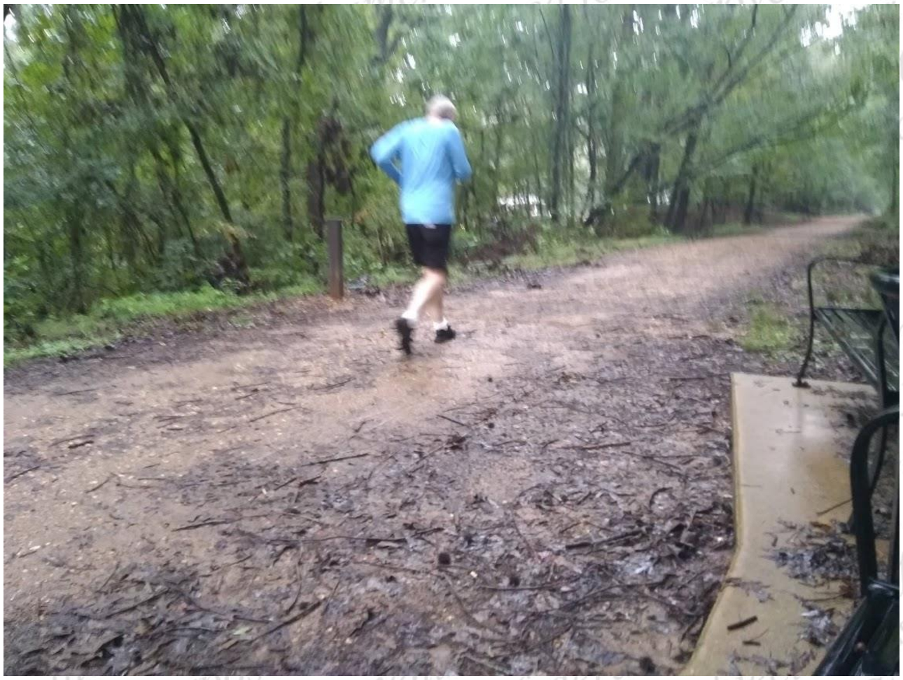

STOP

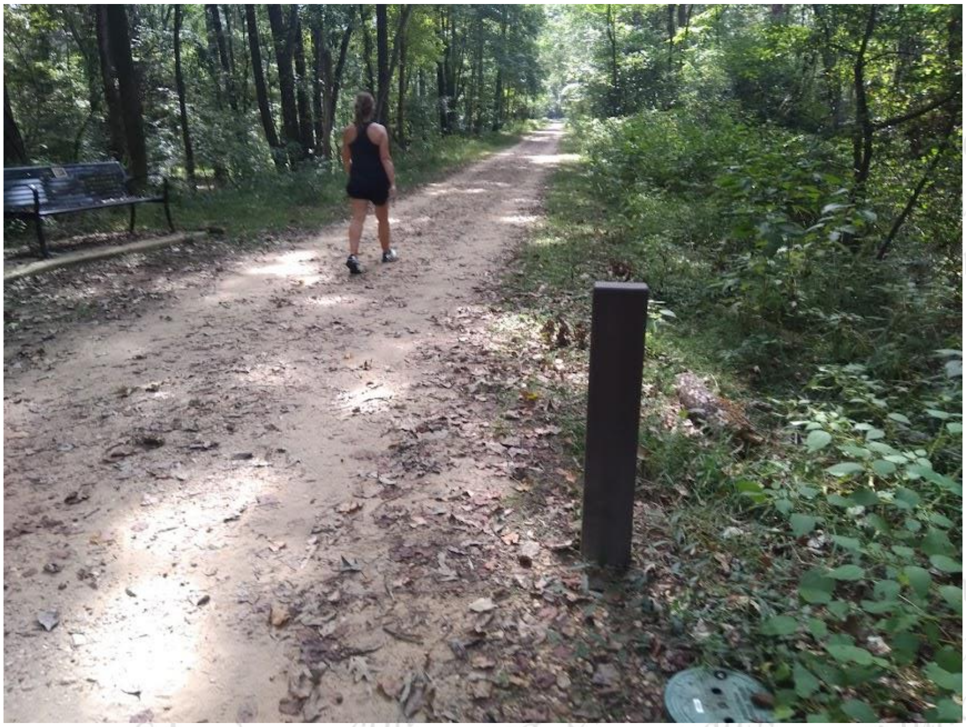
Mandeville Lakefront



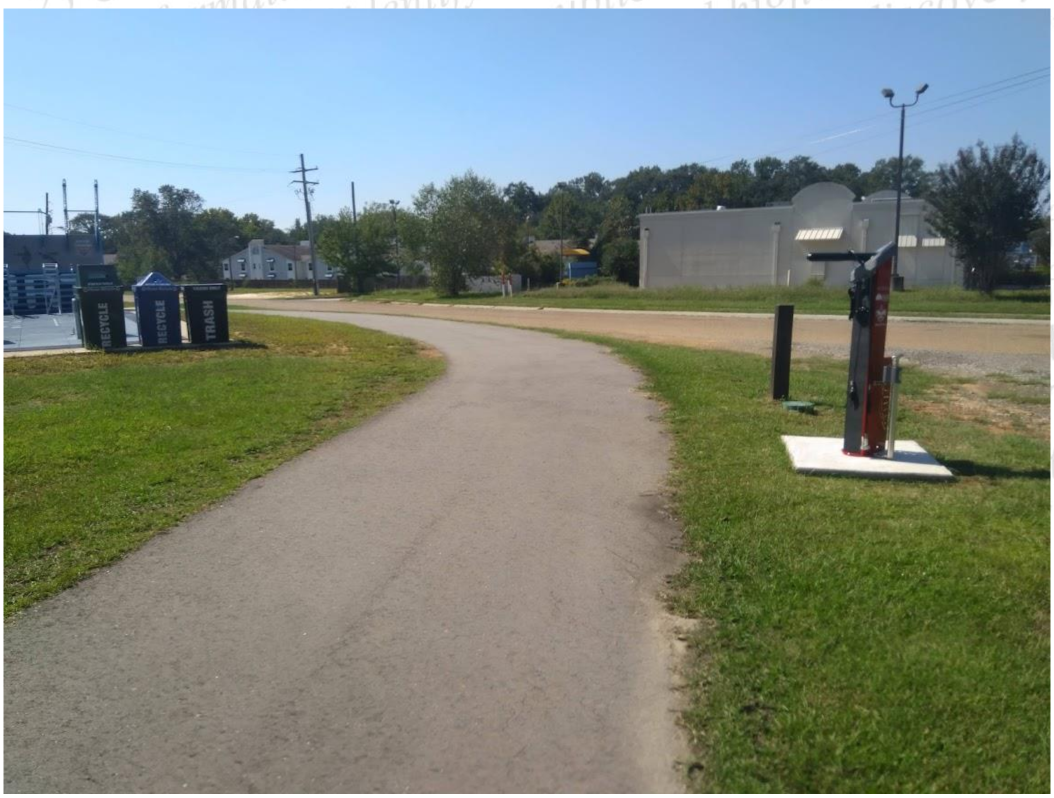
Site Photos - Ruston

Rock Island Greenway - Phase 1





Rock Island Greenway - Phase 2


RECYCLE
RECYCLE
TRASH

Site Photos - Baton Rouge

Capital Heights

Dalrymple Drive Trail

Gardere Lane Sidewalk

Nicholson Drive Trail

Baton Rouge MRT - Water Campus

Baton Rouge MRT - Temporary PYRO

Government Street

Maintenance Checklist and Field Inspection Template

- Visit each site and take a photo on arrival
- Wear safety vest for any on-street work
- Address any evident maintenance issues:
  - — Cut tall grass/pull weeds around counter (especially if in danger of obstructing lens
  - — Carefully spray paint over any graffiti (don't get paint on lens!)
  - — Check lens for dirt or obstructions, clean with soft cloth if needed
  - — Check that post is vertical (not tilting) and adjust as necessary
  - — Remove excess dirt/grass from manhole cover
  - — Check that any exposed connections between inductive loops, posts, and manholes are looking secure
  - — Sweep out excess debris from inductive loops (being very cautious to stay clear of traffic, never turn back to motor vehicles)
  - — Anything look amiss that you can't address with tools on hand? Take a photo and notes in provided form
- Check sensor function
  - — Wake up sensor (on pyro unit or manhole cover) with magnet
  - — Connect to EcoVisio on android
  - — Test infrared sensor by walking back and forth across in front of post a few times
    - ‣ Walk at varying distances: very close to counter, middle of path, far edge of path
    - ‣ Is it consistently counting you?
    - ‣ Is the direction correct?
  - — Test inductive loop sensor by waiting for a bicyclist to pass (wait up to 15 minutes; suggest setting up connection to EcoVisio as soon as you get to site so

you can be ready to capture anyone who comes while you are performing maintenance at less busy sites)

    - Did sensor correctly classify bicyclist as bicycle?
    - Did sensor correctly classify direction?

- After completing maintenance activities:
  - Record your notes and observations, as well as any specific maintenance actions that were needed or any issues observed with sensor accuracy, in provided form
  - Take another picture of overall site showing equipment condition
- Return notes, photos, and equipment to project manager

Table 37. LTRC 19-3SA maintenance template

NEW ORLEANS COUNTERS	Location (description)	Notes (Maintenance actions, sensor issues, etc)
Jeff Davis Trail MULTI	Jeff Davis Parkway at Conti St	
Esplanade Avenue ZELT - South	Esplanade Avenue at DeSoto St, South (Capdeville Place	
Esplanade Avenue ZELT - North	Esplanade Avenue at DeSoto St, North (Desoto Park)	
Wisner Trail MULTI	Wisner Boulevard at Desaix	

NEW ORLEANS COUNTERS	Location (description)	Notes (Maintenance actions, sensor issues, etc)
Lafitte Greenway MULTI	Lafitte Greenway at N Galvez	
Behrman Park MULTI	Behrman Park at Lawrence St	
Baronne St EcoTUBES	Baronne St at Howard Avenue	
Algiers MRT EcoPYRO	Algiers Ferry Terminal	

NEW ORLEANS COUNTERS	**Location (description)**	**Notes (Maintenance actions, sensor issues, etc)**
MANDEVILLE COUNTERS	**Location (description)**	**Notes (Maintenance actions, sensor issues, etc)**
Tammany Trace MULTI	Tammany Trace at Coffee St	
Mandeville Lakefront Path PYRO	Lakeshore Drive at Lafitte St	

NEW ORLEANS COUNTERS	Location (description)	Notes (Maintenance actions, sensor issues, etc)
BATON ROUGE COUNTERS	**Location (description)**	**Notes (Maintenance actions, sensor issues, etc)**
Government St ZELT (x2)	Government St at Lavinia St	
Dalrymple Trail MULTI	Dalrymple Drive at I-10	
River Road MRT MULTI	Baton Rouge MRT at Water Institute Campus	
Capital Heights ZELT	Capital Heights Avenue at Mouton	

NEW ORLEANS COUNTERS	Location (description)	Notes (Maintenance actions, sensor issues, etc)
Gardere Lane PYRO	Gardere Lane at Old Hermitage Pkwy	
Nicholson Drive MULTI	Nicholson Drive at Gourrier Ave	
RUSTON COUNTERS	**Location (description)**	**Notes (Maintenance actions, sensor issues, etc)**
Rock Island Greenway MULTI (Phase 1)	Rock Island Greenway	

NEW ORLEANS COUNTERS	**Location (description)**	**Notes (Maintenance actions, sensor issues, etc)**
Rock Island Greenway PYRO (Phase 2)	Rock Island Greenway	

Figure 32. New Orleans count locations (Google map screenshot)

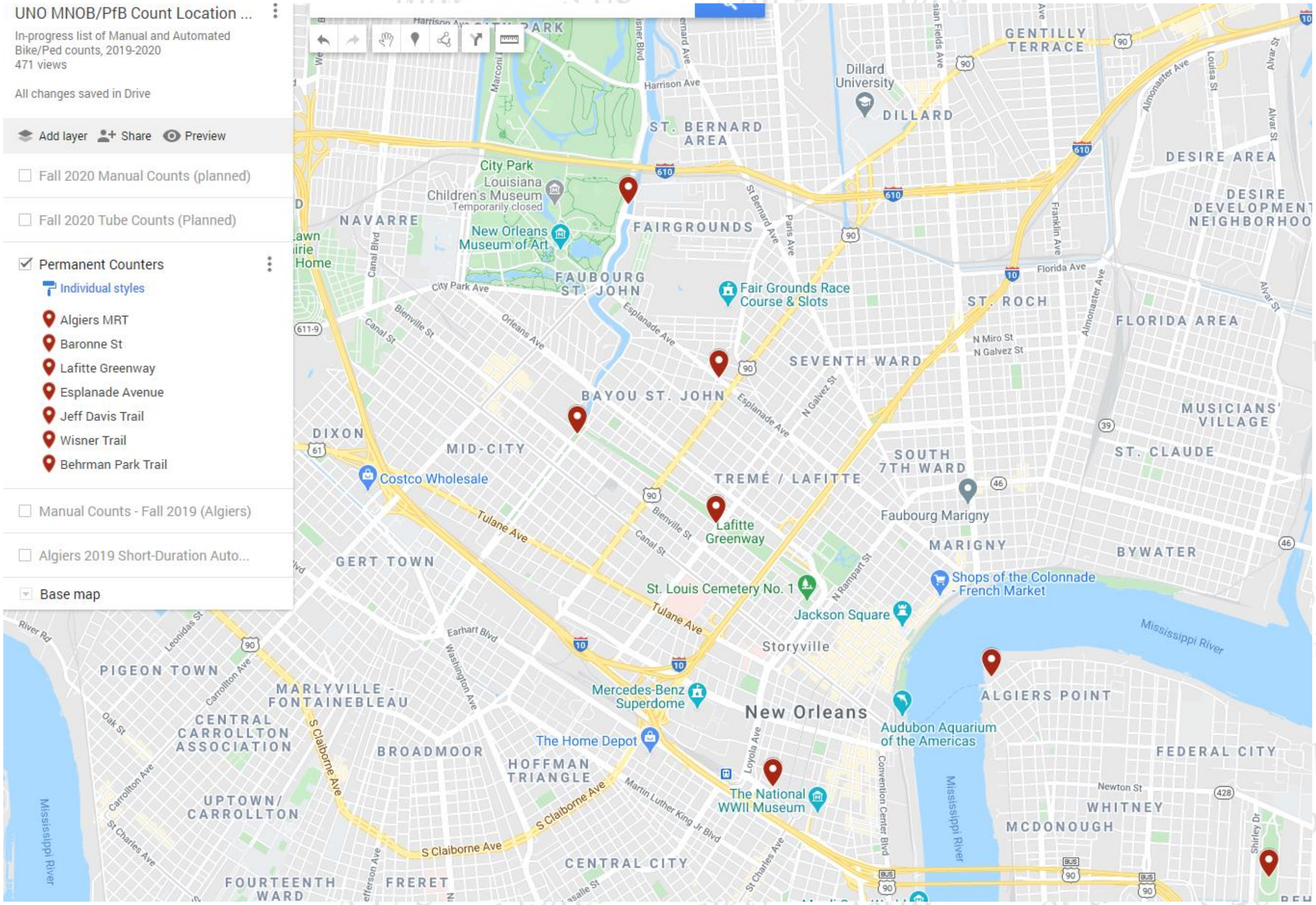


Figure 33. Mandeville count locations (Google map screenshot)

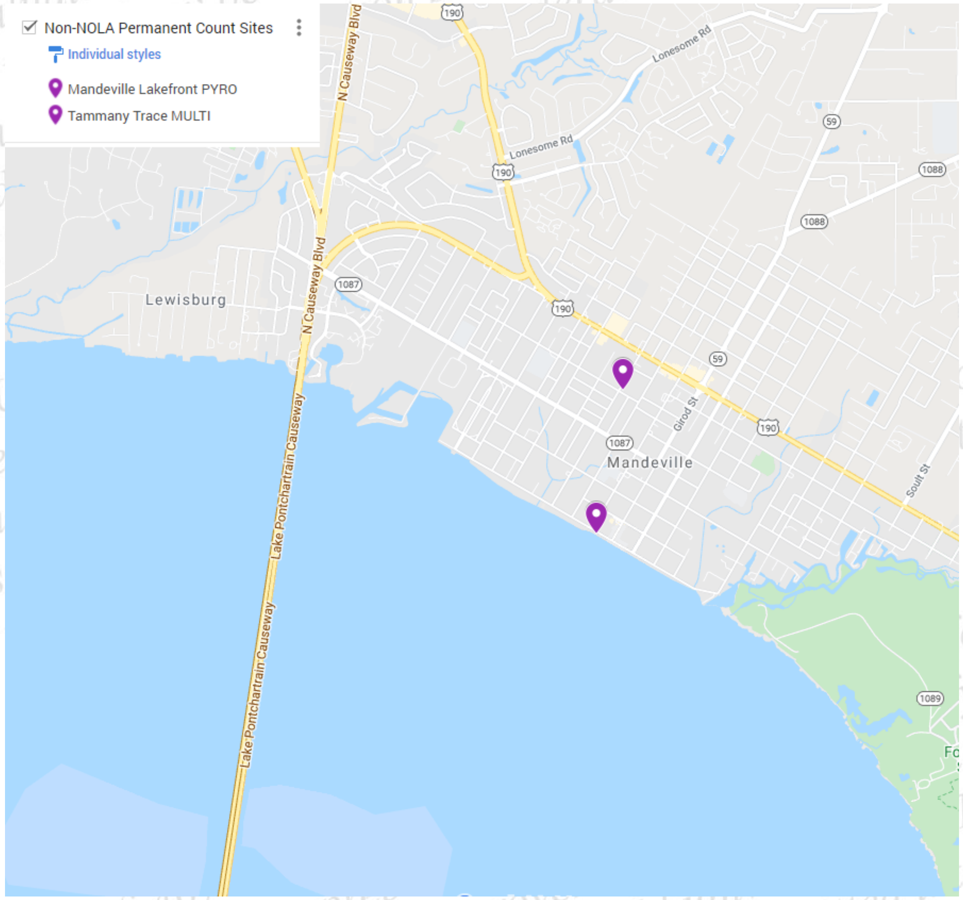
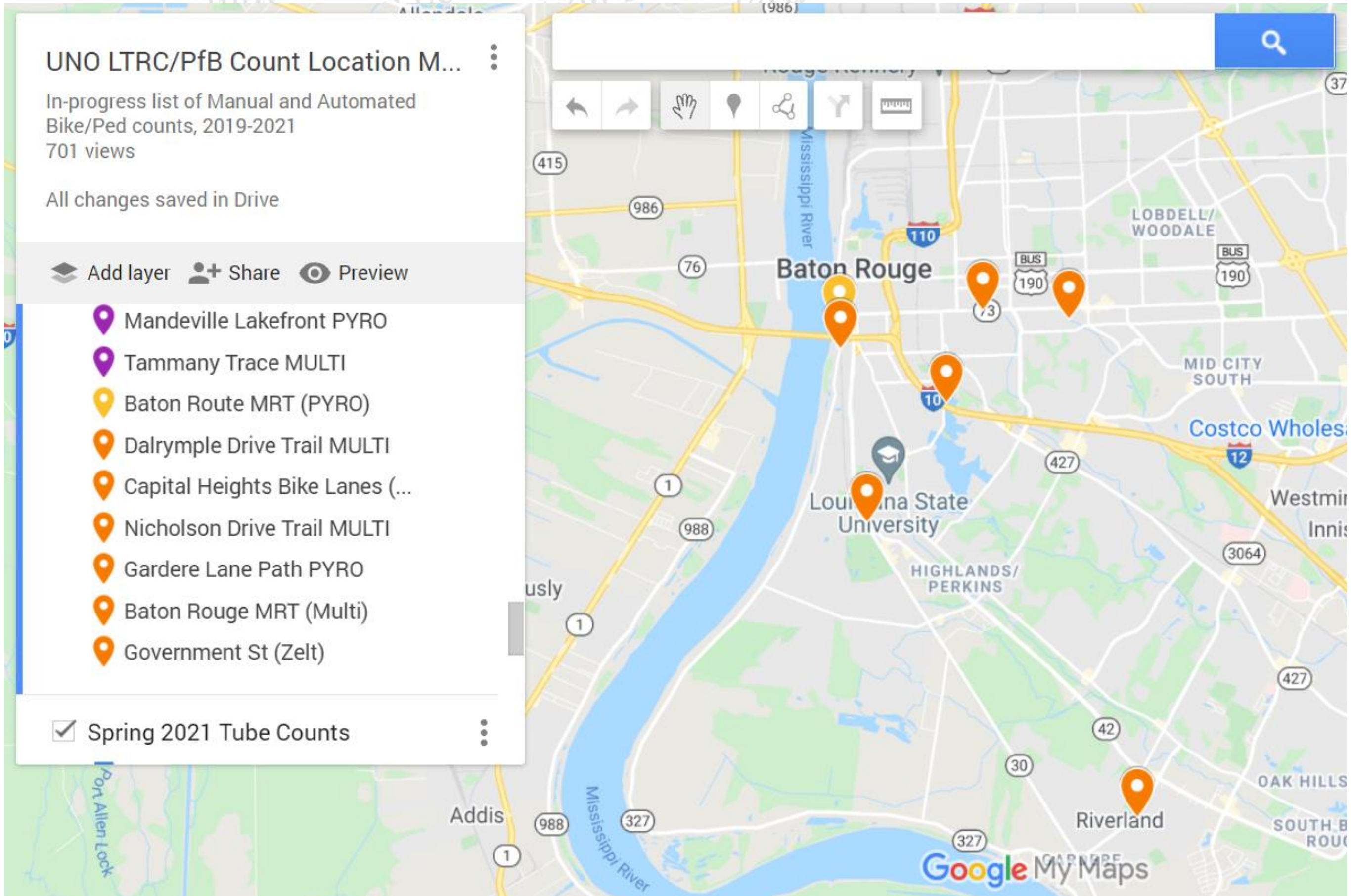


Figure 34. Baton Rouge count locations (Google map screenshot)



E. Daily and Hourly Data

Full Daily and Hourly User Volumes

[see attached Excel Workbook]

