MEMORANDUM

Date: November 19, 2014
To: Aaron Fodge, Alternative Transportation Manager
Organization: Colorado State University
From: CSU Bicycle Master Plan Project Team
Project: Colorado State University Bicycle Master Plan
Re: Summary of Public Engagement

The 2014 Colorado State University (CSU) Bicycle Master Plan (Bike Plan) project included public and stakeholder engagement focused on the following groups:

1. **Steering Committee**: Assembled by CSU Project Manager. Comprises City staff, Facilities staff, Police Department staff, Housing and Dining staff, Parking and Transportation staff, community members and students
2. **Campus Bicycle Advisory Committee (CBAC)**: Provide information to this already-existing group. CSU PM to present at meetings.
3. **General Public**: Consists of three categories of people that we are trying to reach:
   a. Students
   b. Faculty
   c. City residents

During this project the aforementioned groups were engaged in a variety of ways throughout the course of the project. Since the Bike Plan officially began, CSU has reached out to the public in a variety of ways, which are summarized in this memorandum.

**ONLINE INTERACTIVE MAP**

The project team developed a WikiMap, an online interactive map that was available for input from February 5 through March 21. Users were asked to identify routes they already ride, ones they would like to ride, barriers to bicycling, locations where bike parking is needed, and potential bike share station locations. The map was prominently featured on the project’s website and in the City of Fort Collins Bicycle Master Plan’s documents and website.

It was also posted to various CSU social media sites (Facebook and Twitter). The summaries that follow include the activity related to the WikiMap through CSU social media.
Police and Safety Facebook Page
- Page itself has 351 followers
- Post reached 85 people (24% of followers)
- 8 of them clicked through to the site (10% click through)

Police and Safety Twitter Feed
- Retweeted by @FCBikes

Working at CSU Facebook Page
- Page itself has 132 followers
- Post reached 37 people (28% of followers)
- 7 of them clicked through to the site (19% click through)

Working at CSU Twitter Feed
- Retweeted by @FCBikes

WikiMap Users
There were 401 registered users, 158 of which contributed at least one point, line, or comment. Registered users are not representative of the population of Fort Collins: primarily male (64 percent); older (41 percent over the age of 50); and not typical college ages (only 7.2 percent between the ages of 18 and 25). Nearly all of the users—90 percent—were residents of Fort Collins zip codes.

WikiMap Input
- Over 1,100 total points, lines, and comments were added to the map.
- The most utilized category was “Route I Ride” which, in combination with input from the “Route I’d Like to Ride” category, will help determine where to focus priority projects. On an initial scan, it is clear that many residents are riding on existing trails, but many are also using heavy traffic arterials.
- About 350 “Barriers to Biking” were added to the map. Users are asked what physical or traffic condition creates the barrier. Nearly half of the barriers were identified as crossings that feel unsafe or gaps in the bicycle network.
- Bike parking was the category with the least input. 21 points were added, most in Old Town and along the MAX line.

The following text highlights key information received through the WikiMap input related to the CSU Bike Plan.
Where People Bike

- Along Trails
  - Spring Creek Trail
  - Mason Trail
- On-Street
  - Overland Tr.
  - W. Elizabeth Rd.

Barriers to Biking

- Intersections on large arterials
  - S. Shields St. at W. Prospect Rd.
- Stretches of Arterial roads
  - S. Shields St.
  - S. College Ave.

Where People Would Like to Bike

- North/South Arterials
  - College Ave.
- East/West Arterials
  - Laporte Ave.
  - W. Drake Rd.

Parking and Bike Share

- Bicycle Parking
  - Along MAX stations providing connectivity
- Bike Share Stations
  - CSU Main Campus
  - MAX stations

Other Comments

- Narrow pathway west of Rec Center
- Need for eastern N-S route parallel to dismount zone
- Dysfunction of Lake Street/Center Avenue intersection
- About 20% of all marked routes in Fort Collins traverse the CSU campus
- Many routes marked continue through campus and do not have a destination at CSU
- No on-campus routes marked as high stress; most are low stress
- Shields Street: Nearly all intersections marked as barriers owing to lack of signal/feeling unsafe
- Laurel Street: Many comments about lack of bike lane from Remington to Howes
- College Avenue: Intersection with Elizabeth highlighted as important campus connection that does not work well
- Prospect Road: Few riders on here today, but definite interest in improving the road
WEBINAR

On March 12, 2014, a webinar “Bikes on Campus” was held online. Panelists discussed a variety of bicycling and campus specific topics. The webinar focused on how campuses can accommodate the increase in bicycling, traffic safety, and additional common challenges of bicycling in and around college campuses. CSU Parking and Transportation Services staff participated in the webinar.

