Everything You Wanted to Know About Bicyclist and Pedestrian Count Data

Module 3: USING THE DATA

Online Training Presented by:

TxDOT Bicycle and Pedestrian Program &
Texas A&M Transportation Institute (TTI)

August 4, 2020
WELCOME to Module #3: Using Pedestrian and Bicyclist Count Data

- Moderator: Phil Lasley, TTI
- TxDOT Program: Bonnie Sherman, TxDOT

MODULE 3, USING THE DATA
- Introduction & Overview
- Before & After Study
- Trend Monitoring
- Safety Analysis
- Demand Estimation
- Operation, Maintenance, and TSM
- OD Patterns
- Planning & Project Selection
- Other Uses
Module #3: Using Pedestrian and Bicyclist Count Data

Everything You Wanted To Know About Bicyclist And Pedestrian Count Data

COLLECT  

SUMMARIZE

July 23  
Recording

July 29  
Recording  
TODAY
Best Practices for Virtual Meetings

- Please stay muted unless you are speaking

- Remove all other distractions (work email, instant messenger, etc.)

- Actively participate in training
  - Take notes on slide handouts
  - Use Q&A panel for questions or comments (not chat)
  - Respond to polls

- Webcam not necessary
  - Turn off outgoing video to conserve WiFi bandwidth
Webex Event Features

- View Polling (when enabled)
- View Q&A
- Adjust Audio Settings
- More Options
- Ask Question Here
- Answer Poll Here
- Feedback Options
- Raise Hand
Introduction Poll

- Please respond to poll at this time

- Any questions before we get started?
  - Feel free to test question box now
TxDOT Bicycle and Pedestrian Count Program

Bonnie Sherman, TxDOT
Statewide efforts addressing bicycle & pedestrian transportation

<table>
<thead>
<tr>
<th>Texas Transportation Plan 2050</th>
<th>Bikeway Design Effort</th>
<th>Project Development Enhancements</th>
<th>Road to Zero</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economic Impact of Bicycling in Texas</td>
<td>ADA Transition Plan Update</td>
<td>Pedestrian/Bicycle Facility Inventory</td>
<td>Bicycle Tourism Trails Study</td>
</tr>
</tbody>
</table>

www.pedbikeimages.org

[Toole Design Group](https://creativecommons.org/licenses/by-sa/3.0)
Better data is needed to better accommodate bicyclists & pedestrians.

**Needs Identification**
- Promote bike/ped data collection
- Initiate District bike plans

**Scoping**
- Develop scoping tool to address bike/ped needs
- Incorporate bike/ped criteria into Project Safety Scoring Tool

**Design Concepts**
- Strengthen involvement of bike/ped stakeholders in PDCC and DCC

**Traffic Control Plans**
- Better incorporate temporary bike/ped in traffic control plans

**Best Opportunity for Bike/Ped Incorporation**

**Consultant Procurement**
- Update standard contract to promote design flexibility
- Assess bike and ped consultant qualifications separately

**Public Involvement**
- Refine comment response process
- Develop guidance for annual District bike meeting/hearing

**Compliance with Planning and Programming**
- Use bike/ped performance measures in project scoring/selection processes
- Create state-level clearinghouse of bike/ped transportation plans

**Guidance/Training Improvements**
- Standardize bikeway design guidance
- Refine existing or create new TxDOT training classes
- Develop District-level bike/ped design engineering subject matter expertise
### Better data is needed to better accommodate bicyclists & pedestrians