Daily Activity Summary Charts - Full Study Period

Figure 35. Daily user volumes - all sites, New Orleans - pedestrians/mixed users

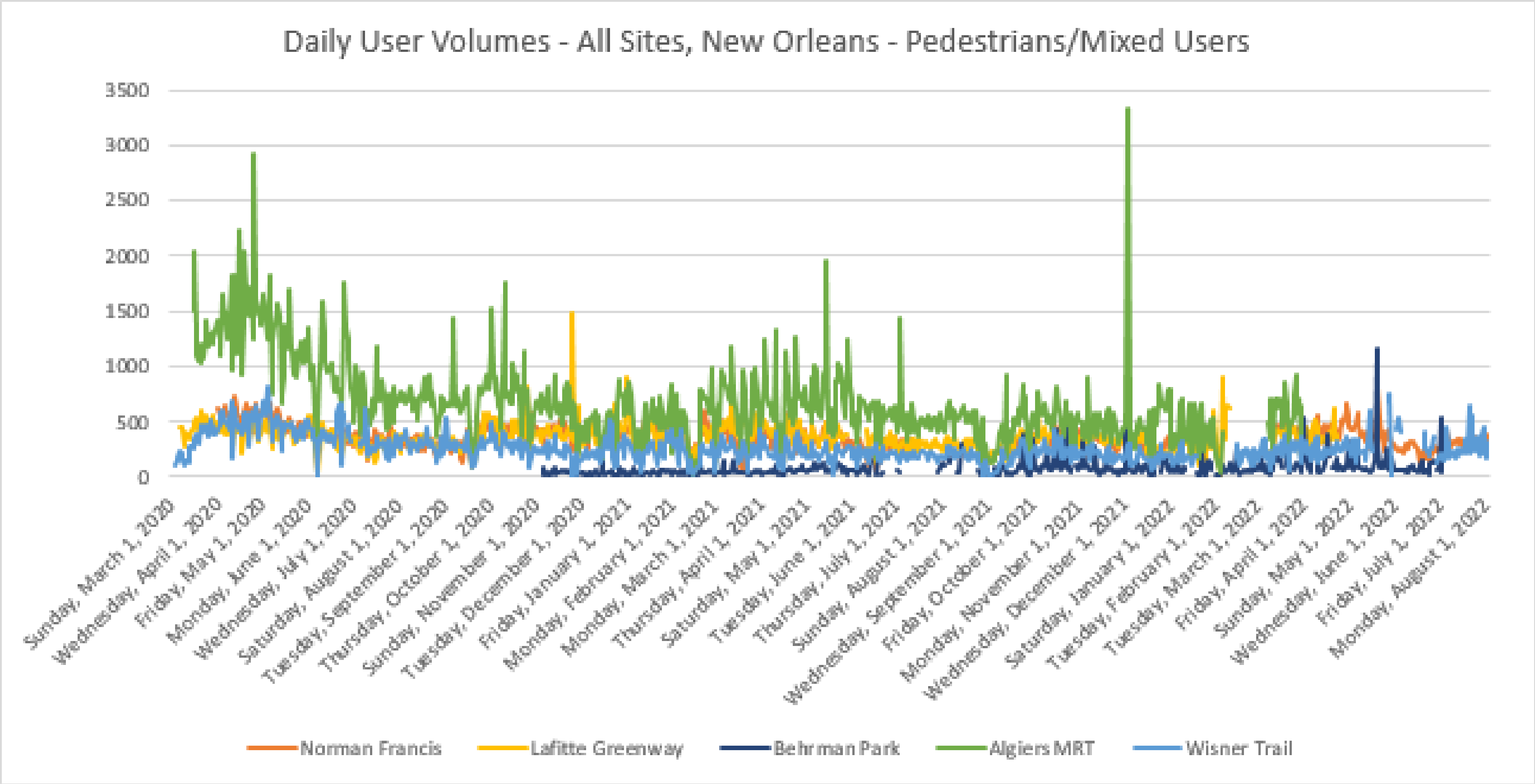


Figure 36. Daily user volumes - all sites, New Orleans - bicyclists

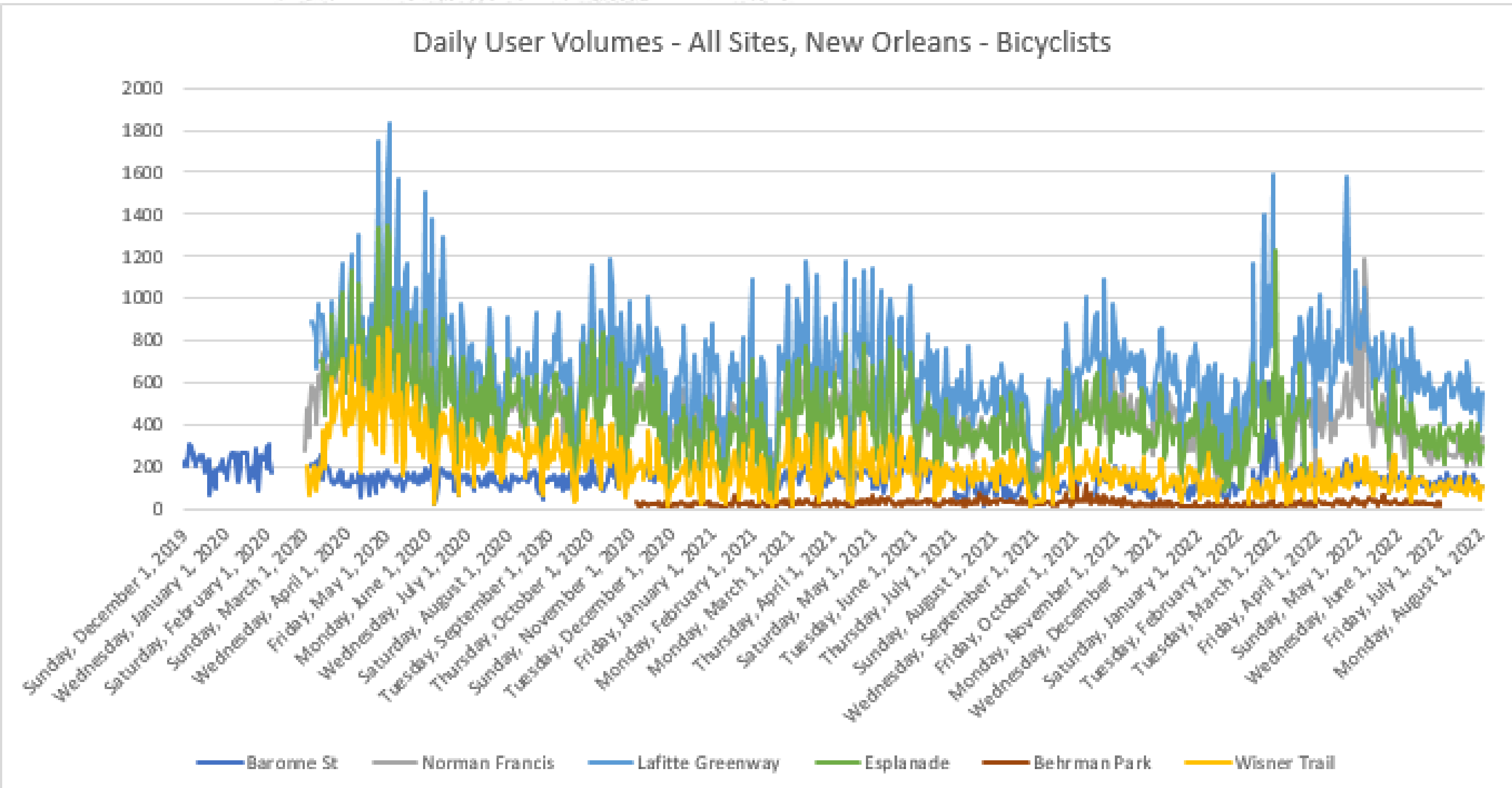


Figure 37. Daily user volumes - all sites, Mandeville

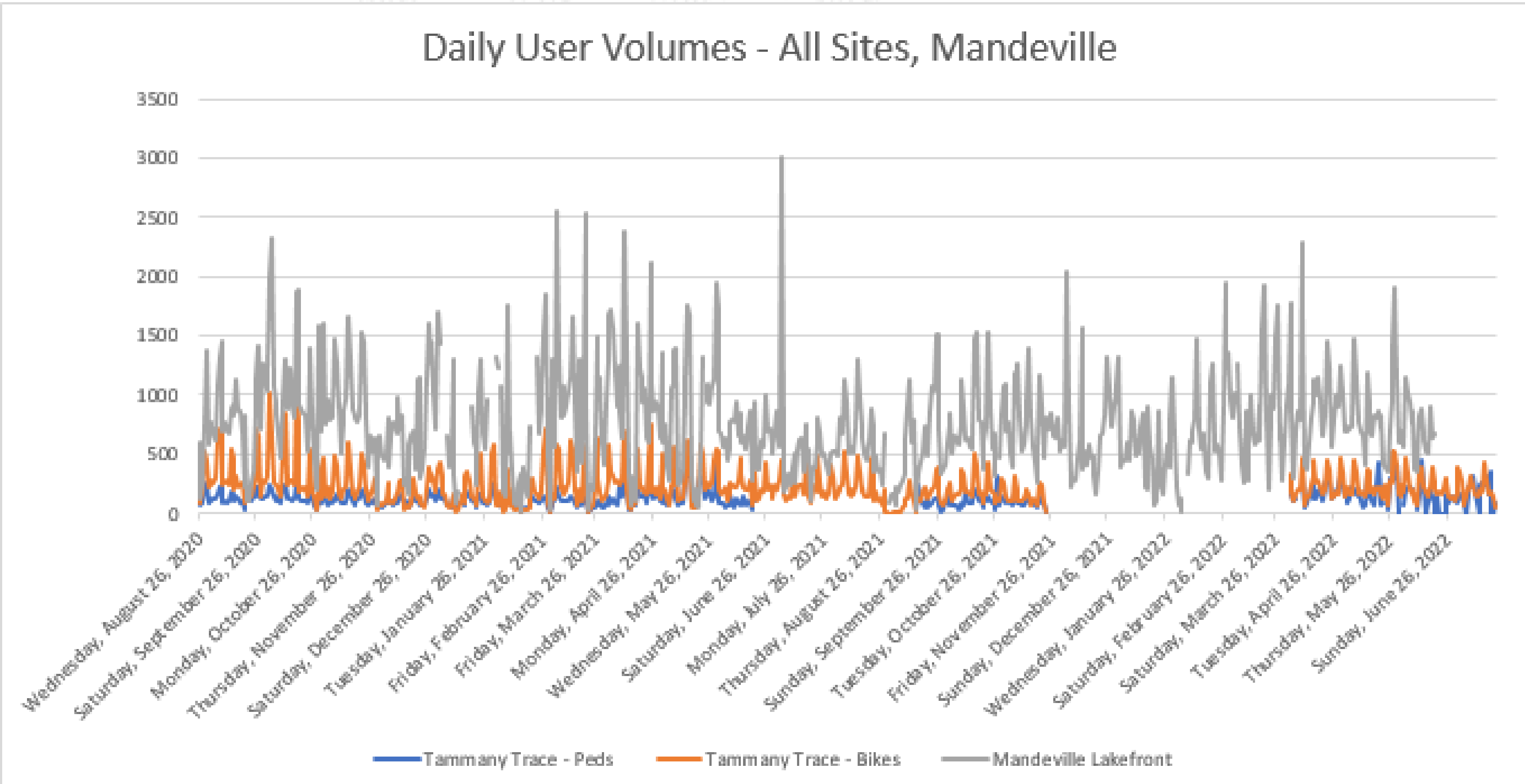


Figure 38. Daily user volumes - all sites, Ruston

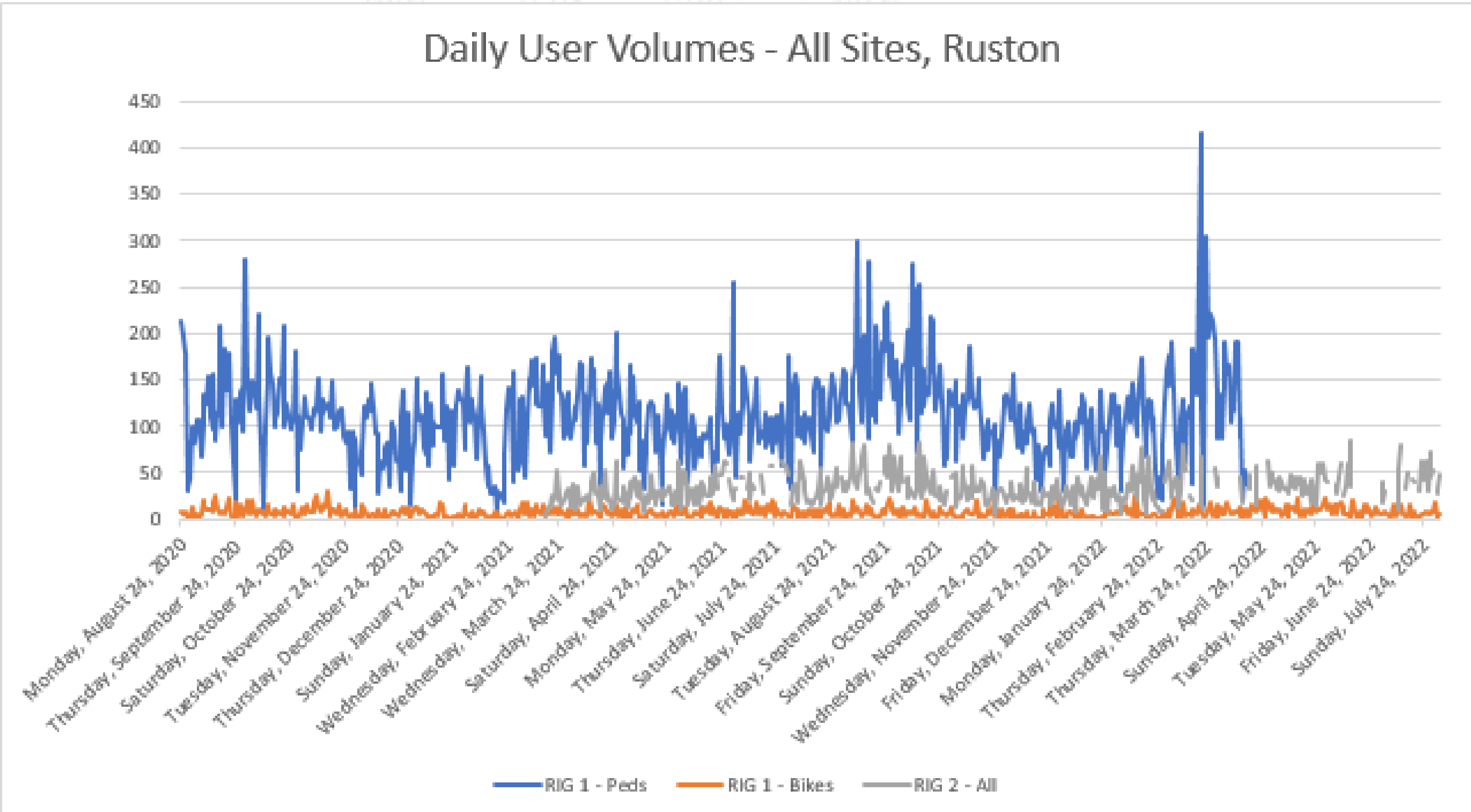


Figure 39. Daily user volumes - all sites, Baton Rouge - pedestrians/mixed users

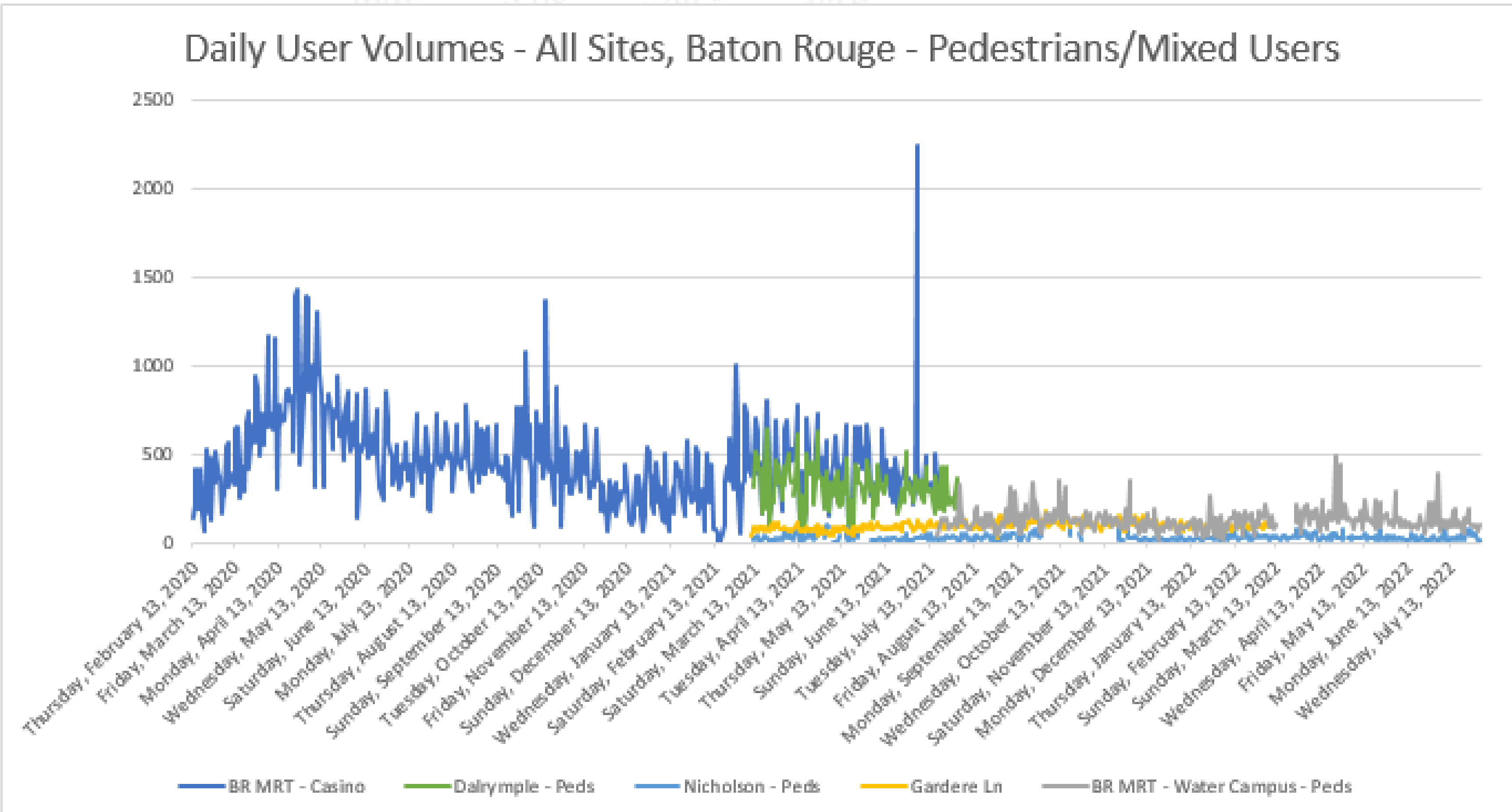
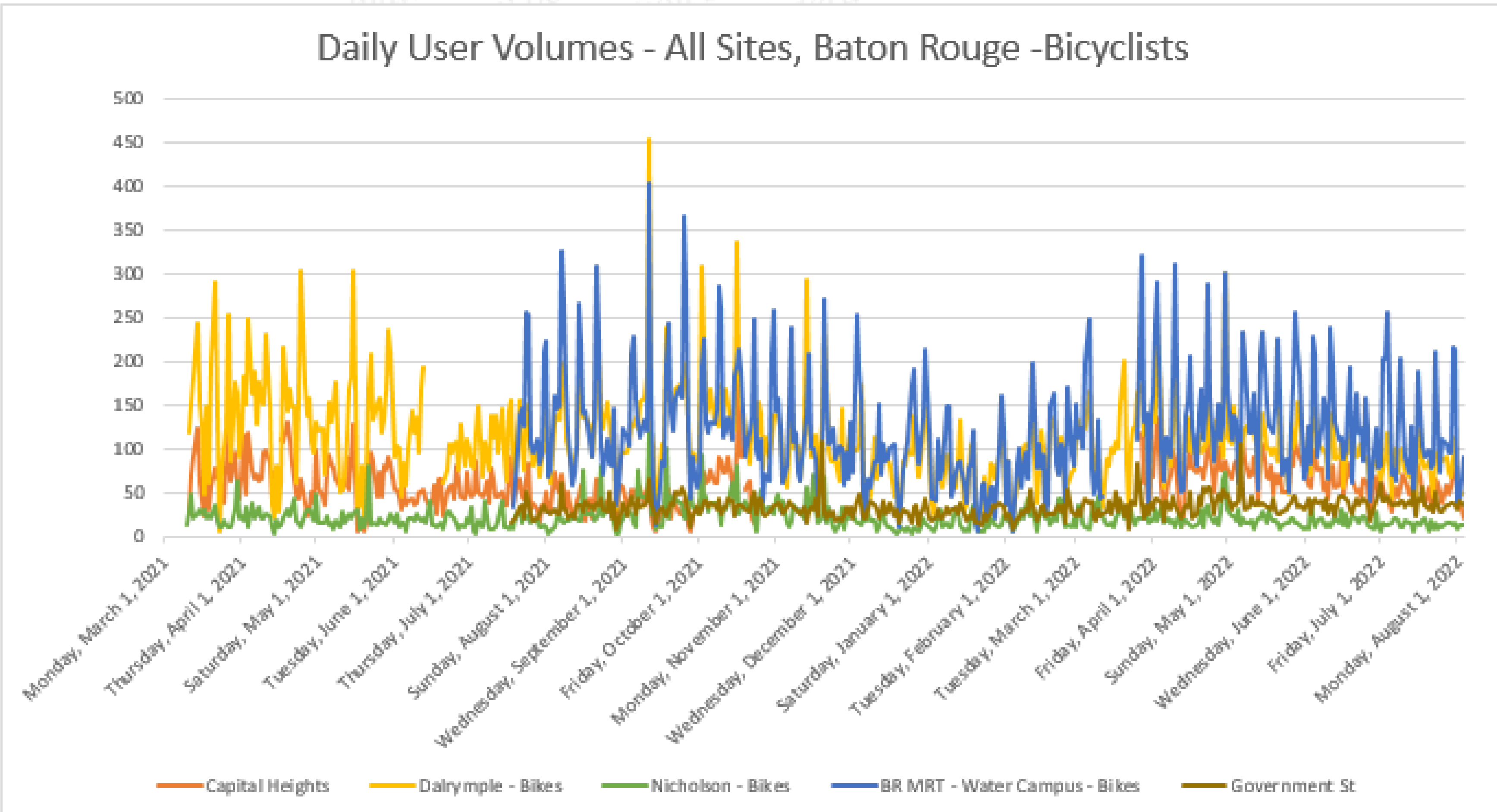


Figure 40. Daily user volumes - all sites, Baton Rouge -bicyclists



Supplemental Summary Tables – All Sites

Table 38. Average daily users by month, all sites (Jan-June)

Site #	Site Name	January		February		March		April		May		June	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
3	Norman Francis Parkway Trail	357	349	331	354	352	458	391	500	375	501	243	343
6	Algiers MRT	470		416		618		689		782		564	
12	Lafitte Greenway	335	514	355	589	406	666	401	768	357	712	308	584
20	Baronne St Bike Lane		88		170		147		156		155		146
25	Wisner Trail	220	144	203	123	237	158	246	171	250	181	237	141

Site #	Site Name	January		February		March		April		May		June	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
39	Esplanade Ave Bike Lanes		301		350		451		477		504		362
40	Behrman Park Trail	54	19	54	19	76	24	91	28	116	34	71	28
41	Tammany Trace	116	201	86	149	95	244	165	254	183	261	114	221
42	Mandeville Lakefront Path	662		679		902		984		864		675	
48	Rock Island Greenway - Phase 1	98	5	88	5	138	8	121	8	98	8	94	7
49	Rock Island Greenway - Phase 2	29		28		33		31		32		37	
44	Dalrymple Drive Trail		70		83	346	121	350	132	296	119	296	100

Site #	Site Name	January		February		March		April		May		June	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
45	Nicholson Drive Trail	21	16	34	23	26	24	37	23	31	20	19	18
46	Capital Heights Bike Lanes						66		73		70		56
47	Gardere Lane Sidewalk	92		85		83		74		72		91	
43	Baton Rouge MRT (Casino)	300		275		405		446		409		348	
56	Baton Rouge MRT (Water Campus)	95	72	109	87	137	122	171	147	134	143	115	126
57	Government St Bike Lanes		26		28		33		39		39		37

Table 39. Average daily users by month, all sites (July – December)

Site #	Site Name	July		August		September		October		November		December	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
3	Norman Francis Parkway Trail	310	357	301	401	315	392	378	538	368	469	307	385
6	Algiers MRT	606		580		548		659		548		525	
12	Lafitte Greenway	289	559	285	548	304	535	394	743	389	661	333	572
20	Baronne St Bike Lane		118		113		117		145		123		
25	Wisner Trail	254	178	240	208	219	189	263	216	212	164	205	138
39	Esplanade Ave Bike Lanes		379		398		376		497		423		341

Site #	Site Name	July		August		September		October		November		December	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
40	Behrman Park Trail	108	33	101	31	67	28	140	48	69	24	65	20
41	Tammany Trace	159	227	141	215	122	222	127	286	841	197	103	157
42	Mandeville Lakefront Path	562		621		682		919		841		693	
48	Rock Island Greenway - Phase 1	99	7	114	6	142	9	136	7	106	8	88	5
49	Rock Island Greenway - Phase 2	42		32		46		38		30		26	
44	Dalrymple Drive Trail	285	94	281	117		140		147		115		87
45	Nicholson Drive Trail	28	16	24	22	39	38	57	37	40	29	17	14

Site #	Site Name	July		August		September		October		November		December	
		Ped/All	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**
46	Capital Heights Bike Lanes		53		41		35		65				
47	Gardere Lane Sidewalk	94		99		118		116		102		111	
43	Baton Rouge MRT (Casino)	424		500		464		527		366		261	
56	Baton Rouge MRT (Water Campus)	118	127	116	133	145	147	143	149	127	116	96	106
57	Government St Bike Lanes		36		32		36		35		32		30

Table 40. Average daily users by day of week, all sites

Site #	Site Name	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
3	Norman Francis Parkway Trail	336	392	342	384	328	400	354	433	319	406	343	476	337	449
6	Algiers MRT	571		555		524		530		499		667		693	
12	Lafitte Greenway	367	560	343	566	332	559	355	615	313	601	364	737	349	684
20	Baronne St Bike Lane		122		130		131		140		146		141		123
25	Wisner Trail	230	155	217	152	217	153	236	157	201	139	273	205	263	225

Site #	Site Name	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
		Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike	Ped/All	Bike
39	Esplanade Ave Bike Lanes		350		362		347		393		380		504		484
40	Behrman Park Trail	65	25	65	26	62	24	70	26	108	28	89	29	95	28
41	Tammany Trace	122	173	105	158	86	144	120	170	114	174	177	407	177	365
42	Mandeville Lakefront Path	720		621		589		657		651		1045		1156	
48	Rock Island Greenway - Phase 1	121	7	119	6	119	7	106	6	93	6	107	8	118	7
49	Rock Island Greenway - Phase 2	35		31		34		33		31		33		37	
44	Dalrymple Drive Trail	331	106	273	94	277	102	293	100	216	96	389	139	405	144

Site #	Site Name	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday	
		Ped/All	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**	**Ped/All**	**Bike**
45	Nicholson Drive Trail	23	23	26	24	25	24	28	22	29	21	37	25	32	16
46	Capital Heights Bike Lanes		54		49		55		52		54		73		77
47	Gardere Lane Sidewalk	93		94		90		92		97		100		99	
43	Baton Rouge MRT (Casino)	349		352		325		329		326		562		529	
56	Baton Rouge MRT (Water Campus)	112	97	143	92	118	103	115	93	103	103	160	196	121	178
57	Government St Bike Lanes		31		30		33		34		36		39		32

Table 41. Average hourly traffic by site, morning peak (7-9am)

Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
3	Norman Francis Parkway Trail	11.7	20.2	32.0	8.2	12.7	20.9
6	Algiers MRT	17.0	17.4	34.4	18.3	19.4	37.7
12	Lafitte Greenway	23.5	28.5	52.0	10.6	20.4	30.9
20	Baronne St Bike Lane	-	5.2	-	-	3.9	-
25	Wisner Trail	9.0	9.7	18.7	14.1	9.8	23.9
39	Esplanade Ave Bike Lanes	-	17.0	-	-	16.4	-

Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
40	Behrman Park Trail	2.9	0.8	3.8	2.1	0.7	2.7
41	Tammany Trace	4.9	6.7	11.7	8.6	15.7	24.4
42	Mandeville Lakefront Path	-	-	35.4	-	-	43.8
48	Rock Island Greenway - Ph 1	7.0	0.4	7.3	7.7	0.4	8.1
49	Rock Island Greenway - Ph 2	-	-	1.8	-	-	2.1
44	Dalrymple Drive Trail	7.7	6.6	14.3	19.8	6.2	26.0
45	Nicholson Drive Trail	0.9	1.6	2.5	1.3	0.7	2.0

Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
46	Capital Heights Bike Lanes	-	2.5	-	-	4.2	-
47	Gardere Lane Sidewalk	-	-	3.9	-	-	3.3
43	Baton Rouge MRT (Casino)	-	-	15.0	-	-	24.7
56	Baton Rouge MRT (Water Campus)	3.3	4.5	7.8	5.9	13.5	19.4
57	Government St Bike Lanes	-	1.6	-	-	1.6	-

Table 42. Average hourly traffic by site, midday (11am-1pm)

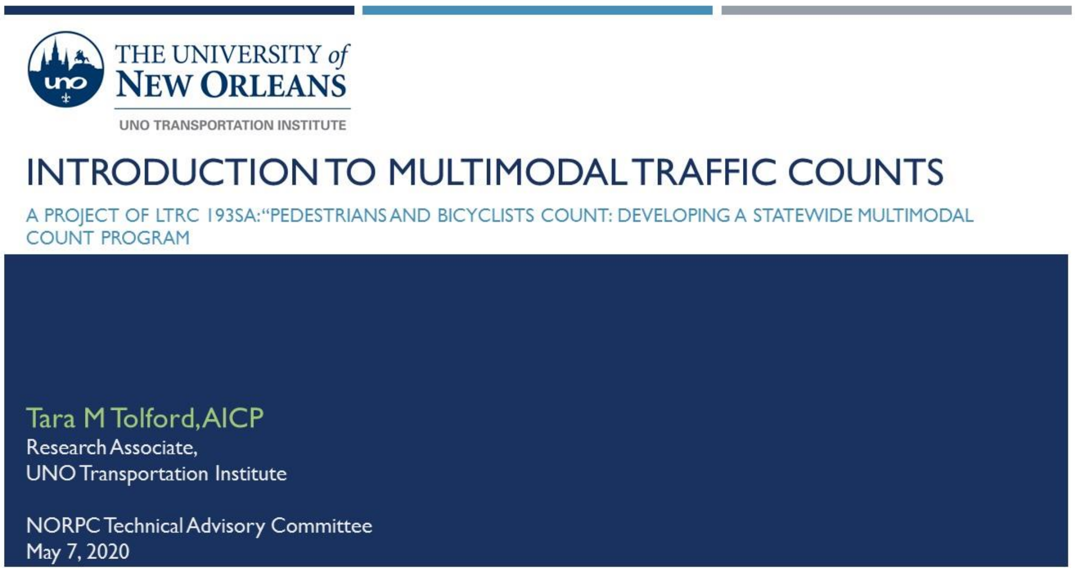
Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
3	Norman Francis Parkway Trail	8.4	21.4	29.8	12.0	34.2	46.2
6	Algiers MRT	16.7	17.0	33.8	20.4	21.6	42.0
12	Lafitte Greenway	17.0	30.2	47.2	14.2	49.7	63.9
20	Baronne St Bike Lane	-	7.7	-	-	8.7	-
25	Wisner Trail	5.7	8.7	14.4	10.9	17.8	28.7
39	Esplanade Ave Bike Lanes	-	22.3	-	-	37.7	-

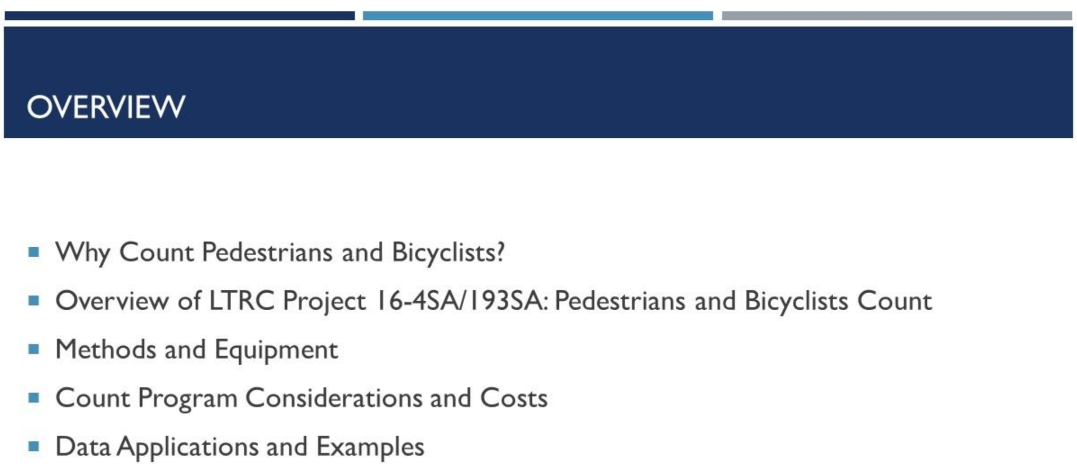
Site #	Site Name	Weekday			Weekend		
		Pedestrians	Bicycles	All Users	Pedestrians	Bicycles	All Users
40	Behrman Park Trail	4.7	1.2	6.0	6.2	1.7	7.9
41	Tammany Trace	8.5	12.8	21.3	17.0	41.4	58.4
42	Mandeville Lakefront Path	-	-	46.7	-	-	87.2
48	Rock Island Greenway - Ph 1	6.4	0.3	6.7	8.7	0.6	9.3
49	Rock Island Greenway - Ph 2	-	-	2.4	-	-	2.5
44	Dalrymple Drive Trail	6.2	6.5	12.6	10.4	12.1	22.6
45	Nicholson Drive Trail	1.2	1.4	2.6	1.7	1.5	3.2

Site #	Site Name	Weekday			Weekend		
		Pedestrians	**Bicycles**	**All Users**	**Pedestrians**	**Bicycles**	**All Users**
46	Capital Heights Bike Lanes	-	2.8	-	-	5.9	-
47	Gardere Lane Sidewalk	-	-	4.6	-	-	5.5
43	Baton Rouge MRT (Casino)	-	-	17.9	-	-	33.3
56	Baton Rouge MRT (Water Campus)	4.4	5.3	9.7	6.2	15.0	21.2
57	Government St Bike Lanes	-	1.7	-	-	2.7	-

F. Stakeholder Outreach Materials

NORPC Technical Advisory Committee Presentation: Introduction to Multimodal Traffic Counts





WHY COUNT PEDESTRIANS AND BICYCLISTS?

- To track changes in overall transportation trends over time
- To better understand travel patterns and existing demand
- To plan for and prioritize future infrastructure investments
- To evaluate impacts of previous investments
- To benchmark progress toward policy goals
- To meet federal expectations for data-driven decision-making and performance evaluation
- To put active transportation on a level playing field with motor vehicles, which we count extensively

> *"The best way to improve transportation networks for any mode is to collect and analyze trip data to optimize investments. Walking and bicycling trip data for many communities are lacking. This data gap can be overcome by establishing routine collection of non-motorized trip information."*
>
> \- United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations, 2010

LTRC PROJECT 16-4SA (PHASE 1) AND 19-3SA (PHASE 2: PEDESTRIANS AND BICYCLISTS COUNT
DEVELOPING A STATEWIDE MULTIMODAL COUNT PROGRAM & IMPLEMENTING AND APPLYING MULTIMODAL DEMAND DATA

Phase 1 Objectives:

1. To research established and emerging methodologies for counting bicycles and pedestrians and identify best practices for statewide count programs
2. To evaluate available count technology equipment options and identify preferred alternatives suitable for statewide deployment
3. To identify potential funding sources for the implementation of a multimodal count program and opportunities to integrate active transportation counts into existing vehicular count programs

Phase 2 Objectives:

1. Install permanent counters at a set of pilot locations and collect one year of pedestrian and bicycle data representative of a variety of usage patterns and/or facility types
2. Develop roadway factor groups for Louisiana communities and preliminary expansion factors for adjusting short-duration multimodal counts
3. Identify, support, and inform opportunities for coordinated local and MPO-led data collection

(we are here)

PHASE 1 FINDINGS: REGIONAL CONTEXT

- **Louisiana's Complete Streets Advisory Committee**: bike/ped data collection recommended policy implementation action
- Existing **New Orleans Regional Bike/Ped Count Program** (Pedestrian Bicycle Resource Initiative w/NORPC): Successful initiative demonstrating usefulnesss of multimodal data collection, but relied on manual counts and difficult to scale up efficiently
- DOTD recognized **need for improved data to evaluate statewide and project/corridor-level safety,** relative to increasing # of people walking and bicycling
- Emerging area of research! Limited national guidance, few states with coordinated multimodal count programs → **opportunity for Louisiana to lead**
- **Research project funded by LTRC** beginning in 2016 to provide guidance for DOTD + local govts and MPOs to develop integrated, cost-effective count programs
- **New Orleans Regional Safety Coalition**: has bike/ped subcommittee, identifies improving data availability as regional priority

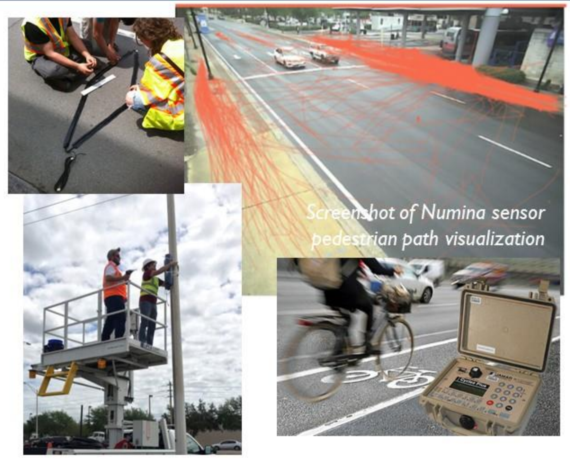
Fatal and severe bike & ped crashes increasing in region: how does this relate to increase in # of people walking and biking? How do we prioritize improvements where they will make the biggest impact?

PHASE 1 FINDINGS: CURRENT STATE OF THE PRACTICE

- Evaluated 50+ state, regional, local count programs
- Only a handful of states with coordinated programs: Colorado, North Carolina, Washington, Vermont
- Variety of methods currently in use – not "one size fits all" – tailor program to specific goals and constraints
- Emerging body of national guidance documenting best practices:
  - Traffic Monitoring Guide (2013)
  - NCHRP Report 797 (2014)
  - FHWA Bicycle-Pedestrian Count Technology Pilot Project (2016)
  - Scalable Risk Assessment Model (TTI 2017/18)

PHASE 1 FINDINGS: METHODS AND TECHNOLOGIES

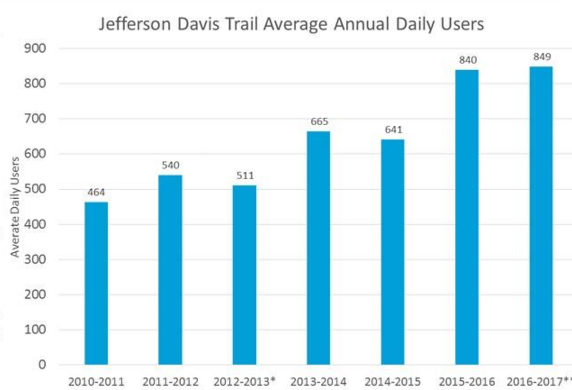
- Evaluated 40+ products/vendors (updated annually)
- Area of rapid change! "Traditional" tech tailored to bike/ped applications still dominates (infrared, pneumatic tube, and inductive loop counters)
- Several promising emerging technologies under development or in pilot use – many based on automated video image processing technology
- All technologies have limitations! Established programs tend to incorporate multiple methods and tools based on context; phase in new tech over time → adapt!