Webinar link: http://www.today.colostate.edu/story.aspx?id=9756

PUBLIC OPEN HOUSES

Two open houses were held as part of the City Bicycle Master Plan. Both included focused information about the CSU Bike Plan and activities designed to gather feedback on existing bicycling conditions and proposed recommendations.

Public Open House #1

The first public open house was held on March 12 at the Lincoln Center from 4-7 pm. Attendees registered at the door, and 236 were recorded. Attendees represented a wide range of ages and a relative balance of genders.

The project team presented information in a number of areas:

- Draft vision and goals for the City Bike Plan
- Existing/previous planning efforts: concurrent projects and the 2013 Trails Master Plan
- Stress level assessment: level of bicycling comfort of city streets
- Non-infrastructure policies and programs in education, encouragement and enforcement
- Bike share system analysis and preliminary station locations
- Possible infrastructure treatments: bike lane upgrades, intersection treatments, neighborhood greenways and protected bike lanes

March 12 Open House
Attendees gave feedback about a number of items as well:

- Voted on the draft goals and “wrote-in” possible additional goals
- Commented on existing education, enforcement and encouragement programs and suggested new ideas for the City to undertake
- Agreed/disagreed with the current draft stress assessment of streets in Fort Collins
- Agreed/disagreed with proposed bike share locations and suggested alternatives
- Provided input on Colorado State University campus bike infrastructure and issues
- Identified streets and intersections where the infrastructure treatments presented would help fix current issues for comfort and safety
- Voted on priorities among the areas that the Plan will address: infrastructure improvements (improved bike lanes, intersection improvements, protected bike lanes and neighborhood greenways), education programs, enforcement programs, and encouragement programs

Public Open House #1 Feedback

Three Words Question

Attendees were asked the following questions, and the word clouds illustrate the responses and the relative number of each.
What **three words** best describe bicycling in Fort Collins **today**?

![Word Cloud for Current Bicycling in Fort Collins]

What **three words** would you like to use to describe bicycling in Fort Collins in the **future**?

![Word Cloud for Future Bicycling in Fort Collins]

**CSU Feedback**

CSU Staff presented an aerial map of the main campus and led a group discussion about existing issues with bicycling around and through campus. The comments received echoed many of the comments from WikiMap feedback.
Public Open House #2

The second public open house was held on July 30 at the Lincoln Center from 4-7 pm. Attendees registered at the door, and 114 were recorded. The purpose of this open house was to present and get input on draft Plan recommendations.

The project team presented information in a number of areas:
- Project goals and performance measures
- Public involvement to date
- Existing/previous planning efforts: concurrent projects and the 2013 Trails Master Plan
- Updated stress level assessment
- Non-infrastructure policies and programs in education, encouragement and enforcement, including existing and proposed
- Bike share system analysis, preliminary station locations, and summary of business plan
- Information about new types of infrastructure treatments
- Proposed bicycle network
  - 2020 Low Stress Network
  - Full Build Vision including
- Proposed implementation strategies including costs per mile of infrastructure recommendations and a process for developing a phasing plan

At the registration table, attendees were given a survey to complete during the open house. Each question corresponded to one of the presentation boards. Attendees were encouraged to submit the completed surveys before they left the open house; 92 did so. Basic information was also collected, and the table below shows the distribution of bicyclist types that the open house reached. The sections that follow summarize key responses to the survey questions.
**Public Open House #2 Feedback**

*What is the most important intersection to improve for bicycling at the edge of CSU’s campus?*

1. Elizabeth & Shields: 43%
2. Elizabeth & College: 19%
3. Lake & Center: 16%
4. Meldrum & Laurel: 15%
5. Others: 7%

*Is it more important to have a North-South connection to the east or west of the dismount zone?*

1. West: 52%
2. East: 48%

*Given the proposed improvements to Pitkin, which east-west route would you bicycle on through/along campus?*

1. Pitkin: 66%
2. Lake: 25%
3. Prospect: 9%

*What destinations on campus would you include in a system of signs to help direct bicyclists?*

1. Lory Student Center: 45%
2. Morgan Library: 27%
3. Moby Complex: 11%
4. Oval: 10%
5. MAX Stops: 7%
Which **TWO north-south** routes in the 2020 network are most critical and should be created first?

1. Shields: 31%
2. Power Trail: 16%

Which **TWO east-west** routes in the 2020 network are most critical and should be created first?