| 1 | Standardize bikeway design guidance so TxDOT engineers refer to one source |
| 2 | Initiate District bicycle plans statewide |
| 3 | Continue to incorporate bicycle criteria into Project Safety Scoring Tool |
| 4 | Develop District-level bike/ped design engineering subject matter expertise |
| 5 | Promote collection of bike/ped data |
| 6 | Refine DSR or develop scoping tool to address b/p needs based on context |
| 7 | Refine req’ts to better incorporate temporary b/p facilities (detours) in traffic control plans |
| 8 | Refine existing or create new TxDOT training classes |
| 9 | Refine comment response process to better document bikeway needs |
| 10 | Update standard contract to ensure consistent bike/ped accommodation and allow for design flexibility |
| 11 | Develop informational handouts to strengthen b/p involvement at PDCC & DCC |
| 12 | Create a state-level clearinghouse of bike/ped transportation plans |
| 13 | Assess bike and ped consultant qualifications separately |
| 14 | Formalize bike/ped performance measures as part of department project scoring and selection processes (e.g. Decision Lens) |
| 15 | Develop guidance and awareness for annual District bike meeting/hearing |
Better decision-making requires good data

Safety
- Exposure for crash rates
- Behavior (contra-flow riding)

Planning
- Demand estimation
- Travel patterns

Design
- Facility type and design
- Barriers
- High activity areas

Performance Measurement
- Before and after studies
- Long-term trends from areawide improvements
- Mode shift

Understand problems
Anticipate future needs
Identify solutions
Track trends

We need to know about bicycle and pedestrian usage on our roadways.
Working to resolve the data gap for bicyclists and pedestrians...

- Texas Bicycle and Pedestrian Count Exchange
- Crowdsourced bicycle data (StravaMetro)
- Counter equipment loan program
- Upcoming procurement of bike/ped counts
- Data collection and analysis guidance
- Virtual training in Summer 2020
Thank you!

**Bonnie Sherman, AICP**  
TxDOT – Public Transportation Division  
Bicycle/Pedestrian Program Manager  
Bonnie.Sherman@txdot.gov  
(512) 486-5972

**Noah Heath, AICP**  
TxDOT – Public Transportation Division  
Bicycle/Pedestrian Program Planner  
Noah.Heath@txdot.gov  
(512) 486-5973

[Link to website](https://www.txdot.gov/inside-txdot/modes-of-travel/bicycle.html)
Using Bicyclist and Pedestrian Count Data

Shawn Turner
Robert Benz
Ipek N. Sener
Using pedestrian and bicyclist count data

- Catch-22

- “We shouldn’t collect ped/bike count data until we have a defined business process for using it.”
- “We haven’t used ped/bike count data because it hasn’t been available”

- Currently working to get out of this circular logic
“Plan your destination before you start your trip”

Everything You Wanted To Know About Bicyclist And Pedestrian Count Data

COLLECT 1

SUMMARIZE 2

USE 3

The uses (Module 3) inform many decisions made in these first 2 modules
How will you (and others) use count data?

- Most likely will have multiple uses
- Will have to balance the requirements for multiple uses
- Will be used for more things than what you planned

Uses we will highlight today:
- Trend Monitoring
- Before & After Study
- Safety Analysis
- Demand Estimation
- Operation, Maintenance, and TSM
- OD Patterns
- Planning & Project Selection
- Other Uses
Lots of other uses for pedestrian and bicyclist count data

<table>
<thead>
<tr>
<th>Purpose</th>
<th>Geographic Level</th>
<th>Primary Data Collection Elements*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulate public policy</td>
<td>Area</td>
<td>Travel survey repeated at regular time intervals and permanent continuous counters with additional short duration counts</td>
</tr>
<tr>
<td>Measure change over time</td>
<td>Path or road</td>
<td>Permanent continuous counters with additional short duration counts, if needed</td>
</tr>
<tr>
<td>Prioritize projects</td>
<td>Path or road</td>
<td>Travel survey repeated at regular time intervals</td>
</tr>
<tr>
<td>Plan and design future facilities</td>
<td>Path or road</td>
<td></td>
</tr>
<tr>
<td>Calibrate regional model</td>
<td>Path or road</td>
<td></td>
</tr>
<tr>
<td>Assess and market commercial real-estate</td>
<td>Path or road</td>
<td></td>
</tr>
<tr>
<td>Identify and assess the value of locations for advertising (billboards, etc.)</td>
<td>Path or road</td>
<td></td>
</tr>
<tr>
<td>Study safety performance</td>
<td>Intersection</td>
<td>Turning and crossing movement counts, usually at peak hours; preferably adjusted with temporal adjustment factors from permanent continuous counters</td>
</tr>
<tr>
<td>Adjust signal timing</td>
<td>Intersection</td>
<td>Turning movement counts including crosswalks, usually at peak hours</td>
</tr>
<tr>
<td>Conduct before/after safety study</td>
<td>Safety counter-measure on road segments or intersection</td>
<td>Special purpose short duration counts, preferably adjusted with temporal adjustment factors from permanent continuous counters</td>
</tr>
<tr>
<td>Compare safety performance across cities or regions</td>
<td>Area</td>
<td></td>
</tr>
<tr>
<td>Assess community-wide physical activity</td>
<td>Area</td>
<td>Travel survey or diary</td>
</tr>
</tbody>
</table>