Screenshot of Numina sensor pedestrian path visualization

PHASE 1 FINDINGS: PROGRAM IMPLEMENTATION

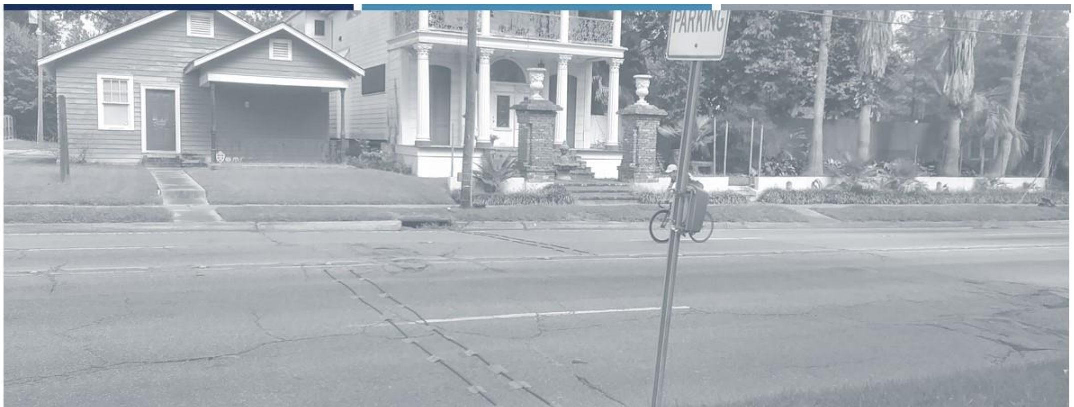
- Data needs are different for pedestrians and bicyclists tha for motor vehicles:
  - longer data collection period
  - increased sensitivity to environmental factors
  - less predictable behavior
  - QA/QC protocols must be adapted
- State leadership + interjurisdictional outreach and partnerships are needed: most streets where people walk and bike are local (but disproportionate share of crashes may occur on state roads)
- Clear best practice: begin establishing strategic permanen count locations for various "factor groups" from which tc contextualize and adjust short-term counts *→ Underway in New Orleans Region (including northshore), data will be shared, opportunity for growth, especially as bike plans are implemented*



Data source: New Orleans Pedestrian and Bicycle Count Report 2017

PHASE 2 UPDATE: BUILDING A FOUNDATION WITH CONTINUOUS COUNTERS

- Continuous, long-term counters for bicyclists and/or pedestrians installed at 15 total locations
  - 7 in New Orleans (leveraged w/3 bonus counters paid for by People for Bikes)
  - 4 in Baton Rouge (+ 2 more pending permits)
  - 2 in Mandeville
  - 2 in Ruston (leveraged bonus counter paid for by BCBS Foundation)
- From this data, on a variety of facility types in a variety of neighborhoods/contexts, we will be able to:
  - Refine roadway factor groups based on land use, activity pattern
  - Develop expansion factors for adjusting short-duration count data for estimating AADB/AADP
  - Track impacts of bike/ped network development over time



METHODS AND EQUIPMENT

HOW TO COUNT NON-MOTORIZED USERS (AKA, PEOPLE!)

TYPES OF COUNTS: MANUAL

- Basically, people observing in real time OR reviewing video data after the fact
- Short duration only
- Segments or intersections
- Volumes, turning movements, travel orientation, behavior, characteristics


UNO student conducting manual count, 2015

*If you **don't have any bike/ped infrastructure,** manual counts might be your best/only option*

Manual Count Summary

Best for:

◊ Understanding user demographics and behaviors
◊ Community-based evaluations
◊ Collecting data for a large number of locations
◊ Intersections and other hard-to-count locations
◊ Validating automated count data accuracy

Key limitations:

◊ High labor demand
◊ Limited data applications
◊ High degree of variation/unreliability
◊ Typically cannot be used year-round

Estimated Cost: Very low (if using volunteer labor), though coordination and data management costs may be prohibitive for large-scale count programs

Examples: New Orleans Regional Planning Commission Pedestrian and Bicycle Count Program, Washington State Bicycle and Pedestrian Documentation Project

TYPES OF COUNTS: AUTOMATED

- Short duration or long duration/permanent
- Mostly segments (video counters may capture intersections)
- Volumes, travel orientation (maybe more with video)
- Primary tools/types of counters:
  - Pneumatic Tubes
  - Infrared Sensors
  - Inductive Loops
  - Automated video detection/classification systems


Short-duration tube count, 2017


Permanent inductive loops, installed 2020

TYPES OF COUNTS: AUTOMATED

Pneumatic Tube Counter Summary

Best for:

◊ Short-duration counts on bike lanes, cycletracks, low-volume shared roadways

◊ Collecting counts at multiple locations on a limited budget

◊ Conducting preliminary counts prior to installing permanent counters

Key limitations:

◊ Tubes wear out quickly in mixed traffic conditions

◊ Regular maintenance required for longer counts

◊ Not suitable for locations where bicyclists' movements are unpredictable (e.g. many sidewalk riders)

Estimated Cost: Approximately $1,500—$2,800 per unit, plus $300 per set of (bicycle-specific) replacement tubes

Examples: LTRC "Pedestrians and Bicyclists Count," Vermont Bicycle and Pedestrian Program

Pneumatic Tubes, Tulane Avenue (2017)

Passive Infrared sensor in housing, Lafitte Greenway, 2017

Passive Infrared Counter Summary

Best for:

◊ Measuring pedestrian volume on sidewalks

◊ Lower-cost permanent counts on off-street bicycle facilities or shared-use trails

Key limitations:

◊ Cannot distinguish between pedestrians and bicyclists

◊ Cannot be used on-street

Estimated Cost: $2,000—$6,000 per unit (depending on range and housing of sensor)

Examples: New Orleans' Lafitte Greenway; San Diego Association of Governments

Relatively inexpensive, easy ways to capture before/after, tubes similar to vehicle counts already collected (but tricky if lacking dedicated infrastructure)

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TYPES OF COUNTS: AUTOMATED

Automated Video-Image Processing Summary

Best for:

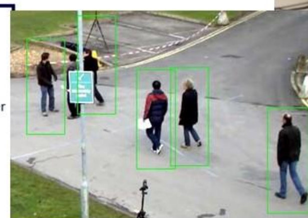
- Intersection and turning movement counts
- Areas without dedicated bike/ped infrastructure or unpredictable user behaviors
- Counting all modes of traffic simultaneously

Key limitations:

- Technology is still emerging; limited research on available products
- Relatively complex installation requirements
- Programming expertise required to calibrate and process data
- Not suitable for poorly lit contexts

Estimated Cost: Varies widely; full-service vendors typically charge on a monthly subscription basis, plus equipment, software, and/or installation costs

Examples: Jacksonville, FL (Numina partnership); Chicago, IL (Miovision)



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- Use of phone-based GPS data
- Bike/Ped applications under (rapid) development but not quite there yet
- Great for understanding impacts on flow overall, route choice, speed, relative frequency
- Can't replace actual counts (yet)

Less Commonly Used Options:

- Piezoelectric strips (similar to inductive loops
- Radar (similar to infrared)
- Overhead thermal sensors (captures movement patterns)
- Fiberoptic sensors
- Laser scanners
- Acoustic/pressure pads
- Magnetometers

COUNT PROGRAM CONSIDERATIONS

Questions to Ask

- What data has already been or is currently being collected?
- What is the purpose of the data collection, and what kinds of data are required to meet planning, policy, or programmatic needs?
- What resources are available for implementation?
- Where are you counting? (facility types, functional class/AADT, land use context, etc)
- Who do you need to count? (bikes, pedestrians, both)
- When will you be counting? (season, weather, etc)

10 Principles of Pedestrian and Bicycle Counting

1. People walking and bicycling are sensitive to weather, traffic conditions, and more: non-motorized user volumes are more variable than motor vehicles
2. The scale of data collection is smaller than for motor vehicles in most places, and there is less historical data available
3. Pedestrian and bicyclist volumes do not directly correspond to functional class and/or motor vehicle ADT
4. People bicycling and walking can behave unpredictably and are more difficult to predict, detect, and count than motor vehicles
5. All count technology has inherent systematic and site-specific error which must be adjusted for
6. Establishing at least one permanent count location is recommended as a foundation for understanding your data
7. A minimum of 7 days (14 preferred) is recommended for short-duration automated counts
8. Short duration counts should be conducted in Spring and Fall if possible, during periods of reasonably good weather
9. Manual counts are still needed for validating sensors, collecting demographic and behavioral data, filling gaps in what automated sensors can capture, and more
10. Routine maintenance, validation, data cleaning, management, and usage protocols must be established

COUNT PROGRAM COSTS

Capital costs – Equipment and Installation

- Long-duration or permanent counters $2,500 to $7,000 per unit
- Temporary/mobile count units: $1,000 to $4,000 per unit,
- Installation for inductive loop counters (if contracted): ~$2000/unit

Operational costs - Maintenance, supplies, vendor/subscription costs

- Maintenance –
  - New tubes ~300/set
  - Supplies: batteries, nails, tape, etc: varies (EcoCounter batteries ~$150/unit every 2 years)
- Vendor/subscription costs – varies – eg EcoCounter, $400/unit per year modem cost, web platforms for analyzing data (may be included), to full-service data solutions (billed per unit per month or as flat rate for period)

Personnel costs – Varies by scale:

- Installation
- Validation
- Maintenance
- Data retrieval and analysis
- Estimate ~ 2 person hrs/month per unit permanent counters, 6 hrs per location mobile counters

Technology Type	Vendor	Product	Est. Price Per Unit
Pneumatic Tubes	Eco-Counter	TUBES	$2,200-$2,800
	MetroCount	RidePod BT	$1,700
	Jamar	TRAX Cycles Plus	$1500 - $1700 + $1500 software cost
	Waycount	Waycount Road Tube Traffic Counter	$499 (protected bikeways only)
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Inductive Loops	Eco-Counter	Urban ZELT/Greenway ZELT	$2500 - $4300
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	Counters & Accessories (CA-Traffic)	Bicycle Recorder	Variable
	Eco-Counter	Easy ZELT (Temporary)	$2700 - $5400
Mixed Infrared/ Inductive Loop	EcoCounter	EcoMULTI	$4100 - $6,600
Video Image-Based Sensors	Numina	Numina	$1,600 -$5,000 + monthly fee
	Miovision	Scout/Datalink	Variable
	Placemeter, Inc.	Placemeter	Variable
	Econolite	Autoscope Cyclescope	Variable
	Migma	MigmaMidblock/ MigmaPedCount; Migma Bicycle	$3,340
	Motionloft	ViMO Sensor	Variable
	Iteris	Smart Cycle; PedTrax	Variable
Piezoelectric Strips	MetroCount	RidePod BP	$4,200
	RoadSys/Q-Free	Hi-TRAC CMU/HI-TRAC CMU Cycle Priority	Variable

COUNT PROGRAM COSTS

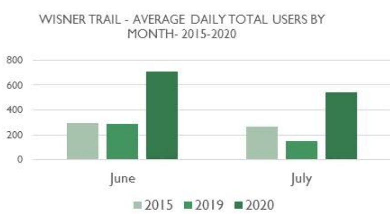
- Many federal funding sources can potentially support bike/ped data collection activities, according to FHWA (and some states!)
- Phased approach is typical; one-time philanthropic partnership often key to initial equipment purchase
- Few jurisdictions fully house bike/ped count programs with vehicle counts due to divergent data needs and objectives (but many coordinate closely)
- Use of independent contractors/full-service vendors increasingly common
- Successful programs rely on interjurisdictional partnerships: establish protocols and guidance to allow collaborative programs; ensure compatible data

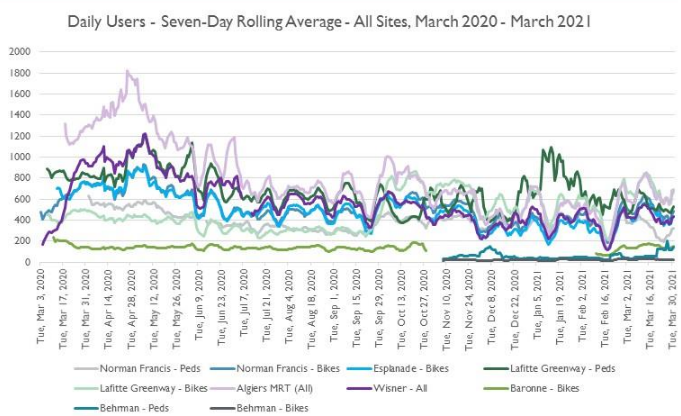
DATA APPLICATIONS AND EXAMPLES

PUTTING BICYCLE AND PEDESTRIAN DATA TO WORK

DATA APPLICATIONS AND EXAMPLES

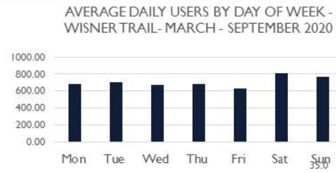
- Tracking the Impacts of COVID-19 on bicycling and walking in New Orleans
  - Showed huge increases over previous years on trail locations (where data available)
  - Showed drop off in activity in CBD

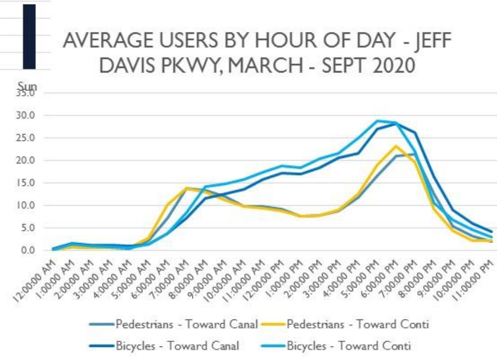


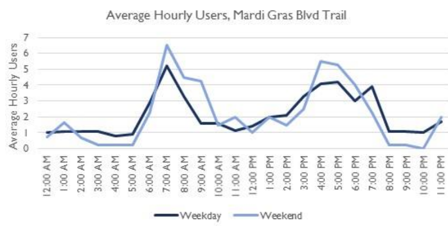


DATA APPLICATIONS AND EXAMPLES

- Understanding daily, hourly, and seasonal patterns: when and why are people walking and bicycling?

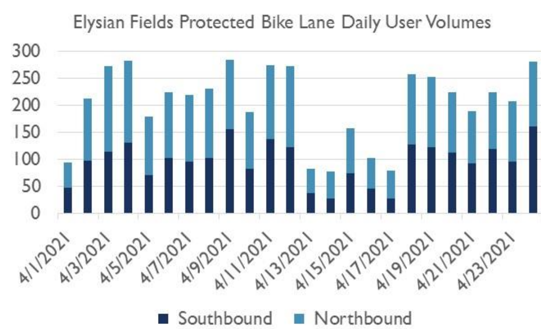


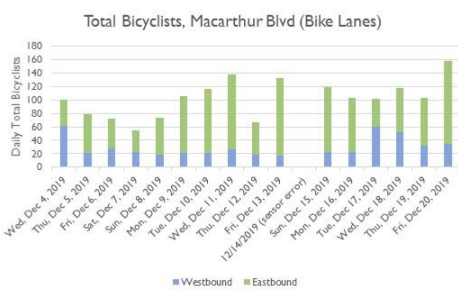




DATA APPLICATIONS AND EXAMPLES

- Understanding impacts of infrastructure development: measure volumes before and after change





TAKEAWAYS

- **Continuous, long-term data** is key foundation for any program, most applications. Start small if needed, but start soon!
- Build on this with **short-duration counts**: systematic across network and/or project by project basis
- Array of different tech solutions appropriate for different contexts – programs should **evolve** over time, **flexible** to include multiple data sources
- Full integration with vehicle count programs is uncommon due to divergent objectives, timelines, sensitivities – focus on **coordination and communication**; build capacity and/or insist on contractors with bike/ped expertise
- **Make multimodal data collection routine** part of complete streets project planning and delivery! (Hard to effectively evaluate without baseline data)

THANK YOU!

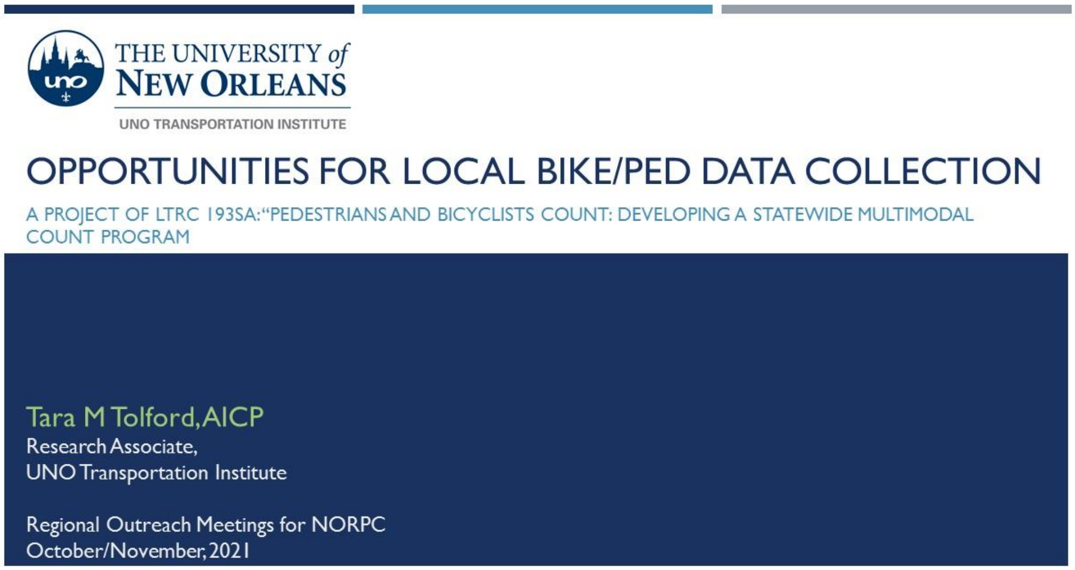
THE UNIVERSITY *of* NEW ORLEANS

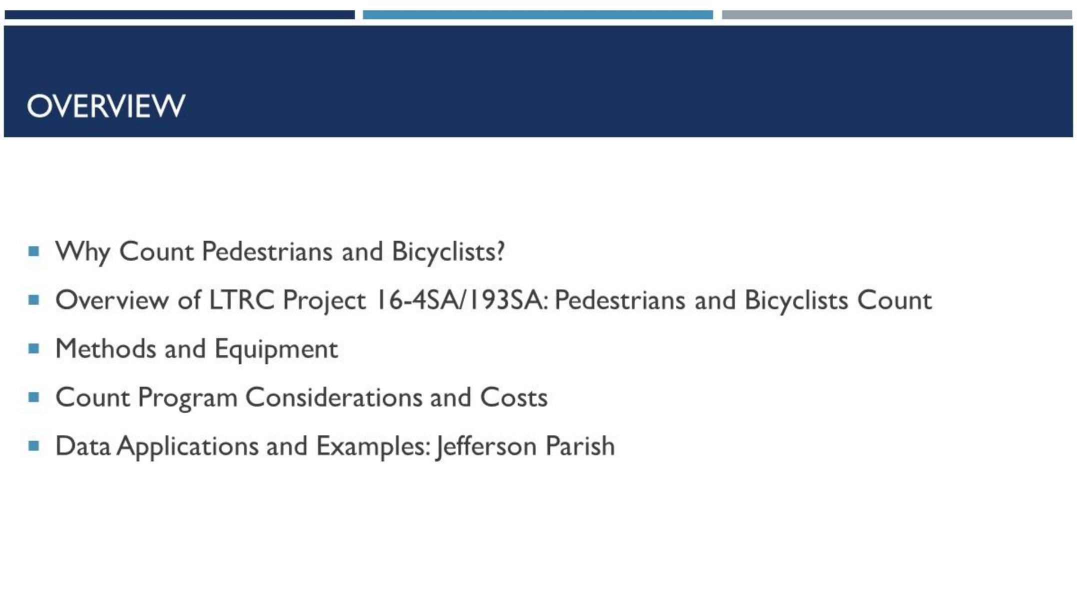
UNO TRANSPORTATION INSTITUTE

TARA M. TOLFORD, AICP (PI)

TMTOLFOR@UNO.EDU

RPC Parish-Level Outreach Presentations: Opportunities for Local Bike/Ped Data Collection





WHY COUNT PEDESTRIANS AND BICYCLISTS?

- To track changes in overall transportation trends over time
- To better understand travel patterns and existing demand
- To plan for and prioritize future infrastructure investments
- To evaluate impacts of previous investments
- To benchmark progress toward policy goals
- To meet federal expectations for data-driven decision-making and performance evaluation
- To put active transportation on a level playing field with motor vehicles, which we count extensively

> *"The best way to improve transportation networks for any mode is to collect and analyze trip data to optimize investments. Walking and bicycling trip data for many communities are lacking. This data gap can be overcome by establishing routine collection of non-motorized trip information."*
>
> \- United States Department of Transportation Policy Statement on Bicycle and Pedestrian Accommodation Regulations and Recommendations, 2010

LTRC PROJECT 16-4SA (PHASE 1) AND 19-3SA (PHASE 2: PEDESTRIANS AND BICYCLISTS COUNT

DEVELOPING A STATEWIDE MULTIMODAL COUNT PROGRAM & IMPLEMENTING AND APPLYING MULTIMODAL DEMAND DATA

Phase 1 Objectives:

1. To research established and emerging methodologies for counting bicycles and pedestrians and identify best practices for statewide count programs
2. To evaluate available count technology equipment options and identify preferred alternatives suitable for statewide deployment
3. To identify potential funding sources for the implementation of a multimodal count program and opportunities to integrate active transportation counts into existing vehicular count programs

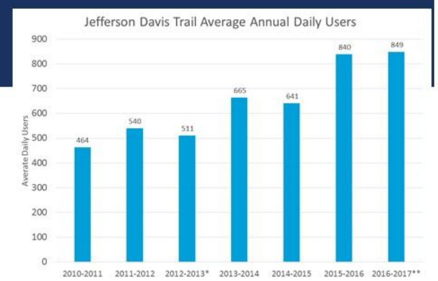
Phase 2 Objectives:

1. Install permanent counters at a set of pilot locations and collect one year of pedestrian and bicycle data representative of a variety of usage patterns and/or facility types
2. Develop roadway factor groups for Louisiana communities and preliminary expansion factors for adjusting short-duration multimodal counts
3. Identify, support, and inform opportunities for coordinated local and MPO-led data collection

(we are here)

PHASE 1 FINDINGS

- DOTD recognized **need for improved data to evaluate statewide and project/corridor-level safety,** relative to increasing # of people walking and bicycling
- Variety of methods currently in use – **not "one size fits all"** – tailor program to specific goals and constraints
- **Data needs are different for pedestrians and bicyclists** than for motor vehicles:
  - longer data collection period
  - increased sensitivity to environmental factors
  - less predictable behavior
  - QA/QC protocols must be adapted
- Clear best practice: begin establishing strategic **permanent count locations** for various "factor groups" from which to contextualize and adjust short-term counts



Fatal and severe bike & ped crashes increasing in region: how does this relate to increase in # of people walking and biking? How do we prioritize improvements where they will make the biggest impact?

PHASE 2 UPDATE: BUILDING A FOUNDATION WITH CONTINUOUS COUNTERS

- Continuous, long-term counters for bicyclists and/or pedestrians installed at 15 total locations
- From this data, on a variety of facility types in a variety of neighborhoods/contexts, we will be able to:
  - Refine roadway factor groups based on land use, activity pattern
  - Develop expansion factors for adjusting short-duration count data for estimating AADB/AADP
  - Track impacts of bike/ped network development over time
  - Provide templates/guidance for local jurisdictions to begin collecting and using their own data

TYPES OF COUNTS: MANUAL

- Basically, people observing in real time OR reviewing video data after the fact
- Short duration only
- Segments or intersections
- Volumes, turning movements, travel orientation, behavior, characteristics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*If you **don't have any bike/ped infrastructure,** manual counts might be your best/only option*

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Estimated Cost: Very low (if using volunteer labor), though coordination and data management costs may be prohibitive for large-scale count programs

Examples: New Orleans Regional Planning Commission Pedestrian and Bicycle Count Program, Washington State Bicycle and Pedestrian Documentation Project

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Estimated Cost: Approximately $1,500—$2,800 per unit, plus $300 per set of (bicycle-specific) replacement tubes
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Relatively inexpensive, easy ways to capture before/after, tubes similar to vehicle counts already collected (but tricky if lacking dedicated infrastructure)


TYPES OF COUNTS: AUTOMATED
Pre-Formed Inductive Loops, Rock Island Greenway (Ruston
Inductive Loop Detector Summary
Best for:
◊ Long-term counts on cycletracks and dedicated conventional or buffered bike lanes
◊ Long-term counts on shared-use paths or trails (combined with an infrared sensor to differentiate modes)
Key limitations:
◊ Electrical/engineering expertise required for installation
◊ Accuracy decreases in mixed traffic conditions
Estimated Cost: Approximately $2,500—$4,300 per unit, not including installation costs
Examples: Tammany Trace (Mandeville), Colorado DOT Pedestrian and Bicycle Continuous Counts
Infrared + Inductive Loops, Tammany trace
Temporary Inductive Loops
Selective Inductive Loops, Esplanade Avenue

TYPES OF COUNTS: AUTOMATED

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- ◊ Counting all modes of traffic simultaneously

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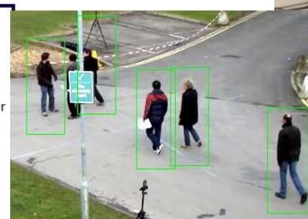

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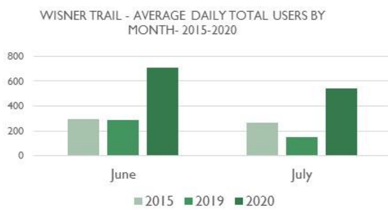

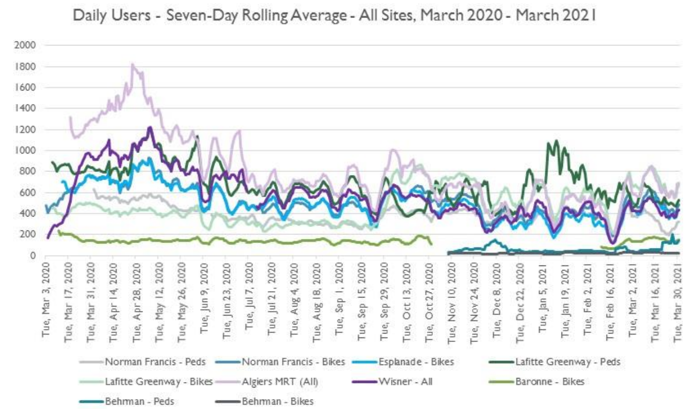

DATA APPLICATIONS AND EXAMPLES

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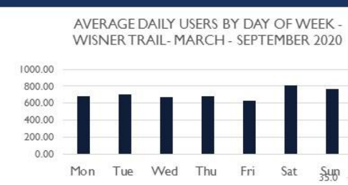
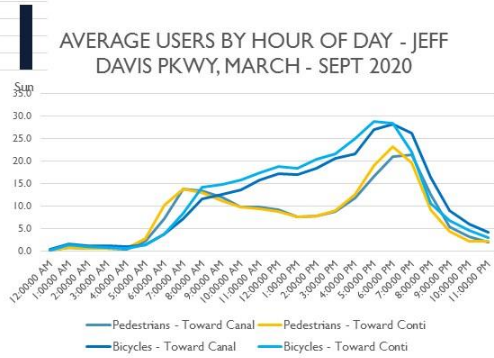
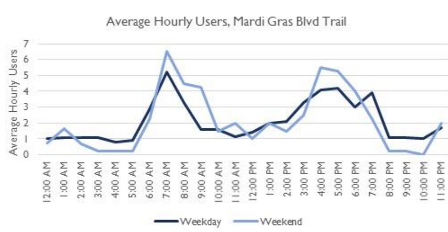
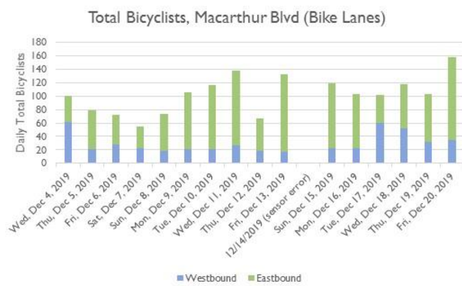


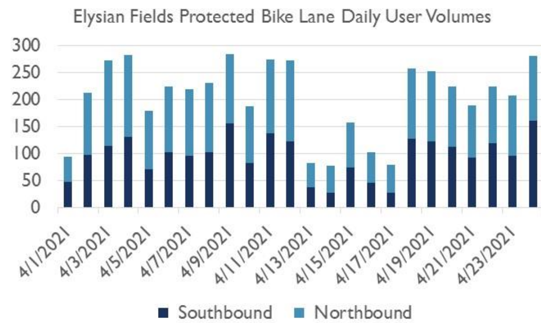




DATA APPLICATIONS AND EXAMPLES

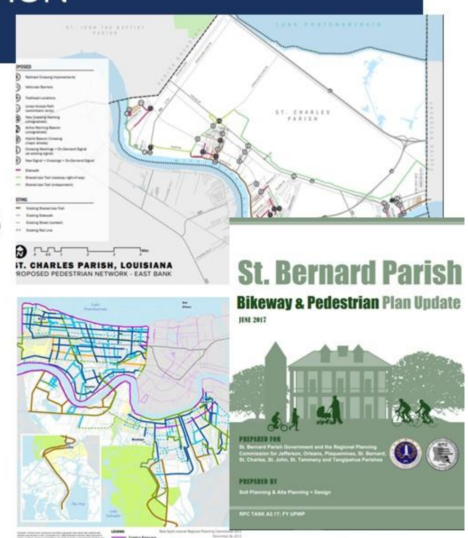
- Understanding impacts of infrastructure development: measure volumes before and after change





NEW ORLEANS REGIONAL IMPLEMENTATION

- **Dedicated bike/ped facilities are the easiest to monitor:**
  - Sidewalks → Infrared sensors
  - On-street bike lanes/protected bike lanes → inductive loops (or pneumatic tubes for shorter counts)
  - Shared-use trails → infrared + inductive loops
  - Levee paths → infrared sensors (unless at off-crown trailhead)
- **Installation may be easiest at time of construction**
  - complete installation in-house or bundle contracts
  - Infrared/tube sensors may be installed by any staff
  - Inductive loops require concrete saw, some specialized training; installation costs $2-3k per location if contracted separately
- **Ongoing costs to plan for:** Data transmission (recommended), batteries, staff time for validation, maintenance, analysis: all are scalable



Pedestrian and Bicycle Funding Opportunities
U.S. Department of Transportation Transit, Highway, and Safety Funds
Updated January 21, 2021

This table indicates potential eligibility for pedestrian and bicycle projects under U.S. Department of Transportation surface transportation funding programs. Additional restrictions may apply. See notes and basic program requirements below, and see program guidance for detailed requirements. Project sponsors should fully integrate nonmotorized accommodation into surface transportation projects. Section 1404 of the Fixing America's Surface Transportation (FAST) Act modified 23 U.S.C. 109 to require federally-funded projects on the National Highway System to consider access for other modes of transportation, and provides greater design flexibility to do so.