1. Pitkin: 29%
2. Swallow: 27%

Which **TWO north-south streets** in the Protected Bike Lanes Vision should be constructed first?

1. Shields: 44%
2. Lemay: 31%

Which **TWO east-west streets** in the Protected Bike Lanes Vision should be constructed first?

1. Drake: 38%
2. Harmony: 24%

What destinations in Fort Collins are most important to include in a system of signs to help direct bicyclists around town?

1. Old Town
2. CSU
3. Others (Downtown, Libraries, Parks, MAX)
Full implementation of the recommended bike network and programs will require choices between the strategies listed below. We want your input: which TWO strategies do you feel are most appropriate for the next 5-10 years?

1. **Create a citywide low-stress bike network**: Focus on non-arterial bike routes, neighborhood greenways and critical crossing improvements
2. **Encourage safer conditions for biking**: By enforcing traffic laws

Open house attendees were generally supportive and enthusiastic about the proposals, particularly the CSU recommendations, the low-stress network and the full build vision.

**BIKE TO BREAKFAST**

On Wednesday, April 23, Bike to Breakfast, part of the Earth Week events, was held at the corner of University Avenue and Meridian. CSU staff was on hand to gather feedback from students, faculty, and staff about the Bike Plan. Participants were invited to provide comments by placing sticky notes on an aerial map. The following comments were received during this activity:

- Add second crossing for eastbound on E. Elizabeth: Note placed on pathway heading east toward College Ave/ E. Elizabeth.
- One-way: Note placed on E. Drive near Shepardson and Natural and Environmental Services.
- Need a direct route from campus to Edora Park/Frisbee Golf/Skateboard – wayfinding to there: Note placed over Lake and College.
- Future trail to Lake: Note placed over Lake and Mason.
- Overpass – Visitor Perspective: Note placed over Prospect and Redwing Rd.
- Scramble cross: Note placed over S. Meldrum and Laurel.
- Smooth out: Note placed over path running between Allison Hall and Weather Station.
- Pitkin- Through: Note placed near Pitkin and Education Building.
- Smooth out: Note placed on path near Visual Arts and Chemistry.
- Way finding through campus: Note placed between Chemistry and Molecular and Radiological Sciences.
- Underpass: Note placed at Center and Prospect.
- Covered/Secured Bike Parking: Note placed at Aggie Village North.
- Add more parking: Note placed at Aggie Village North.
- Light Pole in Bikeway: Note placed at path running by Moby C-Wing and Rec Center.
- Need transit way from campus directly to Hughes Stadium: Note placed over Pitkin Z Lot (#240).
- No stadium bike connection to Hughes: Zip Line/Monorail: Note placed over Pitkin Z Lot (#240).
- Connection to Spring Creek along ditch: Note placed over houses west of the open space/CSU Challenge Course.
- Access for Sorority House: Note placed at Plum and Shields.
- Left Hand Lane @ Light – Protect Cycling: Note placed at Plum and Shields (referring to flow of traffic toward campus from this intersection).
Video coverage of the event and mapping exercise is available here: http://www.collegian.com/2014/04/video-bike-to-breakfast/76008/

OTHER INPUT RECEIVED

In addition to public open houses, the project team staffed booths at the following on-campus locations to solicit student input on the project:

- April 21 – Plaza
- April 22 – Earth Day Event
- April 25 – Morgan Library
- October 7 – Plaza
- October 9 – Plaza

The following suggestions and priorities collected from students on the Plaza:

- Separated pathway on University South of Moby Drive
- Separated Pathway on South Drive
- Intersection and spot improvements at West Plum Street and Meridian Avenue
- Contraflow improvement on East and West Drives
- Protected bike lane at the intersection of Elizabeth Street and Shields Street, in addition to spot improvements
- Protected bike lane on West Laurel Street
- Shared pathway on both sides of Engineering Building
- More bike enforcement on West Pitkin Street, especially at stop signs
- More bike parking

DRAFT PLAN PRESENTATIONS

A draft CSU Bike Plan was presented to the following on-campus groups in the fall of 2014:

- Master Plan Committee
- Physical Development Committee
- President’s Sustainability Committee
- Division of Student Affairs Directors
- Associated Students of Colorado State University (ASCSU) Senate
- Parking and Transportation Open Houses (2)
STEERING COMMITTEE MEETINGS

A CSU Bike Plan Steering Committee was established at the beginning of this project. The committee was comprised of City Staff, Facilities staff, Police Department staff, Housing and Dining staff, Parking and Transportation staff, community members, and students. Steering Committee members include:

- Joy Childress, Police Department
- Fred Haberecht, Facilities
- David Hansen, Facilities
- Aaron Fodge, Parking and Transportation Services
- Jennifer Johnson, Parking and Transportation Services
- Tim Broderick, Housing and Dining
- Tessa Greegor, City of Fort Collins
- Steve Hultin, Facilities
- Kim Sharpe, Bicycle Pedestrian Education Coalition
- Sam Block, ASCSU

The first project steering committee took place on March 11, 2014. The intent of the meeting was to provide committee members with an overview of their role as a committee member, the current CSU bicycling context, the anticipated Bike Plan focus and key topics, and relationship of the Bike Plan to other University and City of Fort Collins efforts.