* This does not include the many data sources that could supplement these data sources (such as GPS trace data from smartphone apps, or sociodemographic data from the American Community Survey), nor does it include other types of data that would be needed for these purposes such as infrastructure, crash data, or sociodemographic information.

Trend monitoring

- “How has biking/walking changed since last year/month/week?”
  - Citywide/areawide
  - Subareas or neighborhoods
  - Corridors or locations

- Situational awareness that informs various decisions, esp. policy changes

- For example:
  - More emphasis on facility designs that attract the most users
  - Better/more frequent maintenance (e.g., street sweeping)
  - Private/commercial investment in redeveloping areas
Trend monitoring

North Central Texas Council of Governments (NCTCOG)

- Annual benchmarking report

Year-to-year Trends

Special Event Analysis

Count Station Summary

Trend monitoring: Key considerations

- REPRESENTATIVE locations
  - NOT JUST BUSIEST LOCATIONS!
  - What areas/locations are you trying to represent in your trends?

- Don’t over-extend the application of your trends
  - For example, 3 counters on a single facility type and then saying “Biking is up XX% citywide”
  - Build credibility with transparency, not hyperbole
Trend monitoring: Key considerations

- Hypothetical example – limited count locations

Biking and Walking in Denver

<table>
<thead>
<tr>
<th>Location</th>
<th>2011 ADT</th>
<th>Trend, 2010-2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Cherry Creek @ Holly</td>
<td>1,250</td>
<td>+9%</td>
</tr>
<tr>
<td>2. C470 @ Ken Caryl</td>
<td>890</td>
<td>+5%</td>
</tr>
<tr>
<td>3. Platte River @ REI</td>
<td>1,620</td>
<td>+3</td>
</tr>
<tr>
<td>4. 6th Ave @ Vaughn</td>
<td>540</td>
<td>-1%</td>
</tr>
<tr>
<td>5. US 287 Underpass (Broomfield)</td>
<td>1,480</td>
<td>+6</td>
</tr>
</tbody>
</table>
Trend monitoring: Key considerations

- Make it super-easy to QUANTIFY THE TREND
  - Create visuals for non-technical people
  - Don’t make them guess or extrapolate % values
  - Write out your main takeaway point(s) on the chart
Trend monitoring: Key considerations

- Make it super-easy to QUANTIFY THE TREND

<table>
<thead>
<tr>
<th></th>
<th>April 2019 vs. 2020</th>
<th>May 2019 vs. 2020</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>55%</td>
<td>65%</td>
</tr>
</tbody>
</table>
Trend monitoring: Key considerations