Pedestrian and Bicycle Funding Opportunities: U.S. Department of Transportation Transit, Highway, and Safety Funds

Key: $ = Funds may be used for this activity (restrictions may apply). ~$ = Eligible, but not competitive unless part of a larger project. $* = See program-specific notes for restrictions.

Activity or Project Type	BUILD	INFRA	TIFIA	FTA	ATI	CMAQ	HSIP	NHPP	STBG	TA	RTP	SRTS	PLAN	NHTSA 402	NHTSA 405	FLTTP
Access enhancements to public transportation (includes benches, bus pads)	$	~$	$	$	$	$		$	$	$						$
ADA/504 Self Evaluation / Transition Plan									$	$	$		$			$
Bicycle plans				$					$	$		$	$			$
Bicycle helmets (project or training related)									$	$SRTS		$		$*		
Bicycle helmets (safety promotion)									$	$SRTS		$				
Bicycle lanes on road	$	~$	$	$	$	$	$	$	$	$		$				$
Bicycle parking	~$	~$	~$	$	$	$		$	$	$	$	$				$
Bike racks on transit	$	~$	$	$	$	$			$	$						$
Bicycle repair station (air pump, simple tools)	~$	~$	~$	$	$	$			$	$						$
Bicycle share (capital and equipment; not operations)	$	~$	$	$	$	$		$	$	$						$
Bicycle storage or service centers (example: at transit hubs)	~$	~$	~$	$	$	$			$	$						$
Bridges / overcrossings for pedestrians and/or bicyclists	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Bus shelters and benches	$	~$	$	$	$	$		$	$	$						$
Coordinator positions (State or local)						$ 1 per State			$	$SRTS		$				
Crosswalks (new or retrofit)	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Curb cuts and ramps	$	~$	$	$	$	$*	$	$	$	$	$	$				$
Counting equipment				$	$		$	$	$	$	$	$	$*			$
Data collection and monitoring for pedestrians and/or bicyclists				$	$		$	$	$	$	$	$	$*			$
Historic preservation (pedestrian and bicycle and transit facilities)	$	~$	$	$	$				$	$						$
Landscaping, streetscaping (pedestrian and/or bicycle route; transit access); related amenities (benches, water fountains); generally as part of a larger project	~$	~$	~$	$	$			$	$	$						$
Lighting (pedestrian and bicyclist scale associated with pedestrian/bicyclist project)	$	~$	$	$	$		$	$	$	$	$	$				$
Maps (for pedestrians and/or bicyclists)				$	$	$			$	$		$	$*			
Paved shoulders for pedestrian and/or bicyclist use	$	~$	$			$*	$	$	$	$		$				$
Pedestrian plans				$					$	$		$	$			$
Recreational trails	~$	~$	~$						$	$	$					$
Road Diets (pedestrian and bicycle portions)	$	~$	$				$	$	$	$						$
Road Safety Assessment for pedestrians and bicyclists							$		$	$			$			$
Safety education and awareness activities and programs to inform pedestrians, bicyclists, and motorists on ped/bike safety									$SRTS	$SRTS		$	$*	$*	$*	
Safety education positions									$SRTS	$SRTS		$		$*		

- **Data Collection is an allowable expense** on numerous federal/state funding sources: **$$$** potentially available for equipment in particular
- **The time to start is now!** A few continuous monitoring sites will help contextualize all future data, show impact of investments over time

THANK YOU!

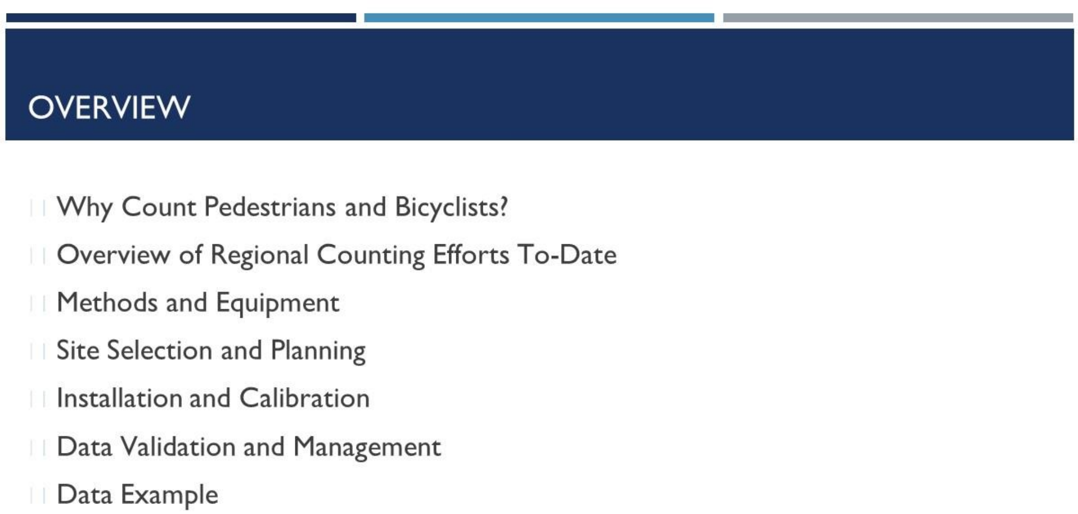
THE UNIVERSITY *of* NEW ORLEANS

UNO TRANSPORTATION INSTITUTE

TARA M. TOLFORD, AICP (PI)

TMTOLFOR@UNO.EDU

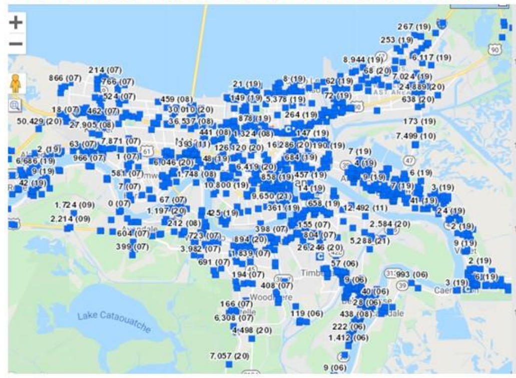
RPC Consultant Workshop: Collecting and Using Automated, Multimodal Count Data for Transportation Planning Projects



WHY COUNT PEDESTRIANS AND BICYCLISTS?

- To track changes in overall transportation trends over time
- To better understand travel patterns and existing demand
- To plan for and prioritize future infrastructure investments
- To evaluate impacts of previous investments
- To benchmark progress toward policy goals
- To meet federal expectations for data-driven decision-making and performance evaluation
- To put active transportation on a level playing field with motor vehicles, which we count extensively

DOTD Motor Vehicle Counts – New Orleans Area



https://ladotd.public.ms2soft.com/tcds/tsearch.asp?loc=ladotd

WHY COUNT PEDESTRIANS AND BICYCLISTS?

- **Complete Streets Policy in place at multiple levels:** requires bike/ped accommodation in most projects
  - DOTD Complete Streets policy adopted 2010, revised 2016; EDSM and MDG adopted 2017
  - RPC policy adopted 2013 for consistency and alignment
  - City of New Orleans Complete Streets policy adopted 2011, updated 2020; several other local policies statewide
- **IIJA emphasizes Vulnerable Road Users**
  - Adopts Safe System approach, requires VRU Safety Assessments in SHSP
  - Allocated additional funding for Complete Streets (Safe Streets and Roads for All program), minimum spend requirements for active transportation

- **Safety Analysis:**
  - Fatal and severe bike & ped crashes have been increasing in state, region
    - 175 bike/ped fatalities statewide in 2021 out of 730 total fatal crashes (24%)
    - 41% of fatalities bike/ped Orleans 2021
  - How does this relate to increase in # of people walking and biking?
  - Are our streets becoming less safe, or are there more people using them? (or both)
  - How do we prioritize improvements where they will make the biggest impact?
- No FHWA count *mandate* yet, but increasing expectation of data-driven plans and projects: multimodal data collection supports evidence-based decisions and proposals

WHY COUNT PEDESTRIANS AND BICYCLISTS?

- **Emerging body of national guidance documenting best practices:**
  - NCHRP Report 797 (2014) – Comprehensive overview
  - Traffic Monitoring Guide (2016) – Non-Motorized count chapter
  - FHWA Bicycle-Pedestrian Count Technology Pilot Project (2016)
  - Scalable Risk Assessment Model (TTI 2017/18) (counts are foundation for safety modeling)
  - AASHTO *Guide for the Planning, Design, and Operation of Pedestrian Facilities* just updated 2021; Bike Guide and Green Book updates underway with more data collection content anticipated
  - NCHRP 07-31 State DOT Usage of Bicycle and Pedestrian Data: Practices, Sources, Needs, and Gaps (anticipated FY 2022)
- **More Resources:**
  - NCHRP Web-Only Document 205: Methods and Technologies for Pedestrian and Bicycle Volume Data Collection (2014)
  - **Recent best practice guidance from: North Carolina, Washington, Virginia, Texas, Michigan**

OVERVIEW: MULTIMODAL COUNT DATA COLLECTION IN LOUISIANA

- 2010-2017: NORPC PEDESTRIAN & BICYCLE RESOURCE INITIATIVE
  - Joint partnership of New Orleans Regional Planning Commission and UNO Transportation Institute (Supported by DOTD)
  - Count Program grew over time to 71 total manual count locations + several short and long-term automated count locations
- 2019-2021: CITY OF NEW ORLEANS BIG JUMP PROJECT SUPPORT
  - Laying a groundwork for routine data collection, mixed methods flexible approach
  - Capturing usage of new infrastructure completed (before/after where feasible): show success of new facilities
- 2017-2022: LTRC "PEDESTRIANS AND BICYCLISTS COUNT" STUDIES
  - Project 16-4SA (Phase 1) : Developing a statewide multimodal count program
  - Project 19-3SA (Phase 2): Implementing and applying multimodal demand data

OVERVIEW: MULTIMODAL COUNT DATA COLLECTION IN LOUISIANA – KEY FINDINGS

- Variety of methods currently in use – **not "one size fits all"** – tailor program to specific goals and constraints: **Why are you counting?**
- **Data needs are different for pedestrians and bicyclists** than for motor vehicles:
  - longer data collection period *required*
  - increased sensitivity to environmental factors
  - less predictable behavior
  - QA/QC protocols must be adapted
- Use **permanent count locations** to contextualize and adjust short-term counts


UNOTI team repairs pneumatic tube sensor, Tulane Avenue, New Orleans, 2017

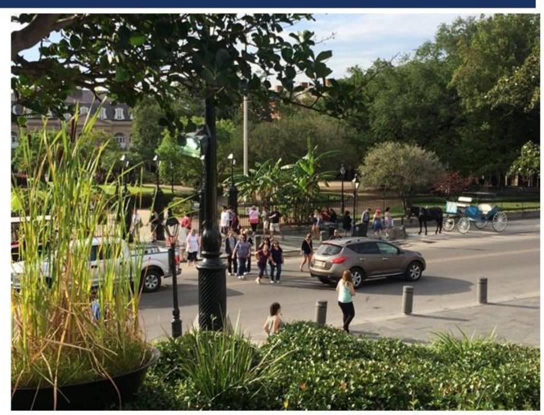
RECOMMENDED APPROACH TO STATEWIDE DATA COLLECTION

- Recommended approach: **Coordinated, de-centralized model with SUPPORT from DOTD**
- DOT provides guidelines, encourages implementation; receives cleaned data for centralized database, research applications (e.g. modeling, safety)
- Local agencies identify sites and primary data uses; manage day-to-day maintenance and operations of permanent counters
- MPOs as lead partner for capital cost support, data repositories – use of data for long range planning, some QA/QC
- Local consultants should be prepared to lead multimodal data collection at project level: Stage 0, corridor plans, etc
- University partners, and/or nonprofits with expertise can support planning, maintenance, data use best at local level

PRINCIPLES AND PRACTICE OF MULTIMODAL COUNTS

FUNDAMENTAL PRINCIPLES

- **Data needs are different for pedestrians and bicyclists** than for motor vehicles:
  - Longer data collection period (min 7 days for automated counts; 8 hrs manual)
  - Increased sensitivity to environmental factors (especially: precipitation, "cold")
  - Less predictable behavior/path of travel
  - QA/QC protocols must be adapted, context specific (no one-size-fits-all rules)
  - You can't predict bike/ped activity by functional class, ADT: many key variables
  - No substitute for (some) on-the-ground manual observation!



Jackson Square, New Orleans

FUNDAMENTAL PRINCIPLES

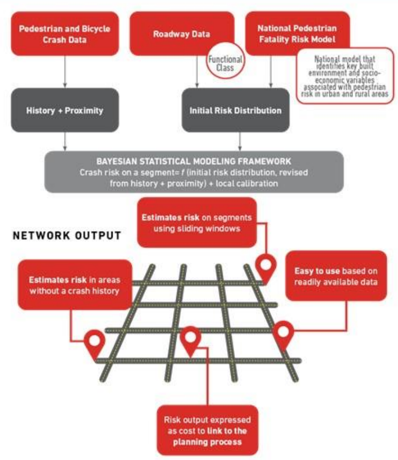
- **The challenge is greatest where bike/ped facilities are inadequate/absent**
  - Mechanical automated counters may not be feasible
  - People may not be where you expect them to be
  - Lack of observed activity does NOT necessarily represent lack of demand
  - Proxy variables must ALSO be considered: sociodemographics, land use, activity generators, transit, etc

Recommended Reading: Understanding Latent Demand and Estimating Potential Bike/Ped Activity

- NCHRP Report 770 – Estimating Bicycling and Walking for Planning and Project Development: A Guidebook (2014)
- Latent Demand for Walking and Cycling (2021)
- Development of Pedestrian Demand Estimation Tool (2015)
- The Latent Demand Method (Louisville Pedestrian Master Plan 2010)
- Bicycle and Pedestrian Forecasting Tools: State of the Practice (2015)
- A conceptual framework for understanding latent demand: accounting for unrealized activities and travel (2017)
- Jefferson Parish Bicycle Master Plan (Ch 3) – 2013
- Moving New Orleans Bikeway Blueprint - 2020

FUNDAMENTAL PRINCIPLES

- **Recommended Resource:**
  Safer Streets Priority Finder
  - Free and open source resource
  - Developed for New Orleans, applicable anywhere
  - Allows practitioners to analyze and understand the risk to vulnerable road users (bicyclists and pedestrians) on their local roadways, even where few crashes may have occurred
  - Minimal input data required (local road and crash files recommended but optional)
  - Proxy variables for demand automatically integrated in model based on ACS, Smart Location database info
  - Produce analysis results in 30 minutes or less
  - *Useful supplement to count data wherever safety, latent demand are a concern!*



saferstreetspriorityfinder.com

FUNDAMENTAL PRINCIPLES

- **All count methods have limitations**
  - Technology has inherent systematic and site-specific error
  - Scale of data collection is smaller; less historical data and fewer points of comparison for modeling, data adjustment
  - Activity impacted by dozens of factors; can't account for all variables
  - Document who ISN'T being counted, and why

COUNT PROGRAM CONSIDERATIONS

Questions to Ask when Developing a Count Plan:

- What data has already been or is currently being collected?
- What is the purpose of the data collection, and what kinds of data are required to meet planning, policy, or programmatic needs?
- What resources are available for implementation?
- Where are you counting? (facility types, functional class/AADT, land use context, etc)
- Who do you need to count? (bikes, pedestrians, both)
- When will you be counting? (season, weather, etc)

10 Principles of Pedestrian and Bicycle Counting

1. People walking and bicycling are sensitive to weather, traffic conditions, and more: non-motorized user volumes are more variable than motor vehicles
2. The scale of data collection is smaller than for motor vehicles in most places, and there is less historical data available
3. Pedestrian and bicyclist volumes do not directly correspond to functional class and/or motor vehicle ADT
4. People bicycling and walking can behave unpredictably and are more difficult to predict, detect, and count than motor vehicles
5. All count technology has inherent systematic and site-specific error which must be adjusted for
6. Establishing at least one permanent count location is recommended as a foundation for understanding your data
7. A minimum of 7 days (14 preferred) is recommended for short-duration automated counts
8. Short duration counts should be conducted in Spring and Fall if possible, during periods of reasonably good weather
9. Manual counts are still needed for validating sensors, collecting demographic and behavioral data, filling gaps in what automated sensors can capture, and more
10. Routine maintenance, validation, data cleaning, management, and usage protocols must be established

TYPES OF COUNTS: MANUAL

- Basically, people observing in real time OR reviewing video data after the fact
- Short duration only
- Segments or intersections
- Volumes, turning movements, travel orientation, behavior, characteristics


UNO student conducting manual count, 2015

*If you **don't have any bike/ped infrastructure, and limited budget,** manual counts might be your best/only option*

Manual Count Summary

Best for:

◊ Understanding user demographics and behaviors
◊ Community-based evaluations
◊ Collecting data for a large number of locations
◊ Intersections and other hard-to-count locations
◊ Validating automated count data accuracy

Key limitations:

◊ High labor demand
◊ Limited data applications
◊ High degree of variation/unreliability
◊ Typically cannot be used year-round

Estimated Cost: Very low (if using volunteer labor), though coordination and data management costs may be prohibitive for large-scale count programs

Examples: New Orleans Regional Planning Commission Pedestrian and Bicycle Count Program, Washington State Bicycle and Pedestrian Documentation Project

TYPES OF COUNTS: AUTOMATED

- Short duration or long duration/permanent
- Mostly segments (video counters may capture intersections)
- Volumes, travel orientation (maybe more with video)
- Primary tools/types of counters:
  - Pneumatic Tubes
  - Infrared Sensors
  - Inductive Loops
  - Automated video detection/classification systems


Short-duration tube count, 2017


Permanent inductive loops, installed 2020

TYPES OF COUNTS: AUTOMATED

Pneumatic Tube Counter Summary

Best for:

◊ Short-duration counts on bike lanes, cycletracks, low-volume shared roadways

◊ Collecting counts at multiple locations on a limited budget

◊ Conducting preliminary counts prior to installing permanent counters

Key limitations:

◊ Tubes wear out quickly in mixed traffic conditions

◊ Regular maintenance required for longer counts

◊ Not suitable for locations where bicyclists' movements are unpredictable (e.g. many sidewalk riders)

Estimated Cost: Approximately $1,500—$2,800 per unit, plus $300 per set of (bicycle-specific) replacement tubes

Examples: LTRC "Pedestrians and Bicyclists Count," Vermont Bicycle and Pedestrian Program


Pneumatic Tubes, Tulane Avenue (2017)


Passive Infrared sensor in housing, Lafitte Greenway, 2017

Passive Infrared Counter Summary

Best for:

◊ Measuring pedestrian volume on sidewalks

◊ Lower-cost permanent counts on off-street bicycle facilities or shared-use trails

Key limitations:

◊ Cannot distinguish between pedestrians and bicyclists

◊ Cannot be used on-street

Estimated Cost: $2,000—$6,000 per unit (depending on range and housing of sensor)

Examples: New Orleans' Lafitte Greenway; San Diego Association of Governments

Relatively inexpensive, easy ways to capture before/after, tubes similar to vehicle counts already collected (but tricky if lacking dedicated infrastructure)

TYPES OF COUNTS: AUTOMATED

Inductive Loop Detector Summary

Best for:

◊ Long-term counts on cycletracks and dedicated conventional or buffered bike lanes

◊ Long-term counts on shared-use paths or trails (combined with an infrared sensor to differentiate modes)

Key limitations:

◊ Electrical/engineering expertise required for installation

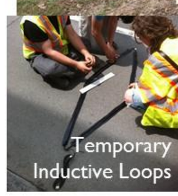
◊ Accuracy decreases in mixed traffic conditions

Estimated Cost: Approximately $2,500—$4,300 per unit, not including installation costs

Examples: Tammany Trace (Mandeville), Colorado DOT Pedestrian and Bicycle Continuous Counts


Pre-Formed Inductive Loops, Rock Island Greenway (Ruston


Infrared + Inductive Loops, Tammany trace


Temporary Inductive Loops


Selective Inductive Loops, Esplanade Avenue

TYPES OF COUNTS: AUTOMATED

Automated Video-Image Processing Summary

Best for:

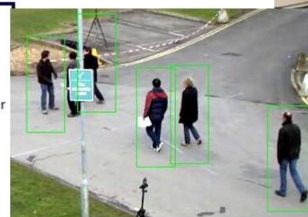
- ◊ Intersection and turning movement counts
- ◊ Areas without dedicated bike/ped infrastructure or unpredictable user behaviors
- ◊ Counting all modes of traffic simultaneously

Key limitations:

- ◊ Technology is still emerging; limited research on available products
- ◊ Relatively complex installation requirements
- ◊ Programming expertise required to calibrate and process data
- ◊ Not suitable for poorly lit contexts

Estimated Cost: Varies widely; full-service vendors typically charge on a monthly subscription basis, plus equipment, software, and/or installation costs

Examples: Jacksonville, FL (Numina partnership); Chicago, IL (Miovision)



Important, emerging alternative:

- Use of phone-based GPS data
- Bike/Ped applications under (rapid) development but not quite there yet
- Great for understanding impacts on flow overall, route choice, speed, relative frequency
- Can't replace actual counts (yet)

Less Commonly Used Options:

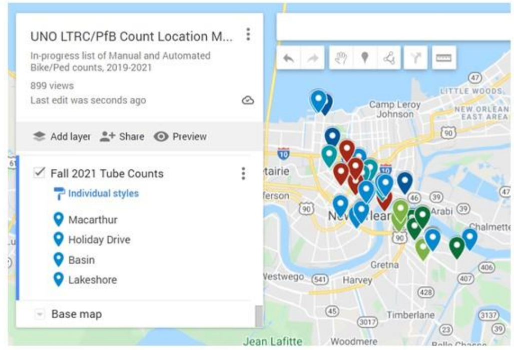
- Piezoelectric strips (similar to inductive loops
- Radar (similar to infrared)
- Overhead thermal sensors (captures movement patterns)
- Fiberoptic sensors
- Laser scanners
- Acoustic/pressure pads
- Magnetometers

COLLECTING MULTIMODAL COUNTS

FROM SITE SELECTION TO DATA MANAGEMENT

SITE SELECTION AND PLANNING: SHORT-DURATION COUNTS

1. **Identify Project Priorities**
   - What is the goal of the proposed data collection?
   - What is the scope of the assessment?
2. **Evaluate Existing Infrastructure:**
   - What kind of bike/ped accommodation currently exists within the project area?
   - What are the "pinch points" in the network?
   - What kind of count technology/approach could be utilized, and where?
3. **Identify Potential Count Locations**
   - Determine site ownership/jurisdiction
   - Collect land use, jobs/population, demographic data; previous counts if available
   - Identify activity generators/preliminary demand estimation
   - Check for previous count data/locations



Map: UNO Count Locations, 2019-2021

SITE SELECTION AND PLANNING: SHORT-DURATION COUNTS

4. **Conduct Site Visits**
   - Do expectations about usage align with observations?
   - Are users constrained to the are being measured?
   - Where, specifically, would counts be conducted?
5. **Determine Count Configuration**
   - Specific plane/zone of observation
     - Detection zone width
     - Facility surface, grade, and alignment (straight, smooth, and level?)
     - Presence of water, debris
   - Identify installation points/feasibility
   - Assess potential impeding factors (security, vegetation, social factors, etc)
   - Presence of electrical interference (testing recommended for infrared/induction; avoid water, direct sunlight, utility lines)
6. **Develop Data Collection Plan**
   - Location, methodology, schedule (inc. weather contingencies)
   - Installation Plan, traffic/worksite protocols
   - Calibration and validation

Gentilly Blvd – Bike Lane Obstructions; Cyclist in parking lane

SITE SELECTION AND PLANNING: SHORT-DURATION COUNTS

- **Count Duration and Timing**
  - 7 days minimum, 2 weeks preferred
  - Fall and Spring ideal (longer "count season" in LA than many places)
  - Exclude periods of inhospitable or unseasonable weather (significant rain events, unusual cold, extreme heat)
  - Avoid holidays, special events (unless part of project scope)
  - In-school periods, minimal COVID restrictions strongly preferred
  - For all counts, record daily high/average/low temp and precipitation at nearest weather station (e.g. wunderground.com)

Cyclist in the rain, Tulane Avenue

SITE SELECTION AND PLANNING: SHORT-DURATION COUNTS

- **Count Equipment Selection**
  - How many observation "zones"?
    - E.g., sidewalk, travel lane, travel lane, sidewalk = 4 zones
    - E.g., two shoulders on a divided highway = 2 zones
  - To what extent are active users constrained to these zones?
  - How many units needed to measure full plane of observation?
    - Active modes counted separately or combined?
    - Travel orientation/direction critical or not?
  - Adequacy of lighting? (cameras)
  - Installation considerations
    - Traffic lane closures
    - Power requirements (eg solar battery placement)

Mobile Counter Options Comparison

(Sample Only, not comprehensive - contact vendors for updated information)

Vendor	Product	Type	Mode(s)	Est. Unit Cost
EcoCounter	EcoTubes	Pneumatic Tubes	Bikes	$2-3k
EcoCounter	EcoPyro	Infrared	Mixed	$2-5k
EcoCounter	EasyZelt	Inductive Loop	Bikes	$3-5k
Spack	CountCAM	Video	Any	$1k
MioVision	Scout	Video (+analysis)	Any	Varies
MetroCount	RidePod BT	Pneumatic Tube	Bike/E-Scooter	$2k
Jamar	Trax Pinnacle	Pneumatic Tube	Bike	$1-2k
RoadSYS	SDR Radar	Radar	Mixed	Varies
Numina	Numina	Video (+analysis)	Any	Varies

INSTALLATION AND CALIBRATION: GENERAL GUIDELINES

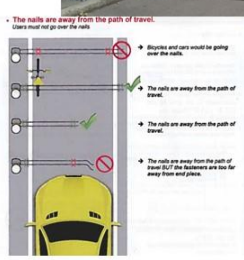
- Follow Manufacturer instructions
- Avoid poorly drained/flood prone areas
- Observe best practices for work site safety
- Plan installation for low-traffic times (all modes) to minimize disruption (e.g., early weekend mornings)
- Bring bicycle to site for testing (if applicable)
- Ensure all tools/equipment prepared (e.g. download and test data link app, inventory materials)

Installation of tubes on Government St, Baton Rouge

INSTALLATION AND CALIBRATION: PNEUMATIC TUBES

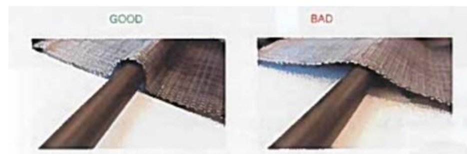
- Identify anchored post for securing equipment
- Avoid high-traffic and loading areas, parking (if possible), stop locations, curves, uneven surface
- Sweep site, measure and mark anchor points
  - Nails/anchors outside of typical path of travel
  - 12" apart or per manufacturer instructions
  - Tubes must be perpendicular to facility, parallel to each other
- Select appropriate fastener/anchor configuration
  - Longer nails for softer surfaces
  - Fasteners suited for traffic volume
  - Mastic tape where nails not feasible/high traffic (reduces tube life)
- Create tape foundation "pads" at anchor locations
  - Not in instruction manuals! Improves adherence
  - Gorilla Tape Tough and Wide works well in most conditions
  - Approx 6"x6" (2 strips each direction)

Tube installation, Basin St



INSTALLATION AND CALIBRATION: PNEUMATIC TUBES

- Drill anchor point guide holes
  - Hammer drill required for concrete; optional for asphalt or soft surface
- Insert/hammer nails, leaving approx. ½ inch exposed
  - 3 lb mini-sledge effective for asphalt installation
- Attach fasteners to tubes at approximate anchor points
- Fix tube ends
  - Place fastener on nail furthest from counter
  - Hammer nail until flush with ground
  - Stretch tube about 15% until taught – little lateral movement—and adjust other fastener to place on nail nearest counter
  - Hammer nail until flush with ground
- **Connect to Counter in app and test for function!**
- Secure/cover fasteners with tape and secure every 2-3 ft between nails
- Secure excess tube and lock unit to pole/post



INSTALLATION AND CALIBRATION: INFRARED SENSOR BOX

- Attachment Mechanisms Vary – follow unit instructions
- Ensure sensors point AWAY from motor vehicles
- Do not point sensors at:
  - Metallic object
  - Door or window
  - Bushes, tall grasses, other movement-prone vegetation
  - Wayfinding, bench, or other locations that encourage congregation
- Wrap sensor in aluminum foil to mitigate potential electrical interference
- Position at correct height (typically 27-32 inches: e.g., tall enough to catch a child, but not a dog), perpendicular to flow of traffic
- Secure and lock unit

Infrared Sensor, Ruston LA

INSTALLATION AND CALIBRATION: ACTIVATION AND TESTING

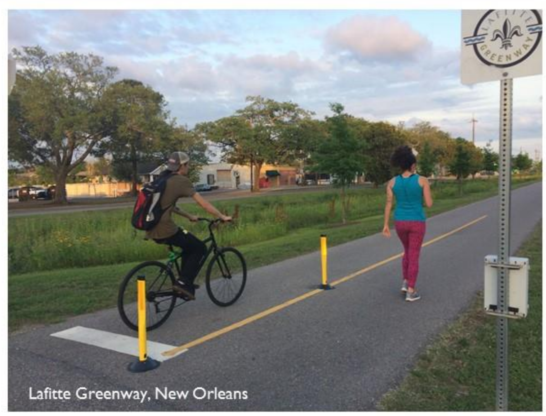
- Follow manufacturer instructions for activation and set-up
- Test GSM connection if applicable
- Conduct synthetic count: test detection at various points within sensor range, all detected modes, directionality (if applicable): minimum 10 passes per mode, per direction
- Adjust sensor settings if issues identified and re-test until 10/10 correctly detected or site-specific limitation diagnosed
  - For infrared sensors, check range sensitivity, sensor alignment, possible interference
  - For pneumatic sensors, check tension, tube condition, pressure on tubes
  - Record installation finish time (exclude any test counts from final data, take photos, note any sensor/context issues preliminarily identified)


Tube Installation, Baronne St

DATA VALIDATION

Type and Extent of errors/bad data:

- Occlusion: most common, bikes + peds in groups = undercount
- Modal misclassification: bikes counted as peds, infrequent, often with occlusion (more likely with groups), implications for siting
- Obstructions: infrequent and easy to spot (zero counts or 1 hr spike due to "loiterers", parked cars), mostly affects infrared (or tubes)
- False positives: mostly affects infrared, can be serious concern – not all instances explained, weather correlations inconclusive – *Exclude any suspicious data*
- Damage: always a risk! Check units periodically in field; set software to alert for zero-counts to minimize time lost