The second committee meeting was on May 8th in conjunction with a CBAC meeting. The focus of the meeting was to provide information on existing conditions, relevant previous planning efforts, opportunities, and initial observations on campus. Additionally, information gathered from the WikiMap was also presented. At the conclusion of the presentation the group discussed the following problem areas: South Drive, Elizabeth & Shields intersection, Elizabeth & College intersection, Lake and Center intersection, and the Oval.

The third meeting was on June 24, 2014. The focus of the meeting was to present draft infrastructure recommendations for the main campus, and to review the City’s draft bicycle network recommendations. Valuable feedback was received about the following areas: Laurel & Mason intersection, Pitkin, a north-south route near the Oval, Meldrum & Laurel intersection, Shields, Plum, Remington, Loomis, and Center.

The fourth and final meeting was on September 12, 2014. Committee members were presented with draft recommendations for bicycle parking, a recommended bicycle counting program, infrastructure recommendations for the Foothills and South Campuses, and initial cost estimates for infrastructure recommendations. The committee helped clarify assumptions and gave feedback on recommendations. As a result, refinements were made to the recommendations; these are reflected in the Plan.
MEDIA COVERAGE

The CSU Bicycle Master Plan, and bicycling on campus in general, received a substantial amount of local media coverage. The following articles and videos appeared in various publications, noted in the footnotes.

1 http://www.collegian.com/2014/02/use-wikimaps-bikers/66759/

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CSU and Fort Collins ask for biking input online
(February 24, 2014)
Use Wikimaps, bikers

by Collegian Staff
11 am, February 26, 2014
Last updated 6 months ago

Wikimaps is a website that allows bikers to update the city’s biking plan, add bike paths on campus and can be used as a place for residents and students to sound off on where they would like to see bike paths. Fort Collins and CSU prides itself on being biker-friendly, and this would only contribute to that image. But, it won’t work unless people actually use it.

This can make things a lot safer for bikers, pedestrians and drivers alike. As drivers, it can be frustrating to deal with bikers that don’t follow the rules of the road, and bikers know how irritating it is to deal with drivers that cut into bike lanes and refuse to respect space that cyclists need. If the University and Fort Collins can get our input on what bikers need, then they can take proactive steps to address the problem of having too many bikes and not enough space.

As students, we need to invest in the future of our roads in transportation, and make our voice known on what we want the biking community of Fort Collins to

Use Wikimaps, bikers
(February 26, 2014)

http://www.collegian.com/2014/02/use-wikimaps-bikers/66759/
VIDEO: Bike to breakfast

by Stefanie Walters
CTV Anchor and Reporter
6 pm, April 23, 2014

Colorado State has been celebrating Earth Week on campus many different ways. Some even include free breakfast burritos and coffee.

Bike to Breakfast Video
(April 23, 2014)

http://www.collegian.com/2014/04/video-bike-to-breakfast/76008/
City Bike Library opens location on Colorado State University campus

Starting this week, visitors, residents and students of Fort Collins can borrow a bike for free through the city’s Bike Library lending service at Colorado State University’s Surplus Property Department.

The new CSU satellite location, located at 201 West Lake Street, will provide 20 bikes available for rental.

Summer hours of operation for the Surplus Property Bike Library are 9 a.m. to 1 p.m. Monday through Friday.

Available bikes have been donated to the Fort Collins Bike Library and include popular and comfortable cruiser style cycles that can be used for relaxed riding or expedient travel.

To rent a bike, visit Surplus Property or sign up online at http://www.600kcol.com/articles/front-range-news-472098/city-bike-library-opens-location-on-12431480/

City Bike Library opens location on Colorado State University campus
(June 5, 2014)
Fort Collins opens bike library at Colorado State

Fort Collins opens bike library at Colorado State

(June 8, 2014)
Fort Collins Bike Library gives residents more transportation options

(June 17, 2014)

6 http://www.collegian.com/2014/06/fort-collins-bike-library-gives-residents-transportation-options/79285/
Colorado State University Bike Infrastructure Plan

Published on Oct 9, 2014

In the master plan update for this academic year, Colorado State University is hoping to approve a bike infrastructure plan that would make biking on campus more friendly to students and employees.