- Make it super-easy to QUANTIFY THE TREND

**Figure 1: Adjusted annual trails count**

<table>
<thead>
<tr>
<th>Trail/Pathway</th>
<th>Estimated Monthly visits/trips*</th>
<th>Estimated Annual visits/trips*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burnt Bridge Creek Trail</td>
<td>20,316.00</td>
<td>253,955.00</td>
</tr>
<tr>
<td>Columbia River Renaissance Trail</td>
<td>78,332.00</td>
<td>986,645.00</td>
</tr>
<tr>
<td>Frenchman's Bar/Vancouver Lake Trail</td>
<td>11,046.00</td>
<td>138,073.00</td>
</tr>
<tr>
<td>I205 Pathway</td>
<td>10,472.00</td>
<td>130,901.00</td>
</tr>
<tr>
<td>I5 Pathway</td>
<td>7,056.00</td>
<td>88,197.00</td>
</tr>
<tr>
<td>Lacamas Heritage Trail</td>
<td>19,935.00</td>
<td>249,192.00</td>
</tr>
<tr>
<td>Padden Parkway Pathway</td>
<td>8,290.00</td>
<td>103,622.00</td>
</tr>
<tr>
<td>Salmon Creek Trail</td>
<td>48,955.00</td>
<td>611,193.00</td>
</tr>
</tbody>
</table>

*Data adjusted per National Bicycle & Pedestrian Documentation Project Count Adjustment Factors March 2009

**Figure 1: Growth in Intertwine use**

- +6%
- +5.55126%
- +2%
- +2.14832%
Trend monitoring: Key considerations

- Make it super-easy to QUANTIFY THE TREND

Bike use increased 486% by expanding the bikeway network 8% per year

Source: Roger Geller, City of Portland
Trend monitoring: Key considerations

- Start big-picture, provide drill-down options
Trend monitoring: Key considerations

- Start big-picture, provide drill-down options
Trend monitoring: Key considerations

- Start big-picture, provide drill-down options

Woodway Dr Trail at E of IH-610 NB FR

Counter Information
- Count Type: Permanent Stations
- Functional Class: Urban, Minor arterial
- Facility Type: Side path for bicycles and pedestrians
- Owner Agency: Memorial Park Conservancy
- Brand: Eco-Counter

YTD Count vs Previous Year:

- 59,177
- 51,869

Legend:
- Bicycles only, Eastbound
- Bicycles only, Westbound
- Pedestrians only, Eastbound
- Pedestrians only, Westbound
Trend monitoring: Key considerations

- Start big-picture...
Trend monitoring: Key considerations

- ... then provide drill-down options
What’s needed to start?

- Select count representative locations in 3 pattern groups
  - Commuting to work/school routes
  - Recreational/utilitarian routes
  - Hybrid/mix of commuting and recreation
- FHWA TMG recommends 3-5 permanent locations in each group
- Test locations with short-term counts
- Install permanent counters (phased approach)
- ~3 years of clean, complete data
- Equipment maintenance program
Before & after study

- "I changed X at this(these) location(s), do more people bike/walk now?
  - X = facilities (i.e, sidewalks, bikeways)
  - X = bikeshare program
  - X = land use/development

- Heard of 3E? It’s actually 5E!
  - **Evaluation**, Engineering, Education, Enforcement, Encouragement

- Reinforces existing policies or informs policy changes
  - Facility design
  - Zoning/mixed land use
  - Effectiveness of traffic control devices
  - Etc.
Corpus Christi MPO

- Before and after-construction bike counts for projects around the area
- Data collection separates anecdotal information from the facts

http://www.coastalbendmotion.org/counts.html
Cameron County

THE ACTIVE PLAN

LEGEND
ACTIVE ROUTES
- LRGV Multi-Use Trail (Proposed)
- LRGV Multi-Use Trail (Alternate)
- LRGV Multi-Use Trail (Existing)
- US Bicycle Route (Proposed)
- LRGV Paddling Trail (Proposed)
- LRGV Paddling Trail (Existing)
- Brownsville Trails (Proposed)
Before & after study: Key considerations

- BIGGEST CHALLENGE: ?
Before & after study: Key considerations

- Comparing conditions before and after a change:
  - No other changes in vicinity
  - Same time of year (or adjust seasonality)
  - Random variation
  - Regression to the mean (“nowhere to go but up”)

- Comparison/control sites
- Minimizing other possible changes
- Empirical Bayes (statistical approach)
- Getting researchers involved