Lafitte Greenway, New Orleans

DATA VALIDATION

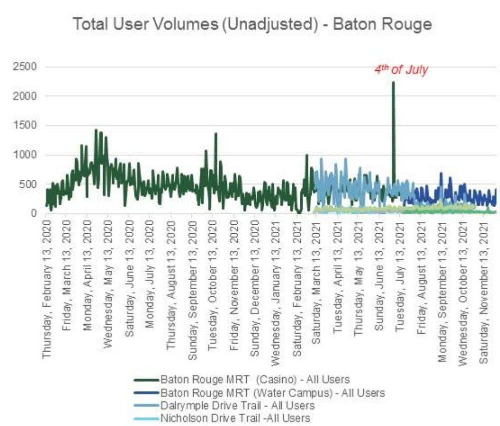
Recommended Practice:

- **At least** one 2-hour manual validation count per installation
  - More if working with new tech, 3rd party video processing
- Observe during recorded or presumed peak period
- Target >100 users for each mode
- To identify systemic errors, context-specific issues, modal split (for mixed-mode facilities)
- Use Manual Count findings to **evaluate the accuracy** of the data by one or more of the following measures:
  - Overall error/average percent deviation (APD): the overall divergence from perfect, observed accuracy, including both over- and under-counts
  - Average of the absolute percentage difference (AAPD): a measure of consistency of the data (the lower the better)
  - Pearsons correlation coefficient R - value


Validating sensor function, Esplanade Ave

DATA VALIDATION: QA/QC

1. Download Data for specified time period (daily, hourly, by mode and direction)
2. Chart and visually inspect daily, hourly data: review for gaps, spikes, irregularities
3. Determine criteria for assessing outliers
   - Recommended practice: use conditional formatting to flag unusual volumes, e.g.:
     - More than 2 standard deviations above or below average of 8 same time of week counts
     - Identify outliers based on interquartile range of all counts of a particular type (including direction, weekday vs weekend)
     - Low volume sites are harder to automate: local knowledge essential!
4. Cross check against special events, weather conditions
5. Use professional judgement and context knowledge/research to decide which data to include/exclude
6. Document all editing decisions and retain a copy of the raw dataset

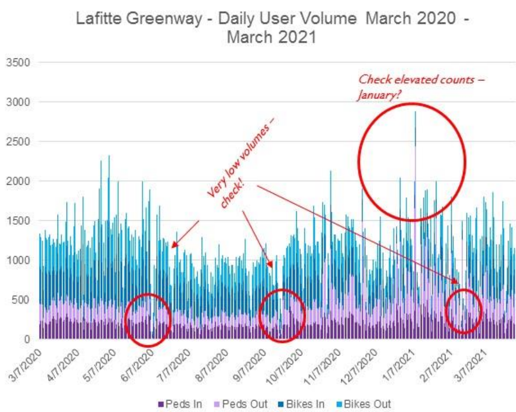


DATA MANAGEMENT AND REPORTING

7. **Calculate Basic Data Outputs/calculations for each location:**
   - Daily/hourly user volumes: full period
     - Preserve raw data; note any exclusions and/or imputations
   - Overall mean, median daily users; standard deviation, interquartile range
   - Average users by month, day of week, hour of day (weekend vs weekday)
   - Peak hour average, AM peak average, mid-day peak average, overnight % of total
   - Weekend and Morning Ratios and preliminary travel pattern
   - Data completeness statistics (hours/days omitted for any reason as % of total)
   - Weather data: temperature, humidity, precipitation – average variation for high, low temps; rainy days
   - Temporal adjustment/expansion factors: derive AADT estimates from short-duration counts at any time of year for sites with 12+ months of solid data and similar characteristics (in development)

DATA PROCESSING EXAMPLE: Lafitte Greenway

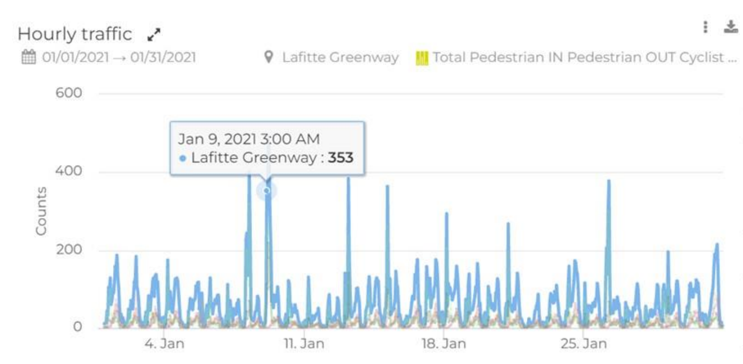
DATA PROCESSING EXAMPLES: INITIAL REVIEW



- **Chart daily data by mode**: look for spikes, zero-counts, outliers
  Can this be explained by weather, events, etc?
- **Chart Hourly data by day of week** (+ weekday vs weekend) – what are the observed trends? Any days/periods look unusual?

- Chart against long duration (same location or peer location) patterns and/or previous data at this location: Are there major changes in either **pattern or magnitude?**

DATA PROCESSING EXAMPLES: DATA QA/QC

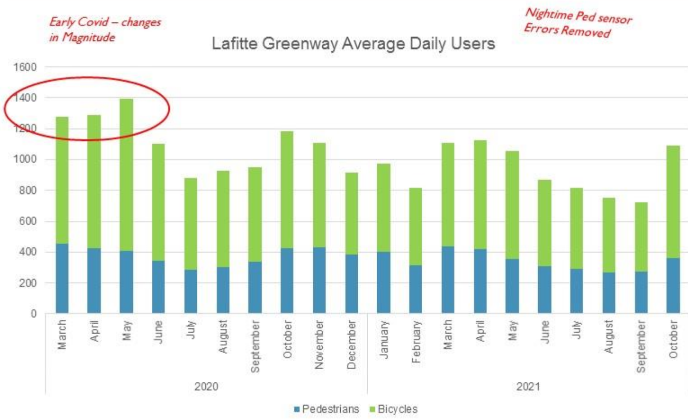


Example initial Review: Unusual spikes in hourly activity during late night hours on Lafitte Greenway, Jan 2021

QA/QC Rules Defined:

- Calculate average total users, midnight – 6am during 3+ months before error started occurring (or same month previous year if available)
- Overnight total typically less than 5% of ADT (3-6% in cleaned sample)
- Conditional formatting to flag all hours where 1 hr total between 12 and 5 > average overnight 6 hr total
- Manual review of flagged results and exclusion of erroneous data
- Recalculate daily totals in excel
- NOTE in daily total hours/periods omitted

DATA PROCESSING EXAMPLES: DATA QA/QC



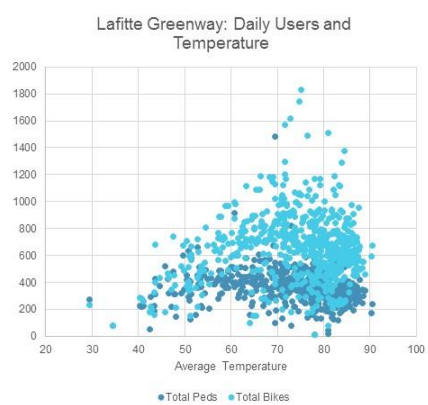
Summary Statistics: July 1 20 - Oct 31, 21	Pedestrians	Bicyclists	Total Users
Mean	351	607	955
Median	342	619	960
Standard Deviation	122	205	
Interquartile Range	124	252	
Q1	282	477	
Q3	405	729	

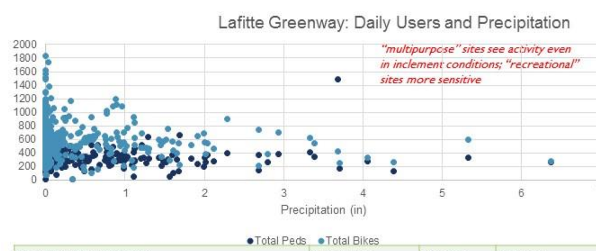
large St. Dev common – high variability, esp. bikes

Site stats used to inform conditional formatting flags for QA/QC: where does data deviate significantly from norm?

Note: irregularity does not mean data is inaccurate!

DATA APPLICATIONS AND EXAMPLES: ANALYZING WEATHER IMPACTS





Weather (FULL PERIOD	Pedestrians	Bicycles	All Users
Average Daily Users - All Conditions	361	656	1016
Average Daily Users, No Precipitation	377.4	703.1	1080.5
Average Daily Users, Precipitation > .5 inch	333.7	561.7	895.4
% Difference, Precipitation vs. Dry	-13.1%	-25.2%	-20.7%
Average Daily Users, High temp above 90 degrees	317.3	649.9	967.2
Average Daily Users, High temp below 50 degrees	198.9	223.3	422.1

Bikes more sensitive to rain than peds

Cold impacts volume more than hot!

DATA PROCESSING EXAMPLES: DEVELOPING ADJUSTMENT FACTORS

Useful for flagging spikes

Used to calculate Weekend/Morning ratios

	Average Daily Users - Weekday			Average Daily Users - Weekend		
	Pedestrians	Bicycles	Total Users	Pedestrians	Bicycles	Total Users
Peak hour average:	31.3	54.5	85.7	27.9	63.7	91.6
Average houly traffic 7-9am:	24.2	27.2	51.5	24.2	20.8	45.0
Average hourly traffic 11am-1pm	16.3	29.6	45.9	24.7	50.9	75.5
Overnight Total	8.1%	3.4%	5.2%	6.7%	3.9%	4.8%

<5% most locations; note LOWER than pre-COVID in New Orleans

Factor Group Calculation:			
	Weekend Ratio	Morning Ratio	Travel Pattern
Pedestrians	0.9	1.5	Multipurpose
Bicycles	1.2	0.9	Non-Commute

Note: Travel patterns of count locations do not neatly fit previously established Factor Group Calculations; most classified as "non-commute" even when obvious utilitarian/transportation activity observed; ***overall volume and weekend % more useful***

DATA PROCESSING EXAMPLES: DEVELOPING ADJUSTMENT FACTORS

- Data Expansion and Short-Duration Count Adjustments
  - Permanent counts used to aid in interpreting/extrapolating short-duration counts (e.g. before/after, seasonal)
  - Temporal adjustment/expansion factors: for sites with 12+ months of solid data only
- Suggested revised factor groups: Louisiana doesn't fit the established, big-city models
  - Most sites "Non-Commute/Mid-Day Activity"
    - Low levels of active commuting outside of larger cities
    - Non-traditional work patterns (i.e. NO hospitality/tourism)
    - COVID long-term impacts on commute behavior
  - More relevant variables: weekend/weekday ratio, overall volume (low, medium, high), facility type, land use/urban form: **which extant count site is the best overall fit for interpreting short-duration data?** Proximity, character, facility type, volume all important

Monthly (Seasonal) Adjustment Factors - Lafitte Greenway July 2020 - Oct 2021

	Average Daily Volumes by Hour		Percentage of Traffic		Adjustment Factors	
	Pedestrians	Bicyclists	Pedestrians	Bicyclists	Pedestrians	Bicyclists
Jan	401	571	9.3%	7.8%	0.90	1.07
Feb	314	505	7.3%	6.9%	1.15	1.21
Mar	438	671	10.1%	9.2%	0.82	0.91
Apr	418	705	9.7%	9.6%	0.86	0.86
May	357	698	8.3%	9.5%	1.01	0.87
Jun	308	563	7.1%	7.7%	1.17	1.08
Jul	290	561	6.7%	7.7%	1.24	1.09
Aug	285	554	6.6%	7.6%	1.26	1.10
Sep	304	534.5	7.0%	7.3%	1.19	1.14
Oct	394	743	9.1%	10.2%	0.91	0.82
Nov	432	676	10.0%	9.2%	0.83	0.90
Dec	383	535	8.9%	7.3%	0.94	1.14

DATA PROCESSING EXAMPLES: USING ADJUSTMENT FACTORS

- Simple Seasonal Expansion: (NCHRP 797)
  - Short Duration Count Data: you have 14 days of counts in JULY on a facility that you have identified *similar in characteristics* the Lafitte Greenway, and need to provide a rough AADT (Average Annual Daily Traffic) figure
  - The ADT for your count period is 189 bicyclists and 125 pedestrians per day
  - **Ped AADT: 125 * 1.24 = 155 estimated pedestrians per day**
  - **Bike AADT: 189 * 1.09 =206 estimated bicyclists per day**
  - *July is a relatively low-volume month: AADT expected to be HIGHER for both bikes and peds*
- Day of Year Expansion:
  - Similar, but adjustment factors calculated for 365 days
  - Inherently accounts for weather, found to be more accurate
  - Short count and adjustment factors must be derived from complete data in same year and recalculated annually

Monthly (Seasonal) Adjustment Factors - Lafitte Greenway July 2020 - Oct 2021		
	Adjustment Factors	
	Pedestrians	Bicyclists
Jan	0.90	1.07
Feb	1.15	1.21
Mar	0.82	0.91
Apr	0.86	0.86
May	1.01	0.87
Jun	1.17	1.08
Jul	1.24	1.09
Aug	1.26	1.10
Sep	1.19	1.14
Oct	0.91	0.82
Nov	0.83	0.90
Dec	0.94	1.14

KEY TAKEAWAYS

- **Dedicated bike/ped facilities are the easiest to monitor:**
  - Sidewalks → Infrared sensors
  - On-street bike lanes/protected bike lanes→ pneumatic tubes
  - Shared-use trails→ infrared (ideally + mini-tubes)
- **Video-based counts are optimal where dedicated facilities do not yet exist**
  - Still want minimum 7 days data, broken down to hour: ensure compatibility with other count sources (mode, direction, travel orientation, etc)
  - Take care to make sure field of vision prioritizes full bike/ped path
- **Plan for field validation, contextualization of data**
  - Infrastructure impacts can take time: network integration is key
  - Use additional data sources, proxies for assessing latent demand
  - Lack of observed activity does not equal lack of demand

THANK YOU!

THE UNIVERSITY *of* NEW ORLEANS
UNO TRANSPORTATION INSTITUTE

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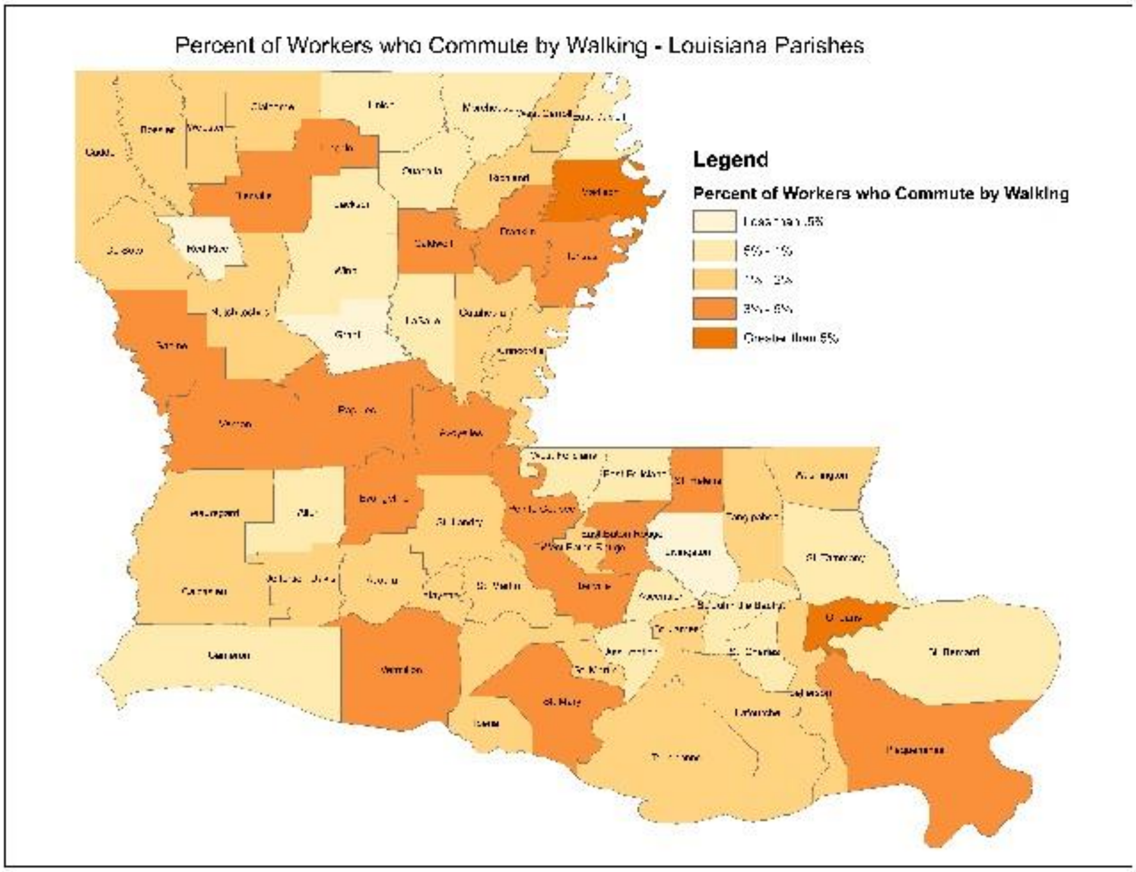
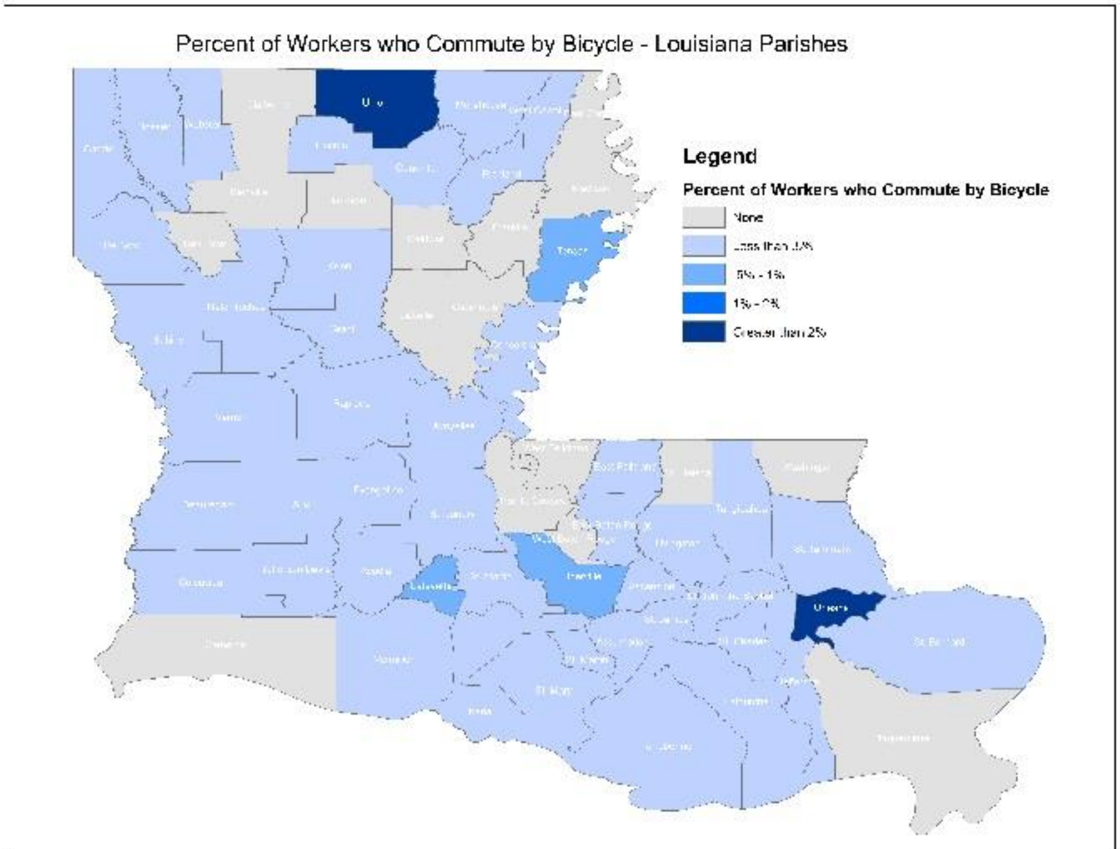
G. Areawide Exposure Estimation Results

Figure 41: Share of commute trips by walking



Data source: ACS 2018 5-year estimates, Table B08103

Figure 42. Share of commute trips by bicycle



Data source: ACS 2018 5-year estimates, Table B08103

Table 43. Annual fatal and severe pedestrian crashes per 100 bicycling or walking commuters

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
East Carroll Parish	7.50	n/a
Morehouse Parish	4.75	5.45
Winn Parish	4.14	2.22
Red River Parish	4.00	n/a
St. John the Baptist Parish	2.68	0.80
Livingston Parish	2.62	25.00
East Feliciana Parish	2.00	0.00
Ouachita Parish	1.96	1.11
West Baton Rouge Parish	1.72	n/a
St. Landry Parish	1.61	8.75
Ascension Parish	1.61	1.48
Union Parish	1.59	0.12

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
Caddo Parish	1.44	1.25
St. Bernard Parish	1.39	0.56
Jefferson Davis Parish	1.37	0.61
Jackson Parish	1.33	n/a
LaSalle Parish	1.33	n/a
Bienville Parish	1.31	n/a
Calcasieu Parish	1.30	0.77
Iberville Parish	1.24	0.90
Tangipahoa Parish	1.21	1.69
Tensas Parish	1.21	0.00
Catahoula Parish	1.14	n/a
Washington Parish	1.13	n/a

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
St. Martin Parish	1.09	2.42
St. Tammany Parish	1.07	0.84
St. Charles Parish	1.00	0.21
West Carroll Parish	0.93	0.00
Allen Parish	0.91	13.33
Bossier Parish	0.90	0.49
Natchitoches Parish	0.90	1.43
Terrebonne Parish	0.90	0.87
Iberia Parish	0.86	0.64
Assumption Parish	0.86	10.00
Webster Parish	0.82	2.11
St. Mary Parish	0.80	3.48

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
East Baton Rouge Parish	0.80	0.88
Rapides Parish	0.78	1.05
Lafourche Parish	0.74	2.42
West Feliciana Parish	0.73	n/a
St. Helena Parish	0.71	n/a
Orleans Parish	0.62	0.33
Madison Parish	0.62	n/a
St. James Parish	0.62	0.00
De Soto Parish	0.61	0.95
Grant Parish	0.59	0.00
Caldwell Parish	0.51	n/a
Lafayette Parish	0.51	0.66

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
Concordia Parish	0.51	0.00
Avoyelles Parish	0.44	0.74
Jefferson Parish	0.43	0.73
Franklin Parish	0.42	n/a
Evangeline Parish	0.40	0.00
Acadia Parish	0.40	4.44
Plaquemines Parish	0.34	n/a
Lincoln Parish	0.31	0.00
Sabine Parish	0.28	0.00
Beauregard Parish	0.26	0.51
Richland Parish	0.24	0.00
Vermilion Parish	0.22	1.79

Parish	Annual Fatal and Severe Pedestrian Crashes per 100 Walk Commuters	Annual Fatal and Severe Bicycle Crashes per 100 Bicycle Commuters
Vernon Parish	0.13	0.00
Pointe Coupee Parish	0.08	n/a
Cameron Parish	0.00	n/a
Claiborne Parish	0.00	n/a

Data sources: Center for Analytics & Research in Transportation Safety (CARTS) SHSP: Vulnerable Road users Dashboard http://datareports.lsu.edu/SHSPVulnerableUsers.aspx, annual average of 5 years (2014-2018) fatal and severe injury crashes per parish; U.S. Census American Community Survey 2018 5-year estimates, Table B08301

23 U.S.C 407 Disclaimer: This document, and the information contained herein, is prepared for the purpose of identifying, evaluating, and planning safety improvements on public roads, which may be implemented utilizing federal aid highway funds. This information shall not be subject to discovery or admitted into evidence in a Federal or State court pursuant to 23 U.S.C. 407.

Louisiana Statewide SCRAM Results

Table 44. Louisiana statewide SCRAM results

	2013	**2014**	**2015**	**2016**	**2017**
Pedestrians					
Estimated Annual Pedestrian Trips	420,195,672	458,213,546	513,110,750	415,051,771	422,650,636
Estimated Annual Pedestrian Miles of Travel	403,152,027	439,627,849	492,298,356	398,216,768	405,507,414
Estimated Annual Pedestrian Hours of Travel	102,794,842	112,095,370	125,525,183	101,536,461	103,395,414
Pedestrian Fatalities	97	105	106	127	115
Pedestrian Fatalities/Million Hours of Travel	0.944	0.937	0.844	1.251	1.112
Bicyclists					
Estimated Annual Bicyclist Trips	47,363,487	40,106,941	45,823,785	40,957,121	49,508,058

	2013	2014	2015	2016	2017
Estimated Annual Bicyclist Miles of Travel	73,856,012	62,540,554	71,455,085	63,866,278	77,200,138
Estimated Annual Bicyclist Hours of Travel	14,477,636	12,259,522	14,006,994	12,519,397	15,133,169
Bicyclist Fatalities	14	13	34	22	23
Bicyclist Fatalities/Million Hours of Travel	0.967	1.060	2.427	1.757	1.520
All Non-Motorized Users					
Estimated Annual Non-Motorized Trips	467,559,160	498,320,487	558,934,535	456,008,892	472,158,694
Estimated Annual Non-Motorized Miles of Travel	477,008,039	502,168,403	563,753,441	462,083,046	482,707,552
Estimated Annual Non-Motorized Hours of Travel	117,272,479	124,354,891	139,532,177	114,055,858	118,528,583
Total Non-Motorized Fatalities	111	118	140	149	138

	2013	2014	2015	2016	2017
Total Non-Motorized Fatalities/Million Hours of Travel	0.947	0.949	1.003	1.306	1.164

MPO-Level SCRAM Outputs

[see attached Excel Workbook]

H. Data Validation, Processing, and QA/QC

Automated Pedestrian and Bicycle Sensor Validation and Calibration Protocol

Pedestrians and Bicyclists Count - LTRC Project

Draft 6/14/17

This protocol outlines procedures for validation and calibration of bicycle and pedestrian counts obtained by Eco-Pyro and Eco-Tubes sensor devices installed at each "Pedestrians and Bicyclists Count" case study location. This protocol is adapted from protocols used in the National Highway Cooperative Research Program (NCHRP) Study 07-19, " Methods and Technologies for Collecting Pedestrian and Bicycle Volume Data,[4]" and

4 Ryus, P., E. Ferguson, K. Laustsen, R. Schneider, F. Proulx, T. Hull, and L. Miranda-Moreno. *Methods and Technologies for Pedestrian and Bicycle Volume Data Collection.* NCHRP Project 07-19 Final Report. Kittelson & Associates, Inc., Portland, Ore., 2014； Ryus, P., E. Ferguson, K. Laustsen, R. Schneider, F. Proulx, T. Hull, and L. Miranda-Moreno. *Methods and Technologies for Pedestrian and Bicycle Volume Data Collection.* Guidebook on Pedestrian and Bicycle Volume Data Collection. NCHRP Project 07-19. Kittelson & Associates, Inc., Portland, Ore., 2014.

protocols used previously by the Rails to Trails Conservancy's Trail Modeling and Assessment Platform (TMAP) project. Procedures for data cleaning (e.g. identification and censoring of invalid counts) are not summarized in this document.

Validation refers to procedures to ensure that each sensor device is recording bicycles and/or pedestrians traveling in each direction as accurately as possible and to adjust monitors in the field. Calibration refers to procedures to measure the consistency and reliability of counts (e.g., relative accuracy at different traffic volumes), determine the need for correction factors, and, if needed, estimate correction equations to apply to monitoring data. Validation generally will occur during or proximate to installation. For short-duration (2 week) counts, this will involve briefly ensuring that each sensor is functioning correctly and logging bicyclists or pedestrians in the sensor path. Calibration will involve a longer duration (2 hour) evaluation of sensor function and accuracy, and may be completed at any point during the monitoring period prior to data analysis. Data for validation may be collected either through field observation or collection, viewing, and analysis of video tape.

Note that these observation durations represent a minimum recommended number of data intervals (8 with 15 minute data increments), appropriate for short-duration counting. Additional observation and calibration time is recommended for permanent or long-duration count locations.

<u>Validation Procedures for Short-Duration Counts</u>

The objective of validation is to ensure that each count device is counting nonmotorized traffic within its range and path of observation as accurately as possible. The general approach to validation is to compare automated counts from each sensor to counts obtained from manual observation of corridor traffic, either in the field or from video. Because the EcoCounter sensor deployed report data only in 15-minute bins, validation studies that involve comparison of counts for binned periods cannot determine why counts are inaccurate. To obtain information about the reasons counts may be inaccurate, different procedures must be used in the field. Because these different procedures involve field observations while accessing the loggers through EcoLink software, validation exercises to determine why counts are inaccurate generally will be done only during installation or if problems in counting are suspected.

Initial Sensor Validation and Trouble Shooting

Initial validation will occur following installation and will be done through manual observation and comparison of counts logged by the device Logger to the counts taken by observation. This approach requires use of Eco-link software (and is the only method that enables observers to determine which traffic events are not being counted properly). This approach also can be used to troubleshoot if there is reason to assume the device is not recording properly and it becomes necessary to confirm that bicycles and pedestrians traveling in both directions are being counted.

Because of the design of the EcoCounter sensors and the Eco-LINK software and the complexity of monitoring high volumes of traffic in the field, it is extremely difficult to determine which events cause inaccurate classification and logging of data. Despite the limitations imposed by design of the devices and software, it is possible to validate automated counts and obtain insight into the nature of events that result in measurement error.

To complete the initial validation or to troubleshoot, you will need these items:

1. A day with clear weather;
2. A Windows laptop with an operating Bluetooth device and the Eco-Link software installed on it OR an android smartphone with Bluetooth and the Eco-Link application installed;
3. The EcoCounter User Guide for each device deployed
4. A sensor activation magnet;
5. Map of counting location from Google Maps or other location for mapping direction;
6. Counter Validation and Calibration Counting forms;
7. Pens, pencils, a marker, paper;
8. Smart-phone with clock, compass;

9. Conveniences: folding chair, water, sunscreen, etc.

For initial validation and troubleshooting, follow these steps:

1. *Before heading out into the field*, Make sure Eco-Link is installed on a Windows laptop or Android phone and that device is recognizing Bluetooth connections. Also confirm that your laptop or phone's date and time are set correctly.