CSU Bike Infrastructure Plan Video
(October 9, 2014)

https://www.youtube.com/watch?v=eHlamKEDVg8
CSU working to make campus more bike friendly

(October 9, 2014)

Colorado State University, in conjunction with the City of Fort Collins, is creating a plan for a more bicyclist-friendly campus to be completed Nov. 17.

Bike plan focuses on creating low-stress routes

(August 4, 2014)

Appendix C
Draft Framework for Data Collection
MEMORANDUM

Date: August 22, 2014
To: Aaron Fodge
Organization: Colorado State University
From: Bill Schultheiss, P.E.
Jessica Juriga, P.E., AICP
Project: Colorado State University Bicycle Master Plan
Re: Draft Framework for Planning and Implementing a Data Collection Program

This memorandum outlines an approach for developing a bicycle counting program at Colorado State University (CSU). Based on best practices and our understanding of existing conditions and needs, the following steps would be involved with implementing a bicycle count program at CSU:

1. Define the data collection purpose and program objectives
2. Identify data collection resources
3. Determine the appropriate method and technology
4. Design the data collection program
5. Implement a pilot count program
6. Manage, maintain and expand the program

1. Data Collection Purpose

There are a variety of applications for bicycle count data that should be considered in the design of a count program. There are numerous trade-offs associated with the available technologies therefore the selection of a technology should be informed by the desired purpose of the counting program and the resulting type of data required to meet the objectives of the program.

The following applications should be considered and prioritized to help define the data collection needs and best develop a strategy for the program.
Typical Bicycle Count Applications and Purposes

- Measuring facility usage – Measure changes in pedestrian and bicycle activity over time and in context with land use and facility types.
- Evaluating before-and-after data – Measure the impacts of bicycle investments toward achieving increases in people choosing to bicycle.
- Monitoring travel patterns – Understand the factors that influence bicycling, such as weather, time of day, day of week patterns that improve planning and forecasting. This includes comparisons of bicycle use based on a facility type (e.g. - cycle track vs. bicycle lane) or comparison of different roadway contexts (e.g. – arterial vs. local street). This data provides a baseline to allow extrapolations of count data from and to predict bicycle facility demand.
- Safety analysis – Improve bicycle crash risk analysis by allowing the determination of a crash rate based on exposure.
- Project prioritization – Improve the ability to prioritize bicycle projects through data supported metrics.
- Multimodal modeling – Improve the accuracy and reliability of bicycle modeling and forecasting through validation.
- Encouragement – Visible counter displays could be used to encourage people to ride in order to achieve participation goals

2. Identify Data Collection Resources

Available resources will define the initial scale of the program. Based on the available resources the program may begin as a small effort with a small number of count locations and investment in time and technology, with the ability to expand over time, with the identification of additional and or dedicated resources.

3. Determine Appropriate Method and Technology

There are numerous technologies available for counting bicycles (and pedestrians), and in many cases several technologies may need to be considered to address the data needs and site considerations for the count program. The most common method for counting bicycles and pedestrians is Manual Counts, followed by passive and active infrared detectors, radio beam devices, pneumatic tubes, inductive loops, piezoelectric sensors, and use of automated video. Identifying the appropriate technology is dependent on numerous factors including:

- Physical site characteristics (e.g. facility type, width and environment, that impact the ability to install, secure, or effectively deploy various technologies)
- User Characteristics (e.g. bicycle only versus bicyclists and pedestrians, mixed automobile traffic, and user volumes such as large groups that may impact the effectiveness of detection)
- Attribute needs (e.g. classification of bicycle OR pedestrian, direction of travel, or ability to track user attributes such as gender or helmet use)
- Ability to gain permissions (e.g. the permitting process or allowable installation types as determined by the jurisdiction controlling the travel-way)
The following table provides a comparison of count technologies based on detection and physical site characteristics.

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<th>Type of Users Detected</th>
<th>Types of Sites</th>
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<td>All People</td>
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<tr>
<td>Automated Video</td>
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<td>Manual Counts</td>
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<td>Passive Infrared</td>
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<td>Active Infrared</td>
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<td>Pneumatic Tubes</td>
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<td>Inductive Loops</td>
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<td>Piezoelectric Sensor</td>
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<td>Passive IR + Inductive Loops</td>
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<td>Radio Beam (single frequency)</td>
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<td>Radio Beam (multi-frequency)</td>
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The technology chosen and program designed should align with the statewide Colorado Department of Transportation (CDOT) counting program, which includes over 50 bicycle count locations on trails and streets.