<table>
<thead>
<tr>
<th>Methodology</th>
<th>Treatment Effect</th>
<th>Exposure Effect</th>
<th>Trend Effect</th>
<th>Random Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before-and-After with Empirical Bayes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Before-and-After with Comparison Group</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Before-and-After with Yoked Comparison</td>
<td>Yes</td>
<td>Yes</td>
<td>Potential</td>
<td>No</td>
</tr>
<tr>
<td>Naïve Before-and-After Study</td>
<td>Yes</td>
<td>Potential</td>
<td>No</td>
<td>No</td>
</tr>
</tbody>
</table>
Before & After Studies

What’s needed to get started?

– Portable equipment
– Determine locations
  • Planned improvements
  • Moderate to high activity levels (also growth potential)
  • Not just the highest-volume locations
– Count before & after (7-14 days) during an average time of year
– Upload and verify count data in the BP|CX platform
– Repeat as the area changes
Safety analysis


Different types of safety analysis

A. Safety performance measures
B. Network screening, area-based
C. Network screening, facility-based
D. Project prioritization
E. Countermeasure evaluation
F. Site evaluation
What is common element in safety analyses?

EXPOSURE!

1 cyclist

20 cyclists
Crash rate definition

\[
\text{Crash Rate} = \frac{\text{Observed crashes}}{\text{Exposure}}
\]

\[
\text{Crash Rate} = \frac{\text{Observed crashes}}{\text{Counts} \times \text{distance traveled}}
\]
Exposure in Safety Analysis

- Exposure Estimation Options:
  - Counts
  - Demand Estimation Models
    - Several options here
  - Travel Surveys
    - ACS
    - NHTS
    - Regional household travel survey

Source: Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists (FHWA)
Exposure in Safety Analysis

- Risk = Crashes / Exposure
  - Larger geographic areas – more likely to use surveys than counts

**Texas**

- **Annual Fatalities**
  - Walking
  - Bicycling
  - Non-Motorized

- **Annual Risk - Fatalities/Million Hours of Travel**
  - Walking
  - Bicycling
  - Non-Motorized

**Large Metro**

- **Annual Fatalities**
  - Walking
  - Bicycling
  - Non-Motorized

- **Annual Risk - Fatalities/Million Hours of Travel**
  - Walking
  - Bicycling
  - Non-Motorized
Exposure in Safety Analysis

- What’s needed to get started?
  - Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists (FHWA)
  - Facility-specific counts
    - Use automated counter equipment as much as possible
    - Avoid very short duration counts (i.e., two-hour counts)
    - Seek balance between number of count locations and duration
    - Select representative months and days of week for your area and count location
    - Focus on balance of high-priority yet representative locations

Source: Guide for Scalable Risk Assessment Methods for Pedestrians and Bicyclists (FHWA)
Using Bicyclist and Pedestrian Count Data

Demand Estimation

Ipek N. Sener
Demand Estimation Models

- Numerous models to estimate pedestrian and bicyclist demand.
- The models range in complexity and input requirements.
- Most require COUNT DATA to develop and calibrate.
Direct Demand Models

- Statistical models
  - often based on regression analysis
  - developed using different data sources

- Primarily used to develop facility-specific demand estimations
  - facility use or needs
  - estimates of non-motorized activity
  - connection between the built environment and non-motorized demand
Direct Demand Models

- Simple, practical and generally based on available data
- Particularly useful for screening and preliminary analyses when resources are limited

Pros:
- Usually not transferable
- Limited in terms of capturing the underlying behaviors and travel patterns
Model Development Process

Phase A: Study Identification

Phase B: Data Preparation

Phase C: Model Development
- **Build** to estimate at locations where the count data are collected

- **Apply** to predict at locations where the count data are not available
Research Article

Identifying High-Risk Intersections for Walking and Bicycling Using Multiple Data Sources in the City of San Diego