2. In the Eco-Counter "User Guide" for each of the sensors in use, follow procedures in the section "Retrieving the Data Manually" for retrieving data and/or testing a counting point.

    a. Wake up the logger using the magnetic key for the logger (see Appendix A for photos).

    b. Launch Eco-LINK on the laptop/phone.

    c. When on the main Eco-LINK page, click on the tab, "Retrieve, Check the Counter" (laptop) OR tap "counters" to connect to the device (phone)

    d. In Eco-Link, continue to the main page which includes tabs for "Display," Retrieval", "Sensor," "Maintenance," and "Installation."

    e. Click on "Display." This will take you to a page with two options: "Reset" and "Start Count Verification." Clicking on "Reset" will clear the screen and enable you to begin verification. Clicking on "Start Count Verification" will enable you to determine which directions are IN and OUT for bicyclists and pedestrians and will enable to you determine whether bicyclists or pedestrians that cross the detection zone are counted.

    f. Observe bicyclists and pedestrians traveling in each direction to confirm that they are being counted by the appropriate sensor and to familiarize yourself with how the Eco-LINK verification function works.

    g. If traffic volumes permit (i.e., are low enough), connect to each sensor one at a time and watch the Eco-Link screen to determine whether the count was recorded accurately. This task will involve watching the current count numbers change. Errors may include:

        i. A "missed event" (i.e., a bicyclists or pedestrian is not counted)

        ii. A "false positive" (i.e., a bicyclist or user is double counted or an extra count is recorded for another (perhaps unknown) reason).

iii. Note: if the sensor has been installed properly, most errors likely will be missed events associated with the problem of bicyclists or pedestrians crossing the detection zone simultaneously. This problem, which is known technically as occlusion, occurs because the infrared sensor cannot distinguish two individuals traveling side-by-side.

h. Note that Eco-LINK does not record time stamps and that the only way to determine if an event has been recorded is to see whether a number has been added to the running total. Only one sensor may be monitored at a time.

i. We suggest a minimum of 5 minutes of initial traffic observation, or sufficient time to determine that pedestrians and/or bicyclists are being accurately counted by each device.

Calibration Procedures for Short-Duration Counts

There are two methods for calibrating counts: video monitoring or manual field monitoring. In either case, after trail traffic counts are obtained, project staff will follow procedures established in the NCHRP 07-19 study for validation (described in detail below). These procedures involve comparison of hourly counts recorded by each sensor device with hourly counts obtained through manual observation in the field or through reduction of video, with a minimum recommended 8 data intervals (2 hours at 15 minute increments). This approach to validation is being taken because the validity of counts provided by Eco-Counter sensors generally has been established and because the emphasis is on quantifying and adjusting for known error is estimates provided by the Eco-Counter counters.

Calibration involves:

- Calculation of relative accuracy of device sensor counts for multiple one-hour periods,
- Determination whether the error (i.e., difference between automated and observed counts) is systematic (e.g., consistently low or varies with flow);
- Determination whether the error requires correction, and
- Calculation of correction equations (if necessary).

Researchers will create scatterplots of manual and automated counts to assess magnitude and consistency of error for each sensor device, at each location installed.

Technical Recommendations for Count Validation Using Video

- The camera view and field of placement must be adequate to observe all users (and avoid obscuring users traveling side-by-side);
- The camera must be sufficiently sensitive to maintain images during periods of very low light;
- The video images must be able to be played frame-by-frame or at a user-specified frame rate (not all proprietary video recorders available in the market enable this feature);
- Cameras with a resolution of at least 640x480 are preferred;
- Cameras that capture 15 frames per second are preferred.
- Video should be taken for at least two hours during a period of high traffic (e.g., weekdays, 3:00 p.m. – 7:00 p.m. or weekends, 10:00 a.m. – 2:00 p.m. during each calibration period.

Count Validation by Manual Field Observation

To complete the initial validation or to troubleshoot, you will need these items:

1. RTC Counting form (TWO COPIES);
2. Pens, pencils, paper;
3. Smart-phone with clock, compass;
4. Conveniences: folding chair, water, sunscreen, etc.

Effort should be made to complete validation counts during a range of traffic conditions, but with more counts during higher traffic volumes (e.g., weekdays 3:00 p.m. - 7:00 p.m. or Saturday mid-day, depending on the location).

For validation through manual field observation, follow these steps:

1. Complete administrative and other information at top of validation count form, being careful to note being careful to note direction of traffic (may be defined by cardinal directions, lakeside/riverside [New Orleans only], or by landmark as appropriate). On the map, add a screenline indicating the rough location of each count device, and arrows indicating the directions for Side 1 and Side 2.
2. Check to ensure that the time on the EcoCounter device and your phone are aligned.
3. Set an alarm for each 15-minute interval, and begin counting **EXACTLY** at the beginning of the hour, and monitor traffic for 2 hours. Try to obtain a traffic count of at least 100 (summed across all eight categories: two directions for each bicycle sensor, two directions for each pedestrian sensor). Be careful to count users at the exact moment they pass the sensor device (these may be slightly different screenlines on each side of the roadway depending on installation configuration.
4. Record actual traffic on the calibration count form using hash marks in 15 minute blocks. This is the single most important step – because the field counts of “actual traffic” will be used to determine an error rate for the Pyro and pneumatic tube sensors.

How to Count Bicyclists and Pedestrians:

1. A count generally will be recorded each time a pedestrian or bicyclist passes through the EcoCounter detection zone (i.e., through the imaginary line created by the infrared beam or over the detection area formed by the diamonds on the paved trail surface). Some nuance is associated with classifying “pedestrians” and “bicyclists.” Below are lists of particular cases and where they fit within the schema of pedestrians/bicyclists for the purposes of this project.
    a. <u>Pedestrians</u>
        i. Pedestrians
        ii. Pedestrians walking dogs (count as one pedestrian, but write this down in the notes field any time you see it)

iii. People walking with walkers

iv. Pedestrian carrying a child in arms or wheeling a baby in a stroller (count as a single pedestrian but write this down in the notes field any time you see it)

v. People rollerblading or skateboarding

vi. People in wheelchairs

vii. People riding on scooters (e.g. razor scooters – also, make a note of this in the notes field)

viii. Pedestrian walking a bicycle

b. Bicyclists

i. People riding bicycles

ii. Children riding bicycles or tricycles

iii. People on Segways (write this down in the notes anytime you see it)

iv. Tandem bicycles: record each as one bicycle count and note each tandem and number of people in notes section

v. Bicycles with trailers: record each as one bicycle count and note each tandem and number of people in notes section

vi. Bicycle "surreys": record each as one bicycle count and note each tandem and number of people in notes section

2. Make note at the bottom of the form of any unusual activity or non-motorized users who are missed or miscounted by the sensors, including but not limited to:

i. Bicyclists riding on the sidewalk

ii. Bicyclists riding outside of the bike lane (not crossing tubes)

iii. Pedestrians walking in the street

iv. Pedestrians walking side-by-side

v. Obstructions to sensor (describe and note duration)

vi. Anybody loitering in the detection zone (Make a note of this- this type of behavior can give false counts. Record as a single count, and note roughly long people loitered in total in the detection zone.

3. At the end of each hour, begin a new count form. At the end of the count period, tabulate counts for each 15-minute period and for each hour.

4. Submit count forms to project manager. The research team will access Eco-sensor counts via the web and compare the automated and field counts

Validation Field Forms

Figure 43. Pedestrian and bicycle counter validation form for on-street facilities and sidewalks

Pedestrians and Bicyclists Count - Counter Validation and Calibration Count Form									
Name:			Date:			Location:			
Time of Counts		Side 1 (define):				Side 2 (define):			
		Bicyclists (in Bike Lane)		Pedestrians (on Sidewalk)		Bicyclists (in Bike Lane)		Pedestrians (on Sidewalk)	
Hour	Minutes	With Traffic	Against Traffic	With Traffic	Against Traffic	With Traffic	Against Traffic	With Traffic	Against Traffic
	:00 - :15								
	:15 - :30								
	:30 - :45								
	:45 - :00								
TOTAL:									

NOTES: (note any bicyclists on sidewalk or left lanes, pedestrians in street, obstructions to sensor, etc)

Figure 44. Pedestrian and bicycle counter validation form for trails

Pedestrians and Bicyclists Count - Counter Validation and Calibration Count Form - TRAILS								
Name:			Date:	Location:		Inbound Toward:		
						Outbound Toward:		
Time of Counts			Within Sensor Field (on trail, within range of sensor)				Outside of Sensor Field	
			Bicyclists		Pedestrians		Bicyclists (e.g. on roadway)	Pedestrians (e.g. behind sensor
Hour	Minutes		Inbound:	Outbound	Inbound	Outbound		
HOUR 1								
	:00 - :15	M						
		F						
	:15 - :30	M						
		F						
	:30 - :45	M						
		F						
	:45 - :00	M						
		F						
TOTAL:								
HOUR 2								
	:00 - :15	M						
		F						
	:15 - :30	M						
		F						
	:30 - :45	M						
		F						
	:45 - :00	M						
		F						
TOTAL:								
NOTES:	(note any unusual observations, large groups, obstructions to sensor, etc)							

Validation Workbook

[see attached Excel Workbook]

I. Site-Level Summary Results

Summary Statistics by Site

[see attached Excel Workbook]

Temporal Variation Summary Results

Table 45. New Orleans count locations – seasonal variation

	Norman Francis Pkwy Trail (July 2020-July 2022)		Algiers MRT July 2020 - March 2022	Lafitte Greenway July 2020 - July 2022		Baronne St (July 2020 - July 2022)	Wisner Trail July 2020 - July 2022		Esplanade Avenue (July 2020 - July 2022)	Behrman Park Trail (November 2020 - June 2022)	
	Peds	***Bikes***	***All Users***	***Peds****	***Bikes***	***Bikes***	***Peds***	***Bikes***	***Bikes***	***Peds***	***Bikes***
Jan	8.9%	6.9%	6.7%	8.1%	6.9%	5.6%	7.9%	7.2%	6.2%	5.3%	5.5%
Feb	8.2%	7.0%	5.9%	8.5%	7.9%	10.9%	7.3%	6.1%	7.2%	5.3%	5.8%
Mar	8.7%	9.1%	8.8%	9.8%	8.9%	9.4%	8.5%	7.9%	9.3%	7.5%	7.0%
Apr	9.7%	9.9%	9.8%	9.7%	10.3%	10.0%	8.8%	8.5%	9.8%	9.0%	8.2%
May	9.3%	9.9%	11.2%	8.6%	9.6%	9.9%	9.0%	9.0%	10.4%	11.5%	10.2%
Jun	6.0%	6.8%	8.0%	7.4%	7.8%	9.3%	8.5%	7.0%	7.4%	7.0%	8.5%
Jul	7.7%	7.1%	8.6%	7.0%	7.5%	7.5%	9.1%	8.9%	7.8%	10.6%	9.9%
Aug	7.5%	7.9%	8.3%	6.9%	7.4%	7.2%	8.6%	10.3%	8.2%	10.0%	9.2%
Sep	7.8%	7.8%	7.8%	7.3%	7.2%	7.5%	7.9%	9.4%	7.7%	6.6%	8.4%
Oct	9.4%	10.7%	9.4%	9.5%	10.0%	9.2%	9.4%	10.8%	10.2%	13.8%	14.3%

	Norman Francis Pkwy Trail (July 2020-July 2022)		Algiers MRT July 2020 - March 2022	Lafitte Greenway July 2020 - July 2022		Baronne St (July 2020 - July 2022)	Wisner Trail July 2020 - July 2022		Esplanade Avenue (July 2020 - July 2022)	Behrman Park Trail (November 2020 - June 2022)	
	Peds	***Bikes***	***All Users***	***Peds****	***Bikes***	***Bikes***	***Peds***	***Bikes***	***Bikes***	***Peds***	***Bikes***
Nov	9.1%	9.3%	7.8%	9.4%	8.9%	7.8%	7.6%	8.2%	8.7%	6.9%	7.0%
Dec	7.6%	7.6%	7.5%	8.0%	7.7%	5.6%	7.3%	6.9%	7.0%	6.4%	6.0%

Table 46. New Orleans count locations – daily variation

	Norman Francis Pkwy Trail (July 2020-July 2022)		Algiers MRT July 2020 - March 2022	Lafitte Greenway July 2020 - July 2022		Baronne St (July 2020 - July 2022)	Wisner Trail July 2020 - July 2022		Esplanade Avenue July 2020 - July 2022	Behrman Park Trail (November 2020 - June 2022	
	Pedestrians	***Bicyclists***	***All Users***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***
Monday	14.2%	13.3%	14.1%	15.2%	13.0%	13.0%	14.1%	13.2%	12.4%	11.8%	13.4%
Tuesday	14.5%	13.1%	13.7%	14.2%	13.1%	14.0%	13.4%	12.9%	12.9%	11.7%	13.9%

	Norman Francis Pkwy Trail (July 2020-July 2022)		Algiers MRT July 2020 - March 2022	Lafitte Greenway July 2020 - July 2022		Baronne St (July 2020 - July 2022)	Wisner Trail July 2020 - July 2022		Esplanade Avenue July 2020 - July 2022	Behrman Park Trail (November 2020 - June 2022	
	Pedestrians	***Bicyclists***	***All Users***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***
Wednesday	13.9%	13.6%	13.0%	13.7%	12.9%	14.0%	13.2%	12.9%	12.3%	11.1%	13.0%
Thursday	15.0%	14.7%	13.1%	14.7%	14.2%	15.1%	14.4%	13.1%	13.9%	12.7%	13.9%
Friday	13.5%	13.8%	12.4%	12.9%	13.9%	15.7%	12.3%	11.6%	13.5%	19.5%	15.2%
Saturday	14.6%	16.2%	16.5%	15.0%	17.1%	15.1%	16.7%	17.3%	17.9%	16.1%	15.6%
Sunday	14.3%	15.3%	17.2%	14.4%	15.8%	13.2%	16.1%	19.0%	17.1%	17.2%	15.0%

Table 47. New Orleans count locations – hourly variation

	Norman Francis Pkwy Trail (July 2020-July 2022)				Algiers MRT July 2020 - March 2022		Lafitte Greenway July 2020 - July 2022				Baronne St (July 2020 - July 2022)		Wisner Trail July 2020 - July 2022				Esplanade Avenue (July 2020 - July 2022)		Behrman Park Trail (November 2020 - June 2022)			
	Weekday		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**	
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians****	***Bicyclists***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***
12:00:00 AM	0.1%	0.1%	0.1%	0.2%	0.4%	0.5%	0.4%	1.0%	0.5%	1.5%	1.0%	2.3%	0.1%	0.3%	0.1%	0.2%	0.9%	0.8%	0.5%	0.9%	1.7%	1.3%
1:00:00 AM	0.3%	0.7%	0.7%	1.2%	0.4%	0.5%	0.4%	0.7%	0.5%	1.0%	0.6%	1.5%	0.2%	0.2%	0.2%	0.2%	0.4%	0.9%	0.4%	0.7%	0.8%	0.8%
2:00:00 AM	0.2%	0.5%	0.5%	0.8%	0.5%	0.4%	0.5%	0.5%	0.4%	0.7%	0.4%	1.1%	0.1%	0.1%	0.1%	0.1%	0.3%	0.7%	0.0%	0.1%	0.0%	0.1%
3:00:00 AM	0.2%	0.4%	0.4%	0.5%	0.8%	0.3%	0.8%	0.3%	0.3%	0.5%	0.3%	0.7%	0.2%	0.1%	0.1%	0.1%	0.2%	0.5%	0.3%	0.4%	0.3%	0.3%
4:00:00 AM	0.3%	0.3%	0.3%	0.5%	0.6%	0.5%	0.6%	0.4%	0.5%	0.4%	0.5%	0.9%	0.3%	0.1%	0.3%	0.1%	0.3%	0.3%	0.2%	0.4%	0.1%	0.4%
5:00:00 AM	1.4%	0.8%	0.5%	0.4%	1.4%	1.0%	1.4%	0.9%	1.0%	0.5%	2.2%	1.0%	2.3%	0.8%	0.7%	0.3%	0.8%	0.5%	0.2%	0.7%	0.2%	0.4%

	Norman Francis Pkwy Trail (July 2020-July 2022)				Algiers MRT July 2020 - March 2022		Lafitte Greenway July 2020 - July 2022				Baronne St (July 2020 - July 2022)		Wisner Trail July 2020 - July 2022				Esplanade Avenue (July 2020 - July 2022)		Behrman Park Trail (November 2020 - June 2022)			
	Weekday		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**	
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians****	***Bicyclists***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***
6:00:00 AM	4.0%	2.0%	1.8%	0.9%	4.8%	2.2%	4.8%	2.3%	2.2%	1.2%	2.5%	1.3%	6.6%	3.3%	3.0%	1.3%	2.1%	1.3%	1.2%	1.1%	0.6%	0.8%
7:00:00 AM	7.0%	4.2%	3.8%	1.8%	6.6%	4.9%	6.6%	4.4%	4.9%	2.3%	3.6%	2.3%	7.9%	6.0%	9.0%	3.4%	3.7%	2.9%	3.4%	2.8%	1.7%	1.5%
8:00:00 AM	6.5%	5.9%	5.5%	3.6%	6.5%	6.3%	6.5%	5.4%	6.3%	3.5%	4.1%	3.7%	7.5%	6.8%	10.9 %	5.8%	5.7%	4.3%	4.2%	3.7%	2.8%	3.1%
9:00:00 AM	5.3%	5.1%	7.4%	5.3%	5.6%	7.0%	5.6%	5.0%	7.0%	5.1%	4.0%	4.6%	7.6%	5.9%	11.5 %	8.3%	5.7%	5.8%	5.8%	3.4%	4.2%	3.1%
10:00:00 AM	4.8%	4.8%	7.6%	6.4%	5.4%	7.5%	5.4%	4.7%	7.5%	6.1%	4.7%	5.4%	6.7%	5.7%	10.2 %	8.7%	5.8%	7.3%	7.4%	3.9%	5.5%	3.9%
11:00:00 AM	4.8%	5.0%	7.1%	7.2%	5.2%	7.6%	5.2%	5.0%	7.6%	6.7%	5.6%	6.2%	5.4%	5.7%	8.8%	8.9%	6.1%	8.2%	6.6%	4.4%	6.7%	5.2%
12:00:00 PM	4.9%	5.6%	6.3%	7.6%	5.3%	7.4%	5.3%	5.4%	7.4%	7.3%	5.9%	7.0%	4.5%	5.7%	6.6%	7.7%	6.3%	8.2%	5.7%	5.2%	6.7%	6.9%

	Norman Francis Pkwy Trail (July 2020-July 2022)				Algiers MRT July 2020 - March 2022		Lafitte Greenway July 2020 - July 2022				Baronne St (July 2020 - July 2022)		Wisner Trail July 2020 - July 2022				Esplanade Avenue (July 2020 - July 2022)		Behrman Park Trail (November 2020 - June 2022)			
	Weekday		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**	
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians****	***Bicyclists***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***
1:00:00 PM	4.4%	5.6%	5.8%	7.7%	5.3%	7.2%	5.3%	5.7%	7.2%	7.7%	7.1%	7.6%	4.0%	5.3%	5.3%	8.0%	5.9%	8.3%	6.1%	6.3%	6.2%	7.3%
2:00:00 PM	4.5%	6.4%	5.9%	8.0%	6.0%	7.9%	6.0%	6.5%	7.9%	8.3%	7.3%	7.3%	3.9%	5.7%	5.4%	8.0%	7.6%	9.2%	5.7%	6.1%	5.9%	8.0%
3:00:00 PM	5.3%	7.5%	6.4%	8.5%	6.8%	8.1%	6.8%	7.5%	8.1%	8.9%	8.2%	8.1%	4.5%	6.7%	5.3%	8.7%	8.7%	8.9%	6.7%	8.2%	7.5%	8.7%
4:00:00 PM	7.1%	8.6%	7.3%	8.1%	8.4%	8.4%	8.4%	9.2%	8.4%	9.1%	9.5%	7.5%	6.9%	8.9%	5.5%	8.6%	8.2%	7.5%	7.6%	9.6%	9.2%	9.8%
5:00:00 PM	11.5%	10.3%	8.8%	8.1%	9.4%	7.4%	9.4%	9.6%	7.4%	7.6%	8.2%	6.7%	9.5%	10.3%	7.0%	7.8%	8.3%	6.6%	8.3%	10.7%	13.6%	11.5%
6:00:00 PM	9.9%	8.5%	7.5%	6.7%	8.5%	5.5%	8.5%	7.7%	5.5%	6.3%	6.2%	5.8%	10.7%	10.0%	4.7%	5.8%	6.8%	5.2%	9.5%	10.9%	8.5%	7.9%
7:00:00 PM	7.8%	6.6%	6.5%	6.0%	6.2%	4.3%	6.2%	6.3%	4.3%	5.1%	5.7%	4.8%	7.4%	6.8%	3.2%	4.4%	5.8%	4.1%	8.4%	8.6%	6.4%	7.3%

	Norman Francis Pkwy Trail (July 2020-July 2022)				Algiers MRT July 2020 - March 2022		Lafitte Greenway July 2020 - July 2022				Baronne St (July 2020 - July 2022)		Wisner Trail July 2020 - July 2022				Esplanade Avenue (July 2020 - July 2022)		Behrman Park Trail (November 2020 - June 2022)			
	Weekday		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**		**Week day**	**Week end**	**Weekday**		**Weekend**	
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians****	***Bicyclists***	***Pedestrians****	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***
8:00:00 PM	4.6%	4.1%	4.6%	3.8%	2.8%	2.5%	2.8%	4.0%	2.5%	3.6%	3.8%	3.9%	2.3%	2.8%	1.4%	1.8%	3.4%	3.1%	5.1%	5.3%	5.6%	4.7%
9:00:00 PM	2.4%	2.9%	2.5%	2.6%	1.4%	1.3%	1.4%	3.2%	1.3%	2.7%	3.4%	3.9%	0.7%	1.4%	0.4%	0.8%	2.8%	2.2%	3.7%	3.0%	2.9%	3.3%
10:00:00 PM	1.6%	2.5%	1.6%	2.2%	0.8%	0.9%	0.8%	2.5%	0.9%	2.3%	2.9%	4.3%	0.4%	0.8%	0.3%	0.5%	2.4%	1.8%	2.0%	2.2%	1.7%	2.0%
11:00:00 PM	1.1%	1.7%	1.1%	1.7%	0.6%	0.7%	0.6%	1.8%	0.7%	1.7%	2.1%	2.4%	0.2%	0.6%	0.1%	0.5%	1.8%	1.5%	1.2%	1.3%	1.1%	1.5%

Figure 45. Percent of total user volume by month - pedestrians/mixed users, New Orleans

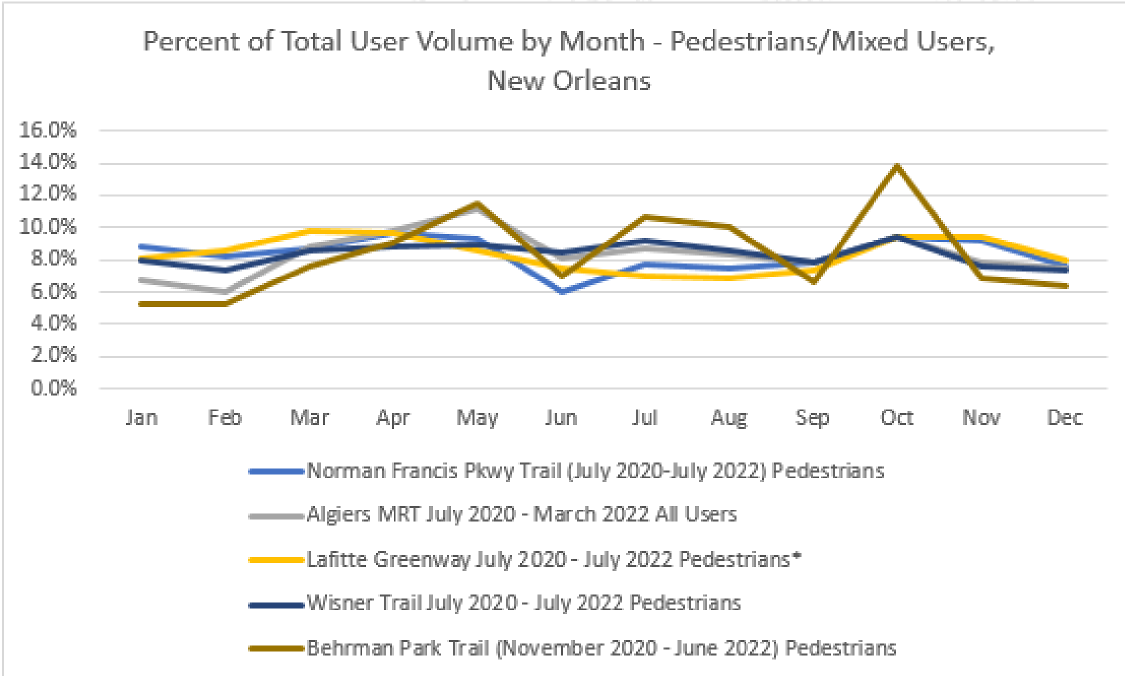


Figure 46. Percent of total user volume by month - bicycles, New Orleans

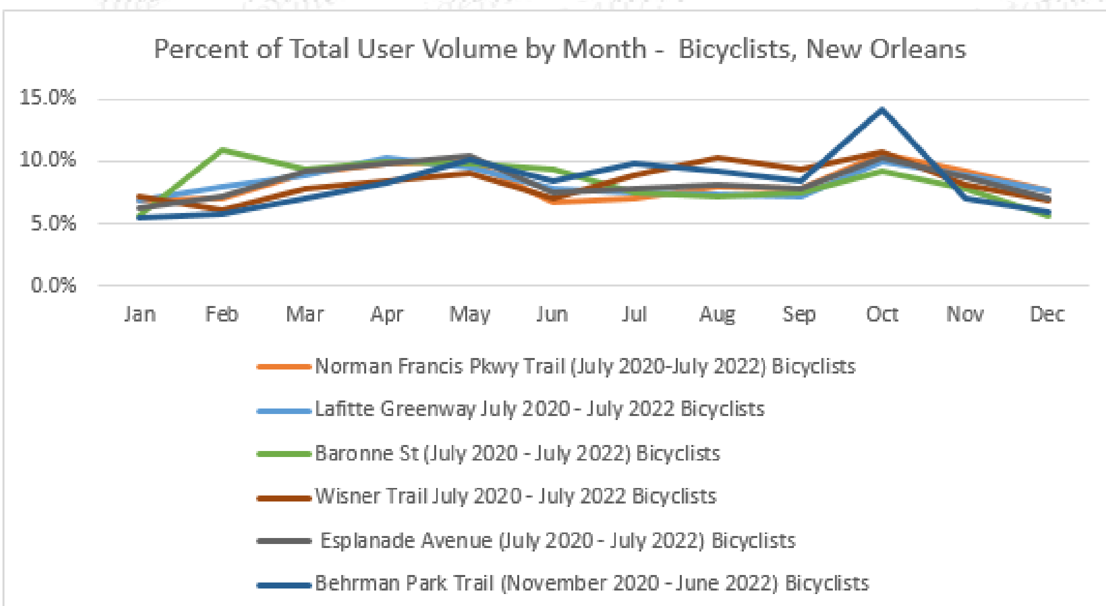


Figure 47. Percent of total user volume by day of week- pedestrians/mixed users, New Orleans

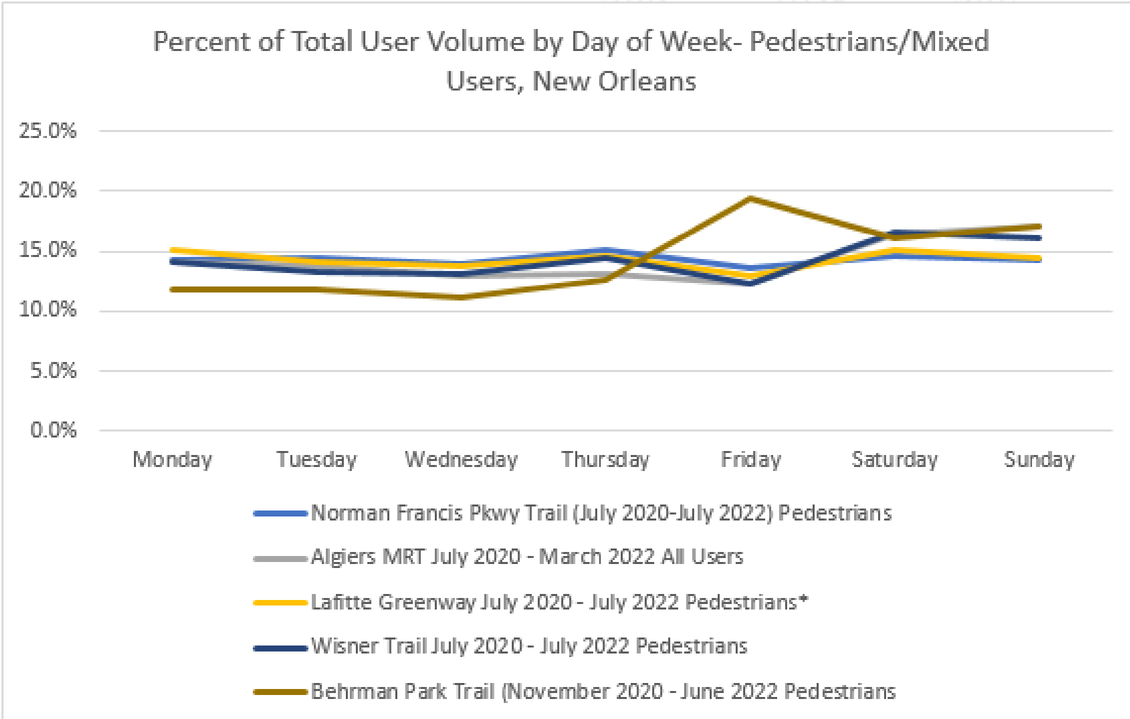


Figure 48. Percent of total user volume by day of week- bicyclists, New Orleans

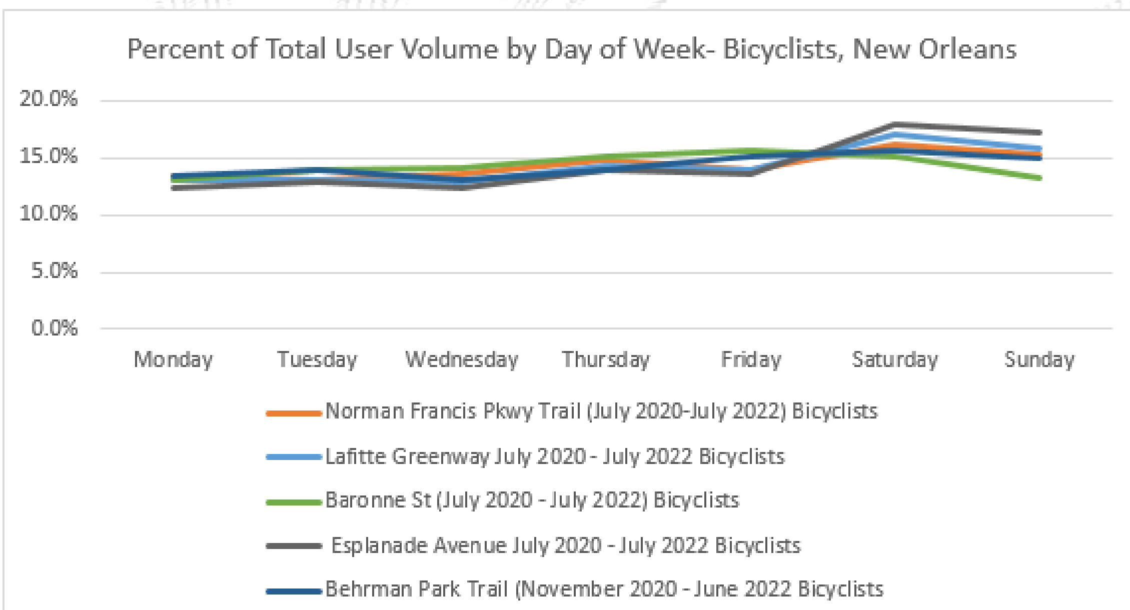


Figure 49. Percent of total user volume by hour of day - pedestrians/mixed users, New Orleans (weekdays)