Based on past experience with using and testing these technologies, we have narrowed this list to several candidates for CSU to consider for pilot implementation.

- Pneumatic tube counters
- Portable passive infrared (IR) counters
- Inductive loop
- Combination inductive loop + passive IR combination counters
- Feedback Counter “Totem”

Feedback Counter “Totem”

One type that may be attractive for pilot deployment at CSU is the instant feedback counter, or “Totem” that, in addition to monitoring bicycle traffic, provides a real-time display of the current volume for the day, year, or overall. These high-profile installations help to increase the visibility and awareness about the amount of bicycling that occur at a key count location.

Pneumatic Tube Counters

Pneumatic tube counters are an affordable, reliable, and highly portable technology that will
allow for conducting short duration (one-three week) bicycle counts at multiple locations. Existing pneumatic tube technology can be used for off-street trail locations (counting bicycles only – no pedestrian detection), or in mixed traffic locations such as on street bike lanes, or shared roadways, using special tubes designed to distinguish bicycles from motor vehicle traffic.

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<th>Pneumatic Tubes</th>
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<td><strong>Duration of Count</strong></td>
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<td><strong>Portability</strong></td>
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<td><strong>Site Preparation</strong></td>
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Passive IR Counters

Passive IR count devices are highly portable and can be mounted easily using existing utility poles, sign posts, or street lamp posts. These counters count both pedestrian and bicycle traffic. These can be deployed for pedestrian only environments (such as sidewalks) or along shared use paths with mixed bicycle and pedestrian traffic. The IR detector does not distinguish bicycle from pedestrian, which can be achieved by deploying in conjunction with Pneumatic Tubes to infer the split of traffic based on simultaneous observations, or through installation of a combination unit that is integrated with an inductive loop installation (permanent).

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Inductive Loop Counters

Inductive loop counters require pavement cuts for permanent installation and are intended for monitoring bicycles only. Inductive loops are effective for long term continuous monitoring of bicycle traffic for a variety of facility types including, but not limited to Shared use paths, bike lanes, shared roadways, and cycle tracks. The technology detects the metallic elements of the bicycle and can distinguish bicycles from automobile in mixed traffic environments.

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Combination Passive IR/Inductive Loop Counter

Another consideration for a permanent installation at a known high-volume bicycle and pedestrian location (such as the Mason Trail), is the combination counter. This unit combines the passive IR and Inductive Loop as a single installation where the Passive IR tabulates total bicycle and pedestrian traffic deducting the tabulations from the loop detector (bicycle only) to project volumes for pedestrians and bicyclists independently along a shared use facility.

Estimating Costs for Counter Procurement and Installation

The costs for purchase, installation, and ongoing maintenance for the different count technologies can vary based on the type of technology selected and the desired features including, count data reporting intervals, desired functionality for detection, and data retrieval and management options. The following table provides a rough estimation of the anticipated costs for each of the technologies recommended for CSU. These costs are based on previous experience with procurement, installation and use of these technologies and are presented for planning purposes only. Actual costs may vary based on changes in market prices and the specific types of technologies and features requested during actual procurement.
Ballpark costs for various pedestrian and bicycle count technologies*

<table>
<thead>
<tr>
<th>Pneumatic tube counters</th>
<th>Cost</th>
<th>Installation</th>
<th>Replacement tubes</th>
<th>Fees**</th>
</tr>
</thead>
<tbody>
<tr>
<td>$3,000</td>
<td>NA</td>
<td>$1,000</td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>Passive IR counters</td>
<td>$3,500</td>
<td>NA</td>
<td>$500</td>
<td></td>
</tr>
<tr>
<td>Inductive loop counters</td>
<td>$3,000</td>
<td>$1,500</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Combination loop/IR</td>
<td>$5,000</td>
<td>$1,500</td>
<td>NA</td>
<td></td>
</tr>
<tr>
<td>Feedback counter -&quot;Totem&quot;</td>
<td>$20,000</td>
<td>$1,500</td>
<td>NA</td>
<td></td>
</tr>
</tbody>
</table>

*Cost estimates based on TDG past experience with procurement and installation and some consultation with vendors

**Fees include anticipated licensing and data transmission fees

4. Data Collection Program Recommendations

The following section provides some key considerations for moving forward with design and implementation of a pilot data collection program. These recommendations reflect guidance from the forthcoming Guidebook on Pedestrian and Bicycle Volume Data Collection developed as part of the recently completed NCHRP 07-19 Methods and Technologies for Pedestrian and Bicycle Volume Data Collection project.

Count Program Scale

The recommended near-term data collection program includes identification of 2 to 4 permanent count locations, supplemented by 7 to 10 short duration count locations. The timing and implementation of these count locations will depend largely on the resources available for staffing and equipment procurement. This approach could be implemented in a single year or staggered over a period of 2 to 5 years. The initial number of short duration count locations will be determined based on the quantity of short-duration count devices that are procured and the schedule for repeating data collection (e.g. bi-yearly, annual or alternating spring and fall).

The long-term recommendation should include expanding the number of permanent locations to at least five to seven, based on a variety of facility types and travel patterns. In the long run the permanent count locations can be linked to site profiles based on the use patterns that can be matched to the short duration sites to develop extrapolation factors for estimating annual use at all locations. The number of short duration sites should expand to as many as can be managed by staffing and budget resources, but at a minimum be expanded to include 12 – 24 locations in and around the CSU campuses. Additional counters should be routinely paired with new campus construction on paths and lanes leading to or around the new building, as part of these improvements as they occur.

Site Planning Recommendations

The project team has identified ten candidate locations recommended for initial consideration of the count program. The following map shows the candidate locations followed by a listing of the location descriptions by Map ID. A more detailed summary of all the candidate locations is included as an attachment to this memo.
<table>
<thead>
<tr>
<th>Map ID</th>
<th>Location Description</th>
<th>Existing facility type</th>
<th>Proposed facility type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elizabeth Street, west of Shields St</td>
<td>On-street bike lanes</td>
<td>Cycle track</td>
</tr>
<tr>
<td>2</td>
<td>Plum Street, east of Shields St</td>
<td>On-street bike lanes</td>
<td>Buffered bike lane</td>
</tr>
<tr>
<td>3</td>
<td>Meridian Ave, south of Laurel St</td>
<td>On-street bike lanes</td>
<td>Buffered bike lane</td>
</tr>
<tr>
<td>4</td>
<td>Path from Laurel Street to Transit Center</td>
<td>Shared use path</td>
<td>No change</td>
</tr>
<tr>
<td>5</td>
<td>Mason Trail, south of Laurel St</td>
<td>Shared use path</td>
<td>Shared use path</td>
</tr>
<tr>
<td>6</td>
<td>Elizabeth Street, west of College</td>
<td>Shared use path</td>
<td>Shared use path</td>
</tr>
<tr>
<td>7</td>
<td>Mason Trail, south of Pitkin Street</td>
<td>Shared use path</td>
<td>Shared use path</td>
</tr>
<tr>
<td>8</td>
<td>W Pitkin Street, east of Center Avenue Mall</td>
<td>On-street bike lanes</td>
<td>Cycle track and Citywide Signed Route</td>
</tr>
<tr>
<td>9</td>
<td>Center Avenue Mall</td>
<td>Cycle Track with separate sidewalk</td>
<td>No change</td>
</tr>
<tr>
<td>10</td>
<td>Lake Street, west of Center Ave</td>
<td>On-street bike lanes</td>
<td>Cycle track</td>
</tr>
<tr>
<td>11</td>
<td>Shields Street, south of Lake St</td>
<td>On-street bike lanes</td>
<td>Cycle track</td>
</tr>
<tr>
<td>12</td>
<td>Pitkin Street, east of Shields</td>
<td>On-street bike lanes</td>
<td>Cycle track and Citywide Signed Route</td>
</tr>
</tbody>
</table>
The following four locations are proposed for near term installation of continuous (permanent) count devices:

<table>
<thead>
<tr>
<th>Map ID</th>
<th>Location Description</th>
<th>Existing facility type</th>
<th>Context</th>
<th>Recommended Technology</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Elizabeth Street, west of Shields St</td>
<td>On-street bike lanes</td>
<td>Major bicycle route from the west; potential high bicycle volumes accessing campus from housing to the west of campus. High crash location with the City.</td>
<td>Inductive loop counters (2)</td>
</tr>
<tr>
<td>4</td>
<td>Path from Laurel Street to Transit Center by Rockwell Hall</td>
<td>Designated separated bicycle path with high pedestrian use</td>
<td>Entry point to campus from North; probably less bicycle traffic than Mason Trail to the east. Good capture point on diagonal route to transit</td>
<td>Combination passive IR/Inductive loop counter (1)</td>
</tr>
<tr>
<td>7</td>
<td>Mason Trail, south of Pitkin Street</td>
<td>Shared use path</td>
<td>Potential to capture significant northbound bicycle traffic from south of campus and intercampus-travel between central and south campuses. This location would provide a good contrast for traffic counts before and after the implementation of the City’s planned improvements (such as the two-way sidepath to connect Pitkin and Springfield) and the CSU decision to open up the walk zone at this point. This count location will capture nearly all campus traffic entering from the east.</td>
<td>“Totem” - Feedback inductive loop counter (1)</td>
</tr>
<tr>
<td>8</td>
<td>W Pitkin Street, east of Center Avenue Mall</td>
<td>On-street bike lanes</td>
<td>Major east-west route through southern part of campus; currently split by walk zone, but planned bicycle facility will increase the attractiveness of the route.</td>
<td>Inductive loop counters (2)</td>
</tr>
</tbody>
</table>