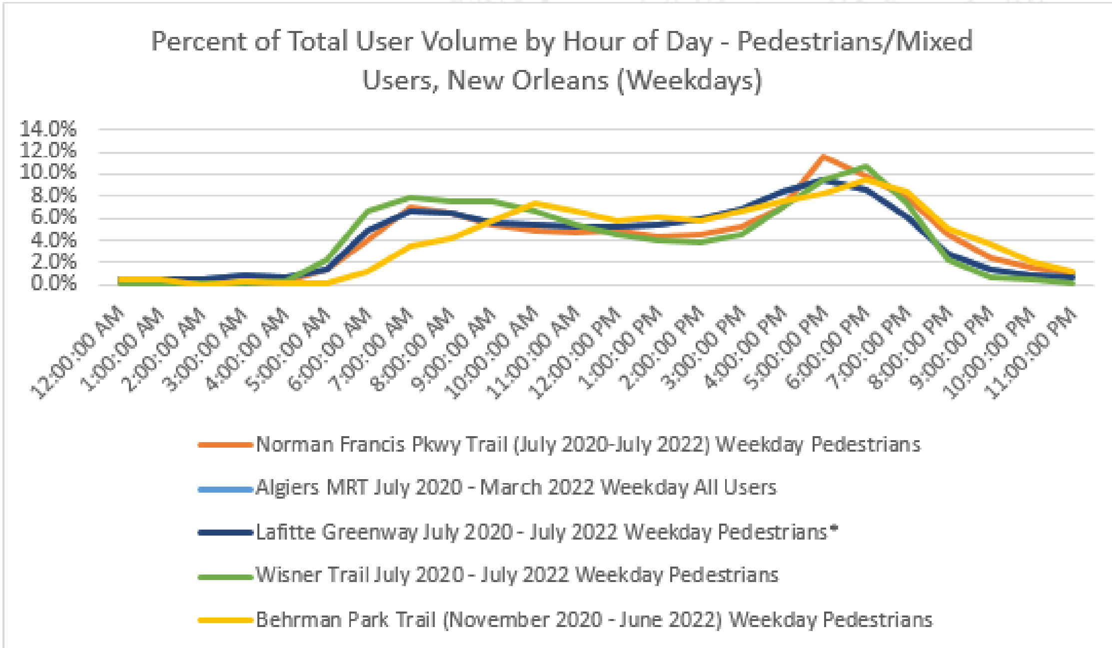


Figure 50. Percent of total user volume by hour of day - pedestrians/mixed users, New Orleans (weekends)

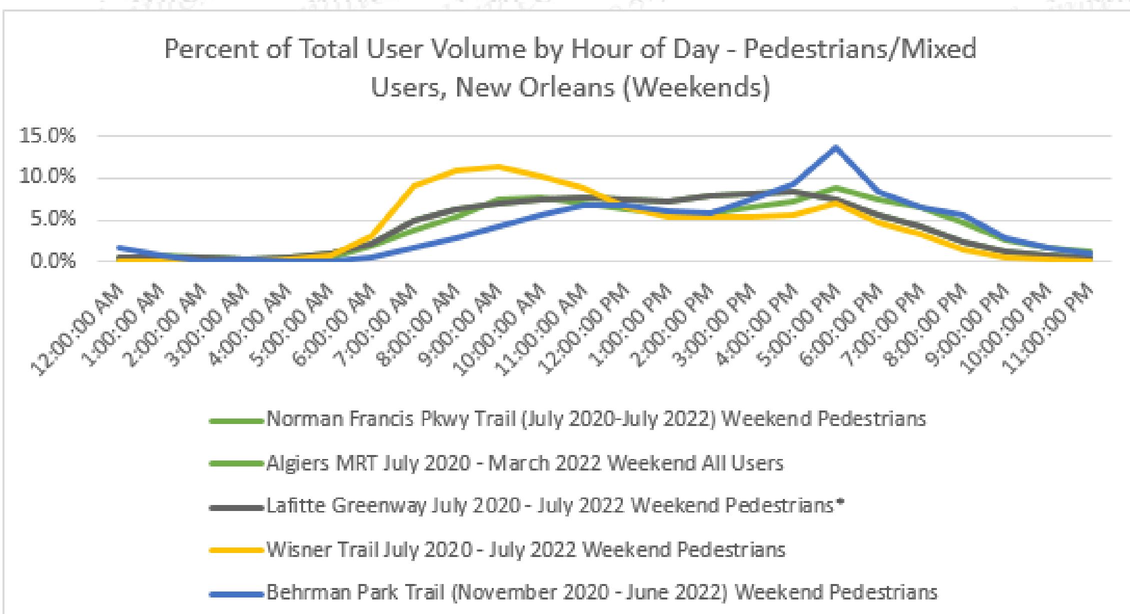


Figure 51. Percent of total user volume by hour of day - bicyclists, New Orleans (weekdays)

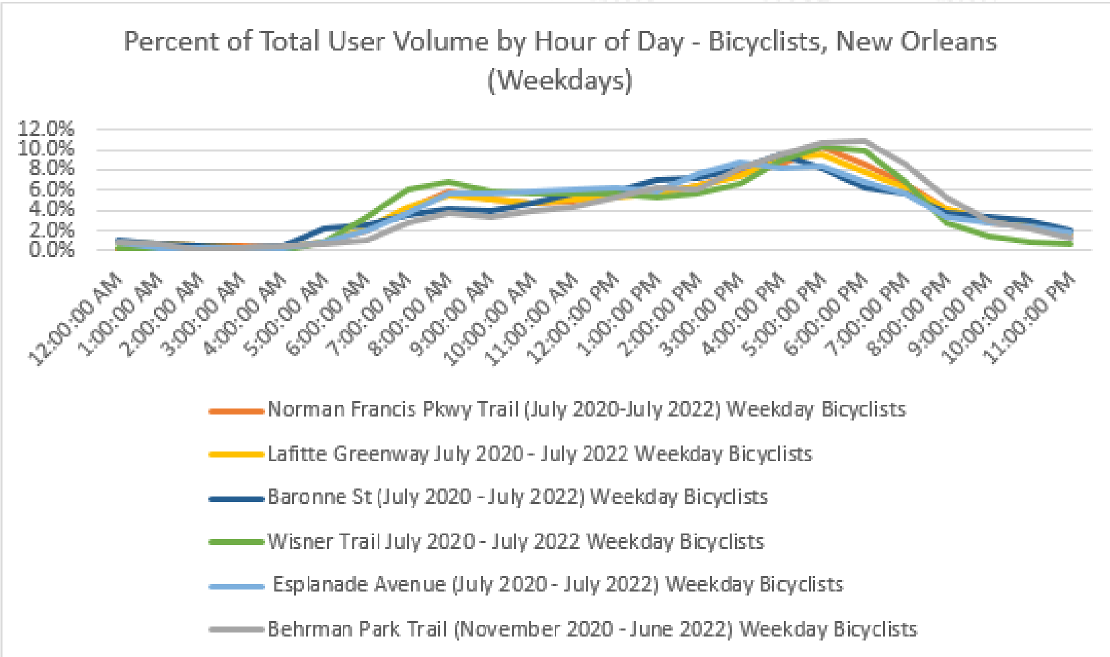


Figure 52. Percent of total user volume by hour of day - bicyclists, New Orleans (weekends)

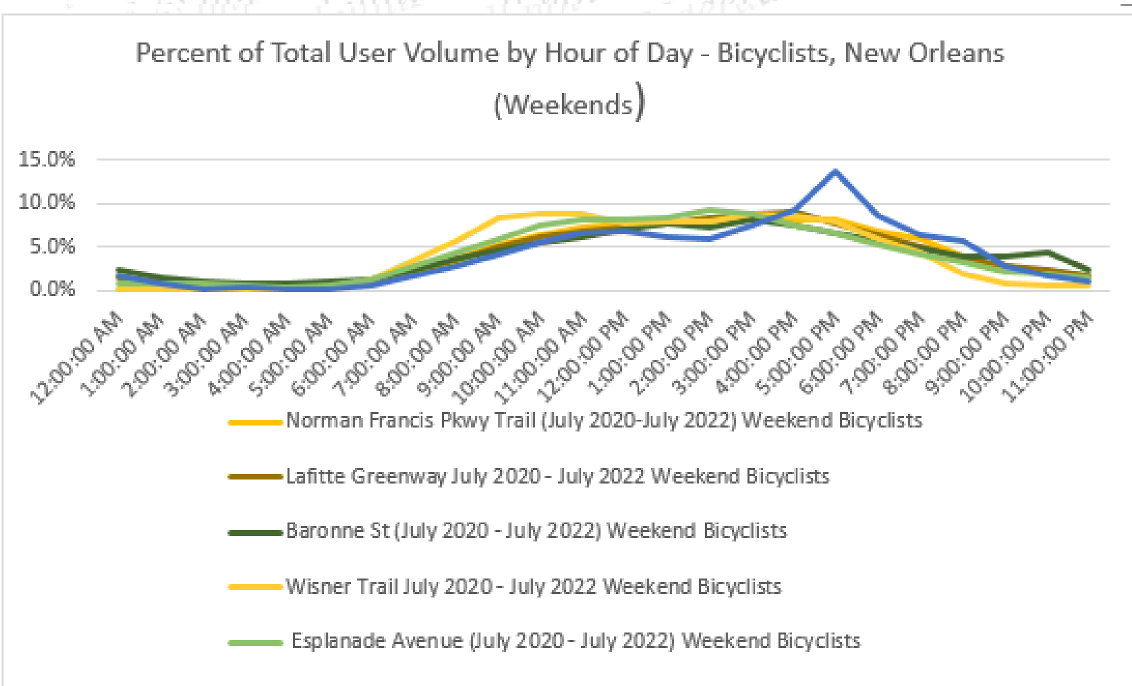


Table 48. Mandeville and Ruston seasonal variation

	Tammany Trace (August 2020 - July 2022)		Mandeville Lakefront Path	Rock Island Greenway Phase 1 (August 2020 - July 2022		Rock Island Greenway Phase 2 (March 2021 - July 2022)
	Pedestrians	*Bicyclists*	*All Users*	*Pedestrians**	*Bicyclists*	*All Users*
Jan	7.7%	7.6%	7.3%	7.4%	5.7%	7.1%
Feb	5.7%	5.7%	7.5%	6.6%	6.0%	6.9%
Mar	6.3%	9.3%	9.9%	10.4%	9.5%	8.1%
Apr	10.9%	9.7%	10.8%	9.1%	9.9%	7.7%
May	12.1%	9.9%	9.5%	7.4%	9.3%	8.0%
Jun	7.5%	8.4%	7.4%	7.1%	9.0%	9.2%
Jul	10.5%	8.6%	6.2%	7.5%	8.9%	10.5%
Aug	9.3%	8.2%	6.8%	8.6%	7.1%	7.9%
Sep	8.1%	8.4%	7.5%	10.8%	10.8%	11.4%
Oct	8.4%	10.9%	10.1%	10.3%	8.1%	9.4%
Nov	6.9%	7.5%	9.3%	8.0%	9.4%	7.4%
Dec	6.8%	6.0%	7.6%	6.6%	6.3%	6.5%

Table 49. Mandeville/Ruston count locations – daily variation

	Tammany Trace (August 2020 - July 2022)		Mandeville Lakefront Path	Rock Island Greenway Phase 1 (August 2020 - July 2022)		Rock Island Greenway Phase 2 (March 2021 - July 2022)
	Pedestrians	***Bicyclists***	***All Users***	***Pedestrians****	***Bicyclists***	***All Users***
Monday	13.6%	10.9%	13.2%	15.4%	14.1%	15.0%
Tuesday	11.6%	9.9%	11.4%	15.1%	13.0%	13.4%
Wednesday	9.5%	9.0%	10.8%	15.2%	14.0%	14.5%
Thursday	13.4%	10.7%	12.1%	13.5%	13.3%	14.0%
Friday	12.6%	10.9%	12.0%	11.9%	12.4%	13.3%
Saturday	19.7%	25.6%	19.2%	13.7%	17.5%	14.0%
Sunday	19.6%	23.0%	21.2%	15.1%	15.6%	15.8%

Table 50. Mandeville and Ruston count locations – hourly variation

	Tammany Trace (August 2020 - July 2022)				Mandeville Lakefront Path		Rock Island Greenway Phase 1 (August 2020 - July 2022				Rock Island Greenway Phase 2 (March 2021 - July 2022)	
	Weekday		Weekend		Weekday	Weekend	Weekday		Weekend		Weekday	Weekend
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*All Users*	*All Users*	*Pedestrians**	*Bicyclists*	*Pedestrians**	*Bicyclists*	*All Users*	*All Users*
12:00:00 AM	0.3%	0.1%	0.1%	0.0%	0.2%	0.2%	0.0%	0.0%	0.0%	0.0%	0.7%	0.4%
1:00:00 AM	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.1%	0.0%	0.2%	0.7%	0.4%
2:00:00 AM	0.1%	0.1%	0.1%	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	0.5%
3:00:00 AM	0.0%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%	0.0%	0.4%	0.7%
4:00:00 AM	0.1%	0.1%	0.0%	0.0%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.4%	0.5%
5:00:00 AM	0.6%	0.4%	0.2%	0.2%	0.3%	0.5%	0.1%	0.2%	0.0%	0.1%	1.7%	1.2%
6:00:00 AM	1.5%	2.0%	1.0%	1.1%	1.6%	1.8%	1.9%	2.8%	1.1%	1.7%	4.3%	5.7%
7:00:00 AM	3.4%	3.8%	3.5%	3.4%	3.8%	4.3%	5.4%	6.9%	5.8%	2.8%	3.9%	5.9%
8:00:00 AM	5.4%	4.4%	6.2%	4.7%	5.7%	5.9%	7.1%	4.2%	7.8%	6.7%	6.3%	5.3%
9:00:00 AM	7.2%	6.7%	8.0%	7.4%	7.1%	7.4%	5.3%	4.7%	8.6%	6.6%	6.7%	6.7%

	Tammany Trace (August 2020 - July 2022)				Mandeville Lakefront Path		Rock Island Greenway Phase 1 (August 2020 - July 2022				Rock Island Greenway Phase 2 (March 2021 - July 2022)	
	Weekday		Weekend		Weekday	Weekend	Weekday		Weekend		Weekday	Weekend
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians****	***Bicyclists***	***Pedestrians****	***Bicyclists***	***All Users***	***All Users***
10:00:00 AM	6.8%	7.5%	9.3%	10.4%	7.8%	7.9%	5.3%	4.6%	8.5%	7.9%	7.2%	7.8%
11:00:00 AM	7.0%	7.6%	9.9%	11.2%	7.7%	7.9%	5.7%	5.2%	7.8%	9.8%	6.7%	6.2%
12:00:00 PM	8.0%	7.9%	9.1%	10.2%	7.1%	7.3%	5.8%	3.6%	7.6%	6.1%	6.6%	6.8%
1:00:00 PM	7.0%	8.1%	8.6%	9.8%	7.2%	6.5%	6.1%	4.7%	7.2%	7.3%	5.6%	6.4%
2:00:00 PM	7.2%	7.2%	9.3%	9.9%	7.6%	6.4%	8.1%	6.1%	8.9%	10.3%	6.3%	6.2%
3:00:00 PM	9.2%	7.9%	10.2%	9.2%	8.1%	6.6%	13.2%	12.6%	10.2%	7.4%	6.9%	6.1%
4:00:00 PM	10.4%	9.7%	9.2%	8.4%	9.1%	9.0%	12.4%	12.0%	10.1%	10.2%	7.7%	7.6%
5:00:00 PM	10.6%	10.6%	6.9%	6.4%	9.2%	10.5%	10.4%	11.4%	8.5%	8.1%	7.2%	6.1%
6:00:00 PM	7.9%	8.9%	3.9%	3.9%	7.5%	8.9%	9.0%	10.4%	4.9%	6.1%	6.1%	5.5%
7:00:00 PM	3.9%	4.8%	1.9%	2.2%	5.4%	5.5%	3.4%	5.5%	2.3%	5.6%	5.1%	5.2%
8:00:00 PM	1.4%	1.3%	1.6%	0.7%	2.5%	1.8%	0.5%	2.5%	0.4%	1.1%	4.4%	4.3%

	Tammany Trace (August 2020 - July 2022)				Mandeville Lakefront Path		Rock Island Greenway Phase 1 (August 2020 - July 2022				Rock Island Greenway Phase 2 (March 2021 - July 2022)	
	Weekday		Weekend		Weekday	Weekend	Weekday		Weekend		Weekday	Weekend
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*All Users*	*All Users*	*Pedestrians**	*Bicyclists*	*Pedestrians**	*Bicyclists*	*All Users*	*All Users*
9:00:00 PM	0.9%	0.4%	0.6%	0.4%	1.0%	0.6%	0.1%	1.0%	0.1%	0.9%	2.1%	1.7%
10:00:00 PM	0.5%	0.3%	0.2%	0.2%	0.6%	0.4%	0.0%	0.8%	0.0%	1.0%	1.6%	1.3%
11:00:00 PM	0.4%	0.2%	0.2%	0.1%	0.3%	0.3%	0.0%	0.6%	0.0%	0.1%	1.0%	1.4%

Figure 53. Percent of total user volume by month - Mandeville

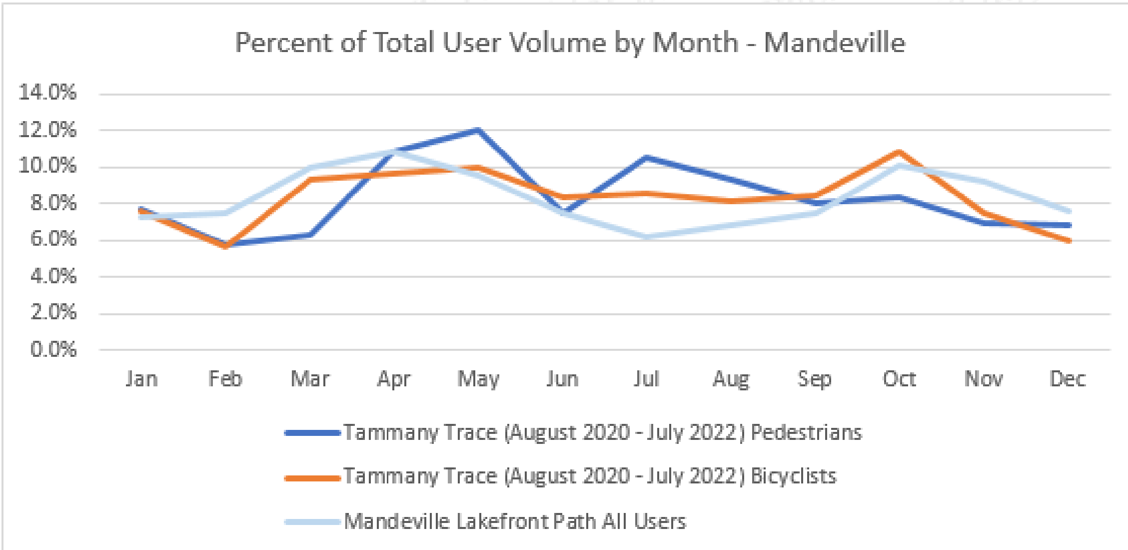


Figure 54. Percent of total user volume by month - Ruston

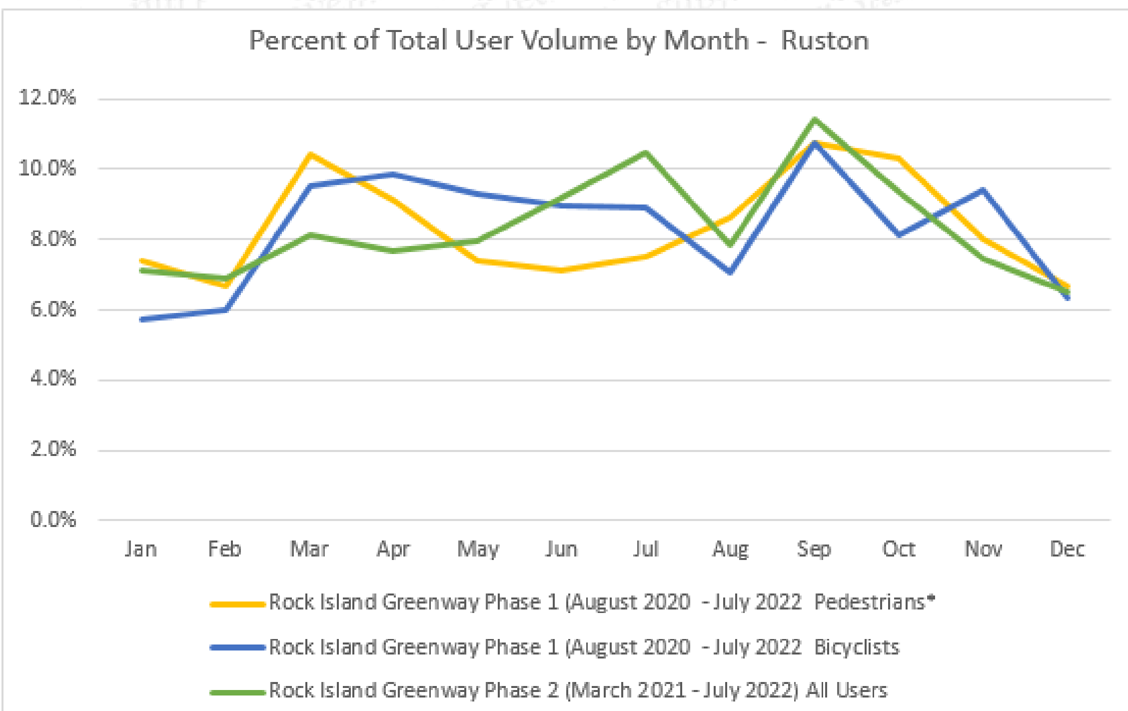


Figure 55. Percent of total user volume by day of week- Mandeville

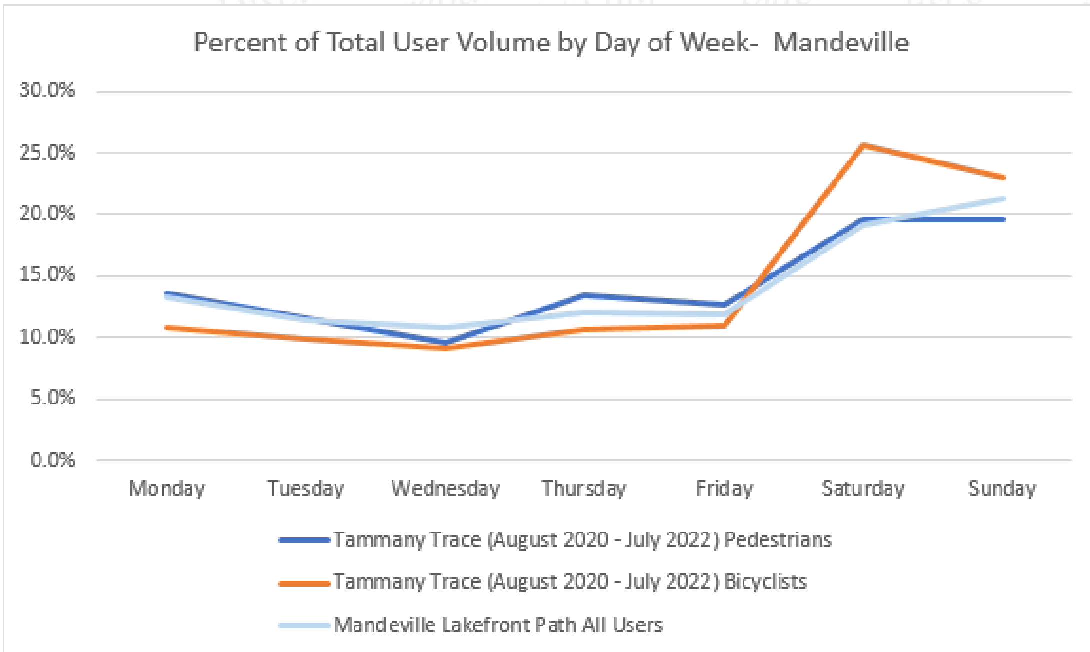


Figure 56. Percent of total user volume by day of week- Ruston

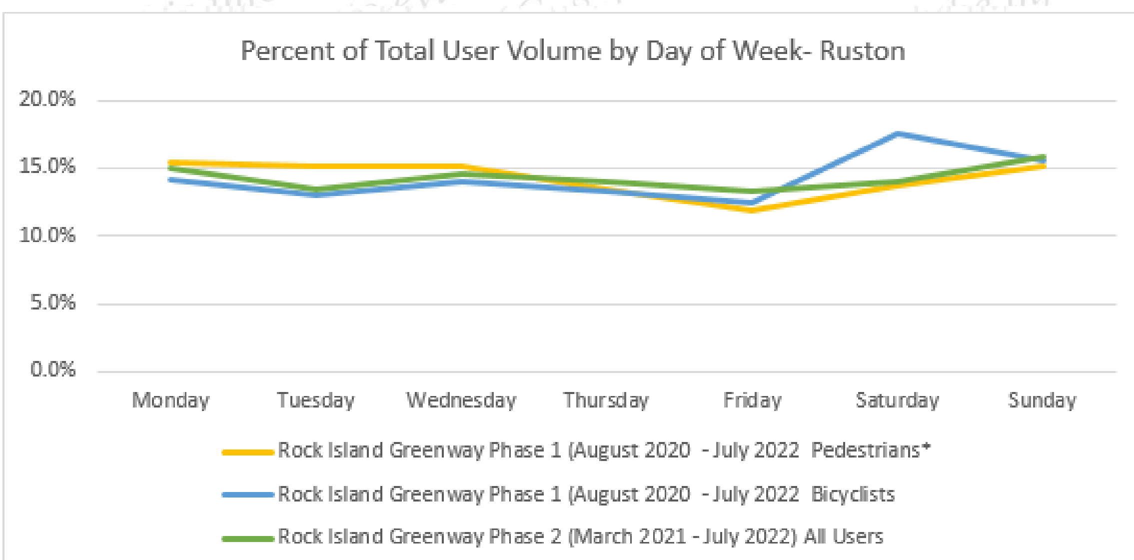


Figure 57. Percent of total user volume by hour of day - Mandeville

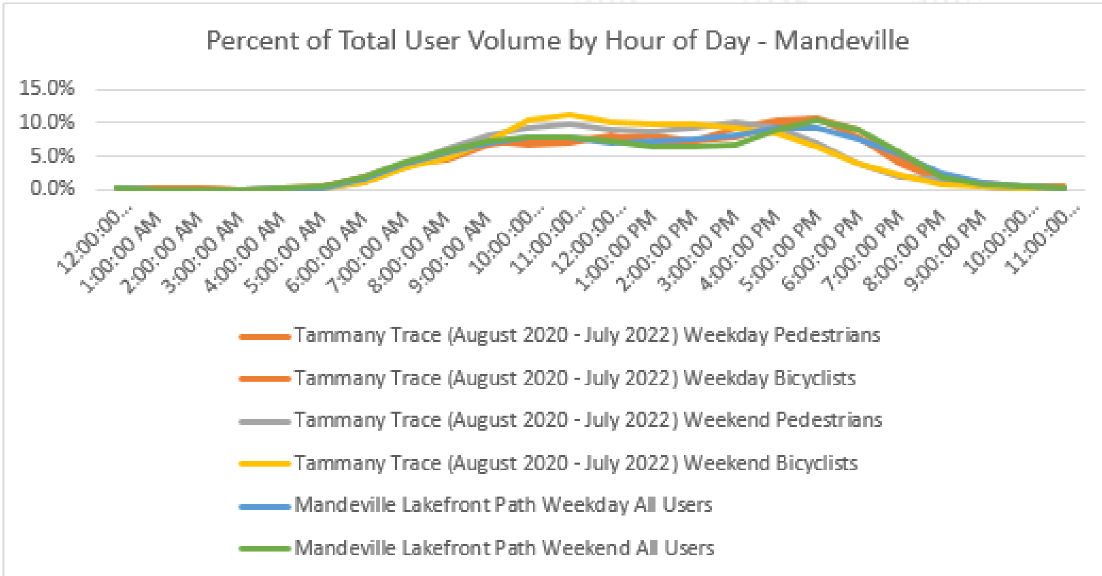


Figure 58. Percent of total user volume by hour of day - Ruston

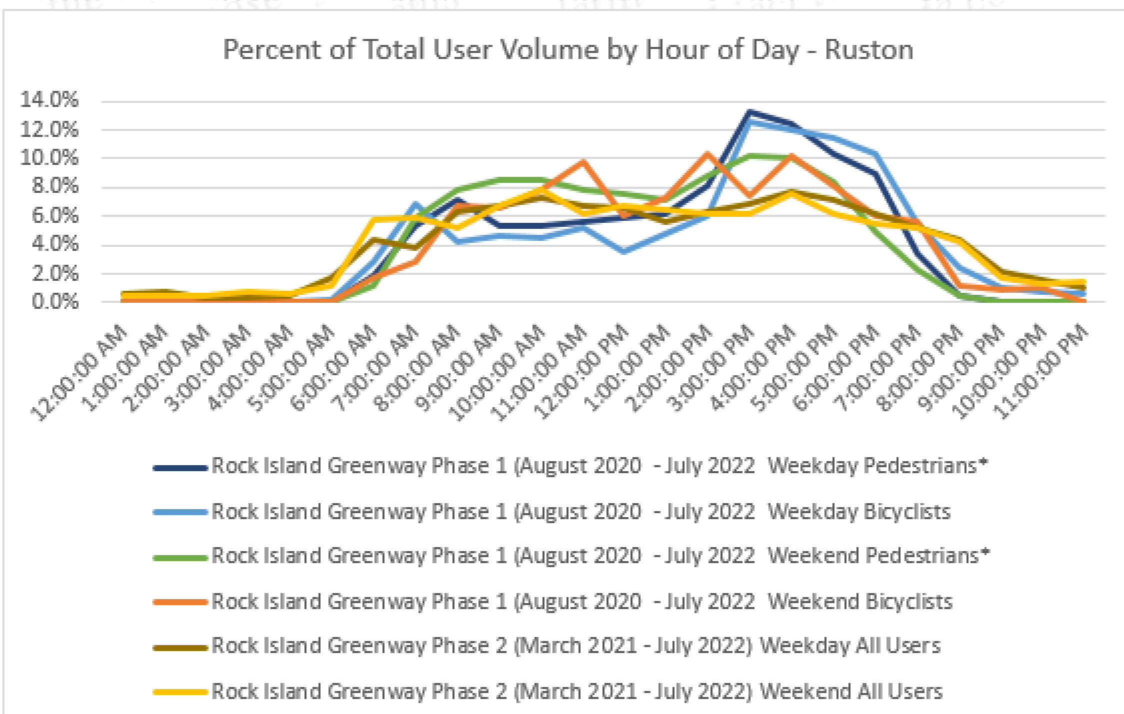


Table 51. Baton Rouge count locations – seasonal variation

	Dalrymple Drive (March 2021 - July 2022)*		**Nicholson Drive (March 2021 - July 2022)**		**Capital Heights (March 2021 - July 2022)**	**Gardere Lane (March 2021 - March 2022)**	**Baton Rouge MRT - Casino (July 2020 - July 2021)**	**Baton Rouge MRT - Water Campus (July 2021 - July 2022)**		**Government St Bike Lanes (July 2021 - July 2022)**
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***All Users***	***All Users***	***Pedestrians***	***Bicyclists***	***Bicyclists***
Jan		5.3%	5.6%	5.6%		8.1%	6.3%	6.3%	4.9%	6.5%
Feb		6.3%	9.1%	8.3%		7.5%	5.8%	7.3%	5.9%	7.0%
Mar		9.2%	7.0%	8.4%		7.3%	8.6%	9.1%	8.3%	8.3%
Apr		10.1%	10.0%	8.3%		6.5%	9.4%	11.4%	10.0%	9.7%
May		9.1%	8.4%	7.1%		6.3%	8.7%	8.9%	9.7%	9.6%
Jun		6.7%	5.2%	6.5%		8.0%	7.4%	7.7%	8.6%	9.3%
Jul		7.2%	7.4%	5.7%		8.3%	9.0%	7.8%	8.6%	8.8%
Aug		8.9%	6.6%	7.9%		8.7%	10.6%	7.7%	9.0%	7.9%
Sep		10.7%	10.4%	13.5%		10.4%	9.8%	9.6%	9.9%	8.8%
Oct		11.2%	15.3%	13.4%		10.2%	11.2%	9.5%	10.1%	8.6%
Nov		8.7%	10.7%	10.5%		8.9%	7.7%	8.4%	7.9%	8.0%
Dec		6.7%	4.6%	5.0%		9.8%	5.5%	6.4%	7.2%	7.4%