The locations proposed are based on preliminary observation of potential suitable count locations and will be refined based on stakeholder input and more detailed site analysis. Once the count locations and technologies are confirmed, there will need to be a more formal field assessment of each location to examine the facility parameters (e.g. facility widths, equipment mounting location and heights, identify obstructions or other limitations), and develop detailed site/installation plans. Both the permanent and short-duration count locations require detailed planning and evaluation to ensure that the sites are suitable for productive data collection that effectively captures bicycle and pedestrian travel patterns and meets the parameters of the selected technology.

5. Program Implementation
Program implementation will require additional steps that should be addressed during the planning process. There are a number of key details that need to be considered with implementation including developing checklists and protocols for both near-term and ongoing operation and maintenance of the program.

The following considerations will need to be addressed during implementation of the count program.

Obtaining permissions. If counts are conducted along facilities or in rights-of-way outside of the University’s control, it will likely be necessary to obtain permits or approval for equipment installed for counts. Even where permits are not required, it is good practice to develop a system of notification, to avoid equipment being inadvertently removed or damaged while in use.

Procurement of Devices. Choosing appropriate technology and identification of a good vendor will be important to the success and ongoing support for the count program. Depending on the procurement process and requirements, significant lead time may need to be accounted for in the planning schedule.

Device Inventory and Preparation. Once procurement is complete and delivery of equipment is made, it is important to have a process for inventory, documentation and identification of each piece of equipment.

Training. Getting up to speed with how the technology works, understanding proper installation, and managing data collection and storage require investment in training. This training develops the program capacity, ensures better quality control and should be an ongoing part of the count program.

Device installation, calibration, and maintenance. Whether installation is performed by staff or outside contractors, it is paramount to have thorough protocols and checklists to ensure devices are properly installed, calibrated and effectively maintained. Once properly installed and operational, ongoing monitoring and maintenance of devices should be planned for.

Data Management. As data is continuously collected there need to be systems for managing retrieval, validation and long-term maintenance of the data. Many vendors include specific software or even remote transmitting web-based data management that should be considered. Data management also includes cleaning and correcting data for missed counts or equipment malfunctions. As a larger volume of data from continuous and short duration monitoring is developed, the ability to make adjustments for missed data and/or account for seasonal and weather conditions that impact data from short duration monitoring will greatly improve. Data should formatted and shared with the State of Colorado’s data collection program.

Count Scheduling

Once site planning is completed, a deployment schedule and pilot implementation plan can be developed. The initial implementation should include at least two of the four permanent count installations deployed on a minimum of one on-street (bike lane) and one off-street (shared pathway or cycle track) facility.

In addition to the two to four permanent installations, initial procurement should include at least one pair of pneumatic tube counters. These devices can be easily deployed for short duration counts and rotated among
remaining count locations or at new identified locations throughout the year. Short duration counts should be a minimum of seven consecutive days and ideally fourteen days to allow for analysis of weekday/weekend patterns at each location.

There may be a desire for procuring additional portable count units, including passive IR to track distinguish pedestrian traffic at off-street locations. Additionally the number of portable counters available will determine the number and duration of short-duration counts scheduled each year. The portable count units can also provide some flexibility to conduct response based counts as needs arise at locations that are not part of the counting schedule, or to examine new locations to determine if they should be added to the ongoing program.

6. Manage, maintain and expand the program

Looking forward, there should be a strategic plan and resources committed to the ongoing monitoring and expansion upon the bicycle and pedestrian count program. A program can be launched with modest investment and limited staff resourcing, but over time will need to become routinized with dedicated funding to maintain and replace devices and equipment and expand the program with new installations.

The initial planning effort should include consideration of the ongoing program expansion and recommend additional steps for updating the count program strategy over time.