Table 52. Baton Rouge count locations – daily variation

	Dalrymple Drive (March 2021 - July 2022)*		Nicholson Drive (March 2021 - July 2022)		Capital Heights (March 2021 - July 2022)	Gardere Lane (March 2021 - March 2022)	Baton Rouge MRT - Casino (July 2020 - July 2021)	Baton Rouge MRT - Water Campus (July 2021 - July 2022)		Government St Bike Lanes (July 2021 - July 2022)
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*Pedestrians*	*Bicyclists*	*Bicyclists*
Monday	15.2%	13.6%	11.6%	14.9%	13.0%	14.0%	12.6%	12.9%	11.3%	13.1%
Tuesday	12.5%	12.1%	12.9%	15.2%	11.8%	14.1%	12.7%	16.4%	10.6%	12.9%
Wednesday	12.7%	13.0%	12.4%	15.3%	13.3%	13.5%	11.7%	13.5%	11.9%	14.1%
Thursday	13.4%	12.8%	14.0%	14.4%	12.7%	13.8%	11.9%	13.1%	10.8%	14.5%
Friday	9.9%	12.3%	14.6%	13.8%	13.0%	14.6%	11.8%	11.8%	12.0%	15.3%
Saturday	17.8%	17.8%	18.6%	16.1%	17.7%	15.0%	20.3%	18.3%	22.7%	16.6%
Sunday	18.6%	18.4%	15.9%	10.4%	18.6%	14.9%	19.1%	13.9%	20.7%	13.6%

Table 53. Baton Rouge count locations – hourly variation

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*		*Weekend*		*Weekday*	*Weekend*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
12:00:00 AM	0.4%	1.0%	0.5%	1.5%	1.1%	0.4%	5.8%	0.4%	0.2%	0.1%	0.2%	0.2%	0.9%	1.0%	0.4%	0.9%	0.6%	0.5%	1.3%	1.4%
1:00:00 AM	0.4%	0.7%	0.5%	1.0%	1.0%	0.2%	6.5%	0.6%	0.4%	0.3%	0.8%	1.8%	0.6%	1.1%	0.0%	0.0%	0.0%	0.1%	1.4%	1.3%

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*		*Weekend*		*Weekday*	*Weekend*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
2:00:00 AM	0.5%	0.5%	0.4%	0.7%	1.8%	0.3%	10.3%	0.8%	0.3%	0.3%	0.5%	0.9%	0.4%	0.5%	0.2%	0.2%	0.4%	0.3%	1.0%	1.3%
3:00:00 AM	0.8%	0.3%	0.3%	0.5%	2.6%	0.3%	2.1%	0.2%	0.2%	0.3%	0.5%	0.9%	0.5%	0.3%	0.2%	0.2%	0.1%	0.2%	0.4%	0.2%
4:00:00 AM	0.6%	0.4%	0.5%	0.4%	2.6%	0.3%	2.1%	0.4%	0.2%	0.1%	0.5%	0.6%	0.5%	0.3%	0.2%	0.3%	0.2%	0.1%	0.6%	0.5%
5:00:00 AM	1.4%	0.9%	1.0%	0.5%	1.7%	0.4%	1.0%	0.8%	1.0%	0.3%	0.7%	0.8%	0.8%	0.3%	0.8%	2.6%	0.3%	0.3%	1.1%	0.6%

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*		*Weekend*		*Weekday*	*Weekend*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
6:00:00 AM	4.8%	2.3%	2.2%	1.2%	3.6%	11.7%	2.1%	2.7%	4.5%	1.5%	3.9%	2.4%	3.1%	1.8%	3.6%	2.5%	1.6%	1.8%	3.1%	2.9%
7:00:00 AM	6.6%	4.4%	4.9%	2.3%	4.1%	7.0%	3.4%	3.0%	5.3%	4.4%	4.2%	3.3%	4.6%	3.7%	5.1%	3.9%	5.3%	5.9%	5.1%	3.1%
8:00:00 AM	6.5%	5.4%	6.3%	3.5%	5.6%	6.7%	5.7%	4.2%	4.2%	6.8%	4.1%	3.3%	4.3%	5.4%	4.6%	5.4%	9.2%	8.5%	4.7%	5.9%
9:00:00 AM	5.6%	5.0%	7.0%	5.1%	5.6%	6.2%	4.9%	7.6%	5.6%	9.2%	5.0%	5.3%	5.5%	6.8%	5.8%	6.0%	9.6%	9.4%	7.4%	6.3%

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Week day*	*Weeke nd*	*Week day*	*Weeke nd*	*Week day*	*Weeke nd*	*Weekday*		*Weekend*		*Weekda y*	*Weeke nd*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
10:00:00 AM	5.4%	4.7%	7.5%	6.1%	5.9%	6.4%	5.6%	7.5%	5.5%	9.7%	4.9%	5.2%	5.4%	7.5%	5.5%	6.1%	10.9 %	10.3 %	6.9%	9.1%
11:00:00 AM	5.2%	5.0%	7.6%	6.7%	5.7%	4.8%	6.0%	8.2%	5.2%	8.3%	5.0%	5.4%	5.2%	6.5%	6.3%	5.4%	8.2%	8.9%	0.048 824	8.6%
12:00:00 PM	5.3%	5.4%	7.4%	7.3%	7.7%	7.6%	6.3%	6.2%	5.2%	7.7%	4.8%	5.8%	5.4%	5.7%	6.6%	5.4%	7.3%	7.0%	0.052 168	6.7%
1:00:00 PM	5.3%	5.7%	7.2%	7.7%	6.8%	6.9%	5.6%	7.0%	4.5%	6.7%	5.3%	5.8%	5.1%	5.7%	4.9%	5.4%	5.7%	6.6%	0.058 522	6.7%

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*		*Weekend*		*Weekday*	*Weekend*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
2:00:00 PM	6.0%	6.5%	7.9%	8.3%	7.3%	4.8%	5.4%	6.3%	5.2%	6.4%	5.4%	6.1%	5.0%	6.1%	5.2%	6.1%	6.3%	6.5%	0.058968	6.4%
3:00:00 PM	6.8%	7.5%	8.1%	8.9%	7.4%	5.5%	4.6%	8.7%	5.8%	7.1%	7.0%	6.2%	5.0%	6.2%	5.5%	6.2%	4.8%	6.8%	0.063204	7.0%
4:00:00 PM	8.4%	9.2%	8.4%	9.1%	5.2%	5.6%	5.7%	7.4%	7.5%	7.7%	6.3%	6.7%	6.2%	6.1%	6.1%	7.2%	5.7%	6.3%	0.077249	7.0%
5:00:00 PM	9.4%	9.6%	7.4%	7.6%	8.5%	6.9%	4.1%	7.5%	10.3%	6.9%	7.0%	7.1%	9.5%	6.2%	10.9%	9.7%	7.3%	5.6%	0.067328	5.6%

	Dalrymple Drive (March 2021 - July 2022)*				Nicholson Drive (March 2021 - July 2022)				Capital Heights (March 2021 - July 2022)		Gardere Lane (March 2021 - March 2022)		Baton Rouge MRT - Casino (July 2020 - July 2021)		Baton Rouge MRT - Water Campus (July 2021 - July 2022)				Government St Bike Lanes (July 2021 - July 2022)	
	Weekday		*Weekend*		*Weekday*		*Weekend*		*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*	*Weekend*	*Weekday*		*Weekend*		*Weekday*	*Weekend*
	Pedestrians	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*	*All Users*	*All Users*	*All Users*	*All Users*	*Bicyclists*	*Bicyclists*	*Pedestrians*	*Bicyclists*	*Bicyclists*	*Bicyclists*
6:00:00 PM	8.5%	7.7%	5.5%	6.3%	5.1%	6.3%	3.7%	6.7%	10.9%	6.5%	7.2%	7.1%	11.6%	5.7%	13.9%	10.0%	5.7%	4.7%	0.067551	3.9%
7:00:00 PM	6.2%	6.3%	4.3%	5.1%	3.4%	4.3%	3.2%	5.3%	9.9%	5.0%	7.1%	6.2%	7.6%	5.9%	6.5%	7.5%	4.1%	4.3%	0.051611	3.5%
8:00:00 PM	2.8%	4.0%	2.5%	3.6%	2.7%	3.1%	1.6%	2.5%	3.6%	2.1%	6.5%	6.4%	4.9%	5.8%	3.9%	3.9%	2.9%	2.3%	0.039906	3.2%
9:00:00 PM	1.4%	3.2%	1.3%	2.7%	1.9%	1.8%	1.5%	2.4%	2.2%	1.1%	5.4%	5.0%	3.7%	5.7%	1.9%	2.4%	1.6%	1.6%	0.03411	2.4%

	Dalrymple Drive (March 2021 - July 2022)*				**Nicholson Drive (March 2021 - July 2022)**				**Capital Heights (March 2021 - July 2022)**		**Gardere Lane (March 2021 - March 2022)**		**Baton Rouge MRT - Casino (July 2020 - July 2021)**		**Baton Rouge MRT - Water Campus (July 2021 - July 2022)**				**Government St Bike Lanes (July 2021 - July 2022)**	
	Weekday		***Weekend***		***Weekday***		***Weekend***		***Weekday***	***Weekend***	***Weekday***	***Weekend***	***Weekday***	***Weekend***	***Weekday***		***Weekend***		***Weekday***	***Weekend***
	Pedestrians	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***	***All Users***	***All Users***	***All Users***	***All Users***	***Bicyclists***	***Bicyclists***	***Pedestrians***	***Bicyclists***	***Bicyclists***	***Bicyclists***
10:00:00 PM	0.8%	2.5%	0.9%	2.3%	1.4%	1.3%	1.3%	1.9%	1.7%	0.7%	4.3%	4.5%	2.4%	3.2%	1.0%	1.4%	1.2%	1.3%	0.028982	2.9%
11:00:00 PM	0.6%	1.8%	0.7%	1.7%	1.4%	1.2%	1.4%	1.9%	0.8%	0.7%	3.6%	3.0%	1.8%	2.4%	1.0%	1.2%	1.1%	0.8%	0.021514	3.4%

Figure 59. Percent of total user volume by month - pedestrians/all users, Baton Rouge

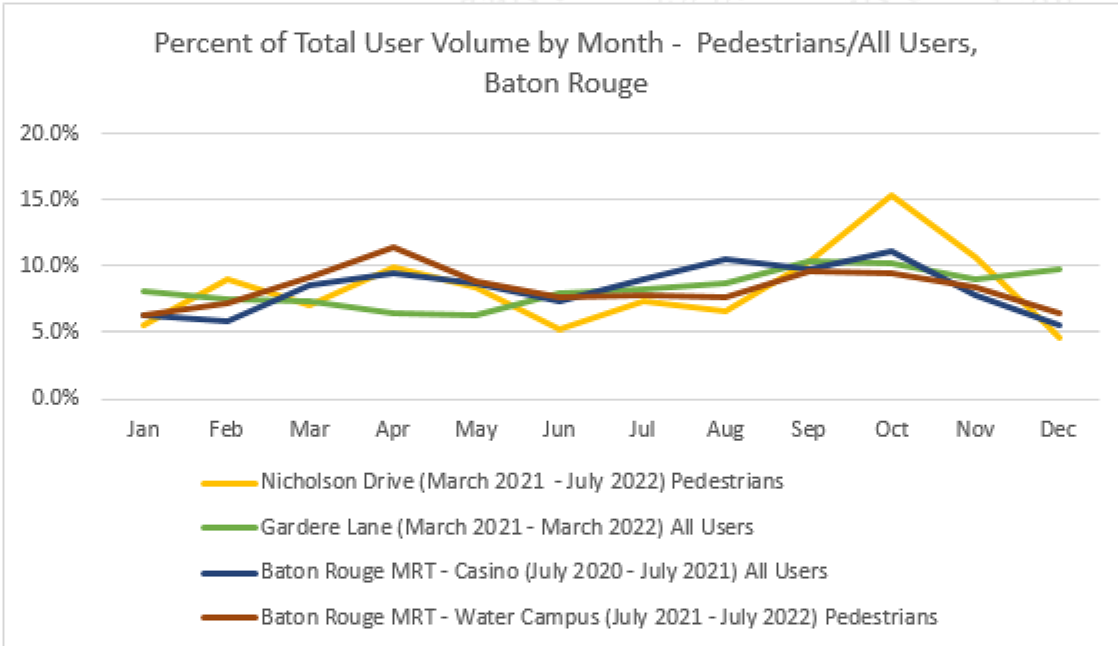


Figure 60. Percent of total user volume by month - pedestrians/all users, Baton Rouge

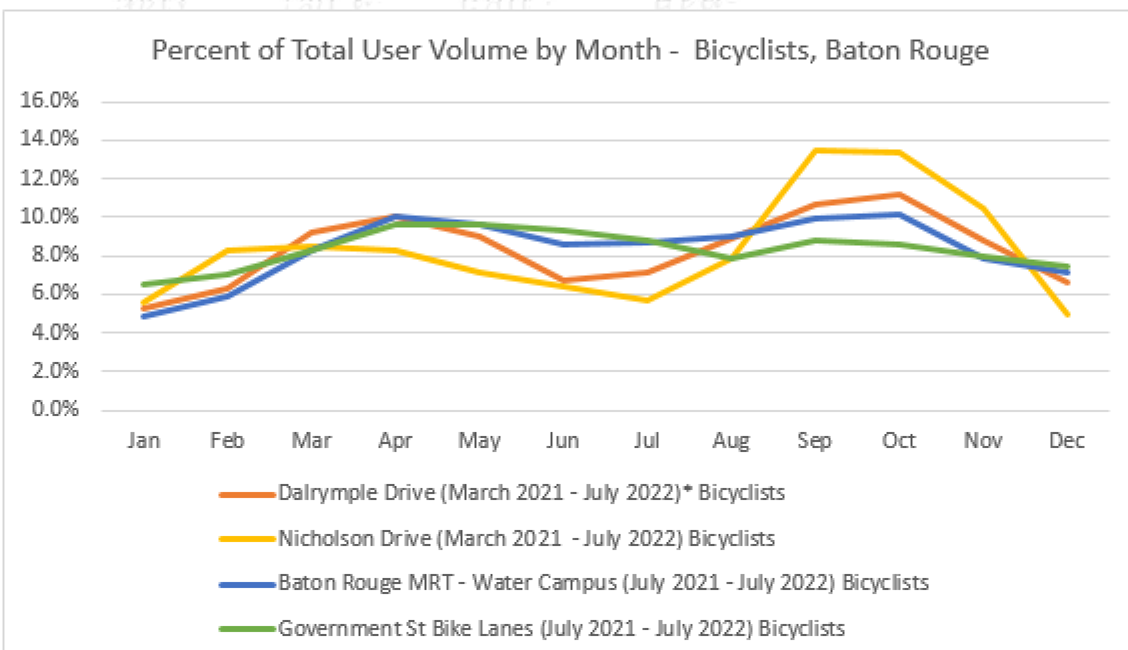


Figure 61. Percent of total user volume by day of week- pedestrians/mixed users, Baton Rouge

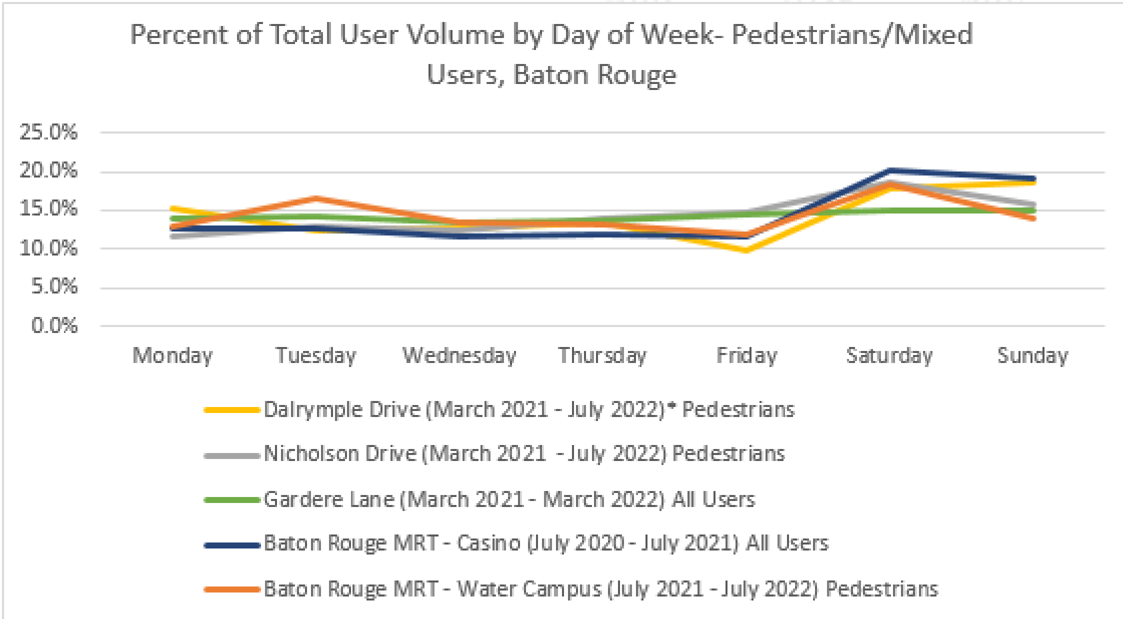


Figure 62. Percent of total user volume by day of week- bicyclists, Baton Rouge

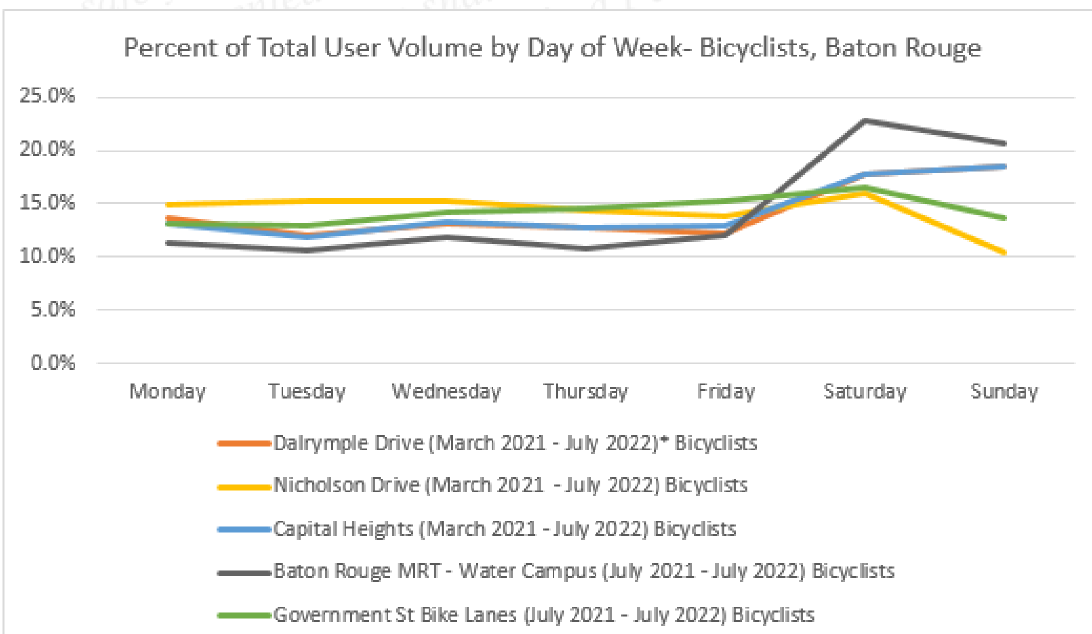


Figure 63. Percent of Total User Volume by Hour of Day - Pedestrians/Mixed Users, Baton Rouge (Weekdays)

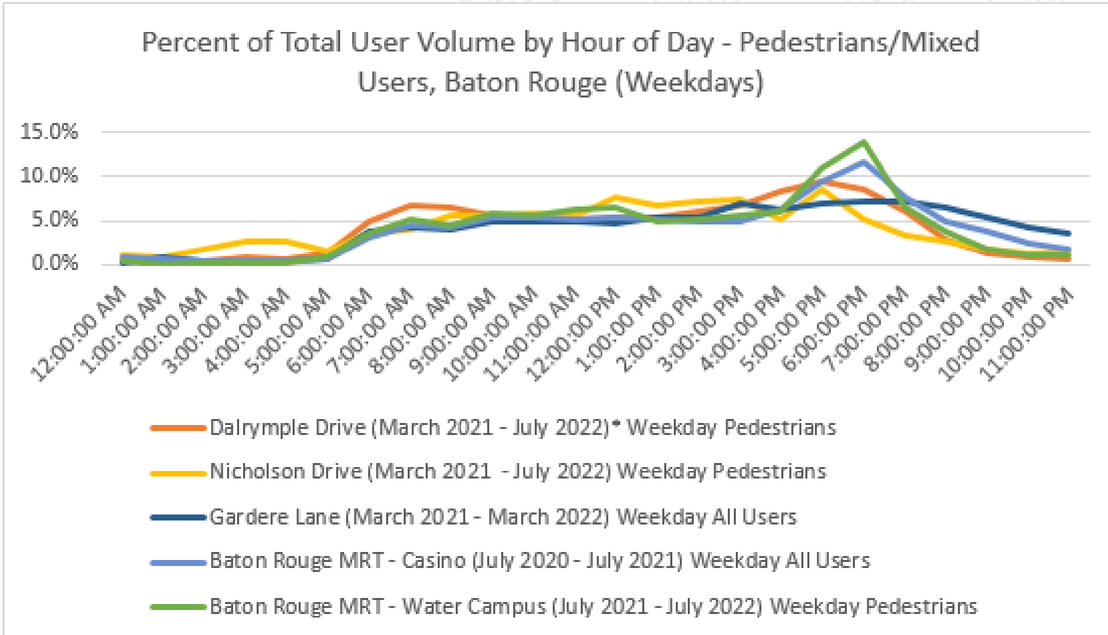


Figure 64. Percent of Total User Volume by Hour of Day - Pedestrians/Mixed Users, Baton Rouge (Weekends)

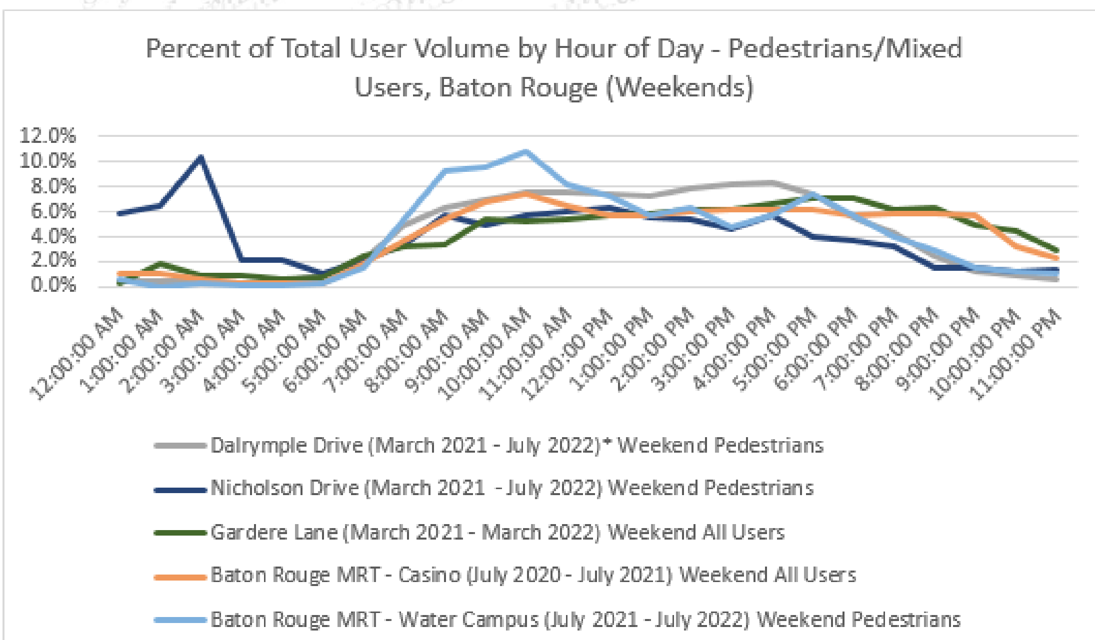


Figure 65. Percent of Total User Volume by Hour of Day - Bicyclists, Baton Rouge (Weekdays)

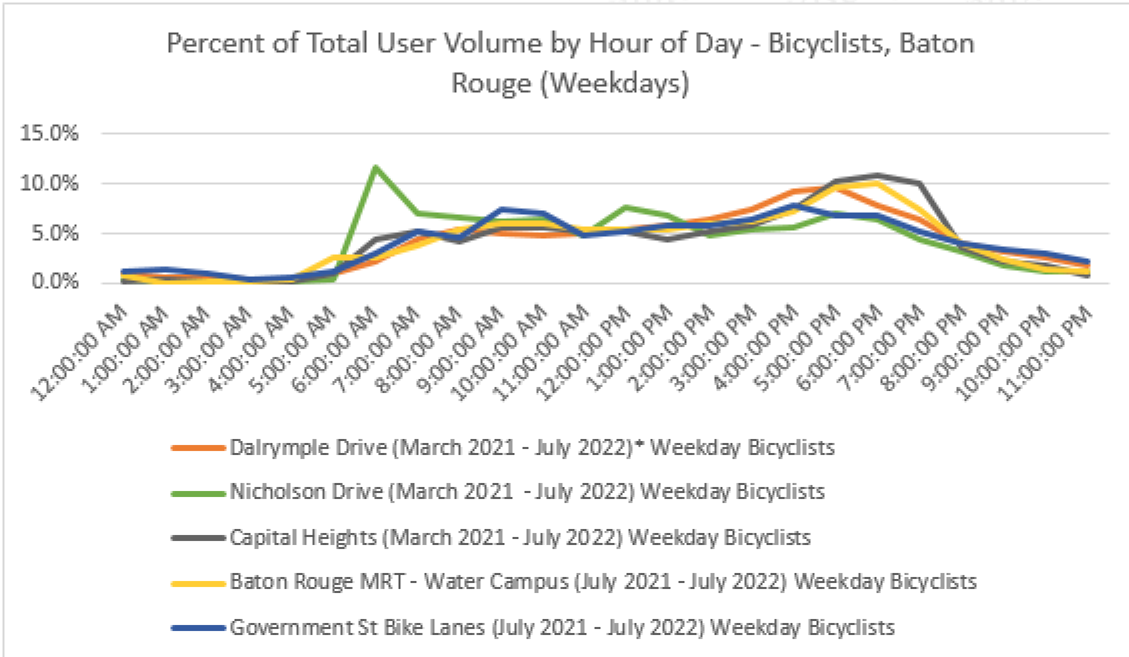
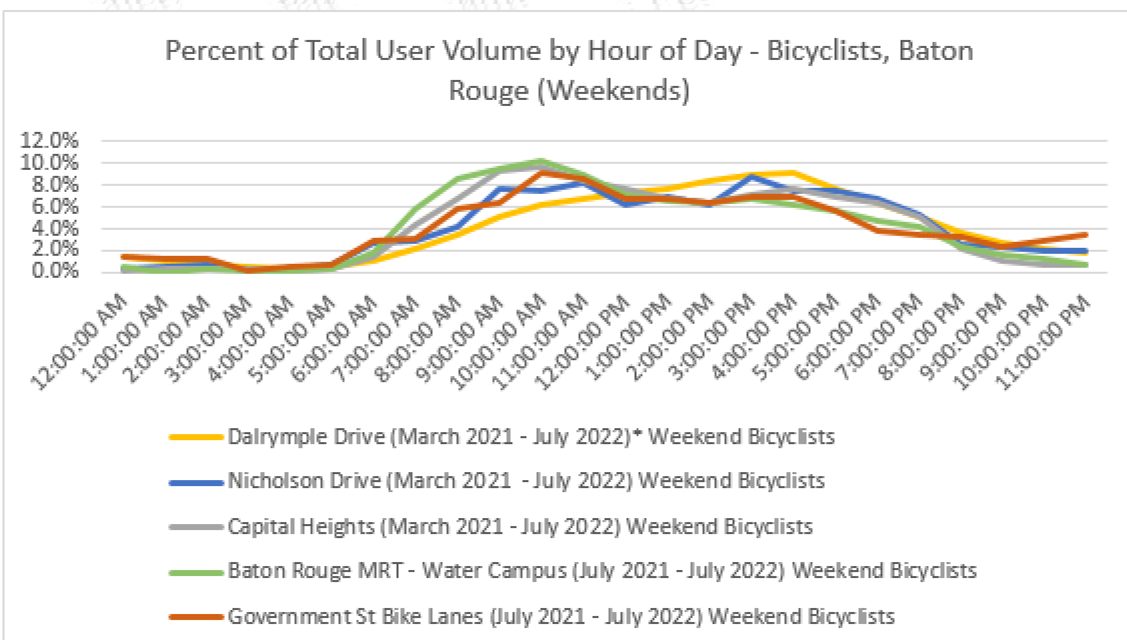


Figure 66. Percent of Total User Volume by Hour of Day - Pedestrians/Mixed Users, Baton Rouge (Weekends)



Sample Site Workbook Template

[see attached Excel Workbook] -

Weather Data

[see attached Excel Workbook]

Expansion Factor Calculation Template

[see attached Excel Workbook]