Mahdie Hasani,1 Arash Jahangiri,1 Ipek Nese Sener,2 Sirajum Munira,2 Justin M. Owens,3 Bruce Appleyard,4 Sherry Ryan,4 Shawn M. Turner,5 and Sahar Ghanipoor Machiani1

1Civil, Construction, and Environmental Engineering, San Diego State University, 5500 Campanile Dr, San Diego, CA 92182, USA
2Texas A&M Transportation Institute, 505 E. Huntland Dr, Austin, TX 78752, USA
3Virginia Tech Transportation Institute, 3500 Transportation Research Plaza, Blacksburg, VA 24061, USA
4School of Public Affairs, San Diego State University, 5500 Campanile Dr, San Diego, CA 92182, USA
5Texas A&M Transportation Institute, 3135 TAMU, College Station, TX 77843, USA

Example 1: Nonmotorized Volume Estimates in San Diego

- Pedestrian & Bicycle Direct Demand Model results

<table>
<thead>
<tr>
<th>Pedestrian Model (buffer in mile)</th>
<th>Est</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transit stop density (0.5)</td>
<td>8.78**</td>
</tr>
<tr>
<td>Regular transit rider, pedestrian, or bicyclist population % (0.25)</td>
<td>3.71*</td>
</tr>
<tr>
<td>Employment density (0.25)</td>
<td>0.05**</td>
</tr>
<tr>
<td>Maximum speed limit &lt;40 mph</td>
<td>1.13**</td>
</tr>
<tr>
<td>% of vacant housing units (0.5)</td>
<td>−3.51**</td>
</tr>
<tr>
<td>Commercial/mixed-use land area (0.1)</td>
<td>0.19**</td>
</tr>
<tr>
<td>If the area contains a higher crime count than the average (0.25)</td>
<td>−0.29*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Bicycle Model (buffer in mile)</th>
<th>Est</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regular bicyclist population (0.25)</td>
<td>0.01**</td>
</tr>
<tr>
<td>Transit stop density (0.1)</td>
<td>0.85</td>
</tr>
<tr>
<td>Maximum speed limit &lt;40 mph</td>
<td>0.45**</td>
</tr>
<tr>
<td>Distance from beachfront access point ≤10 miles</td>
<td>0.37**</td>
</tr>
<tr>
<td>Presence of a school (0.5)</td>
<td>−0.48**</td>
</tr>
<tr>
<td>Bike facility density (0.5)</td>
<td>1.37**</td>
</tr>
<tr>
<td>Total commercial or mixed-use land area (0.25)</td>
<td>0.02**</td>
</tr>
</tbody>
</table>

** Significant at 0.05 level; * Significant at 0.1 level

Example 2: Austin Pedestrian Safety Study

A Bayesian spatial Poisson-lognormal model to examine pedestrian crash severity at signalized intersections

Srajum Munira, Ipek N. Sener, Boya Dai

Texas A&M Transportation Institute, 505 E Huntland Dr, Austin, TX 78752, United States

Example 2: Pedestrian Volume Estimates in Austin

Need to estimate pedestrian exposure at (signalized) intersections citywide

Count data
• Available at 44 sites

Pedestrian Direct Demand Model

Count estimate
• Applied to 409 intersections

Crash model

Example 2: Pedestrian Volume Estimates in Austin

- Pedestrian Direct Demand Model results

- Trail network
- Transit facility
- Land use
- Demographics
Example 3: Austin Bicycle Demand Study (work in progress)

- Development of a bicycle direct demand model
- Use of a composite measure
  - a bikeability index to quantify the bike friendliness of the road network
- Other model variables include demographics and land-use characteristics

Count data available at 44 sites (intersections)

Count estimate applied to 2,518 intersections
Example 4: El Paso Bicycle Patterns Study

- A model to explore bicycling activity in the city (focus on exposure to air pollution)
  - Count data --> Crowdsourced data (StravaMetro)

  • valuable input in estimating bike/ped demand
  • need to be aware of challenges (e.g. sample bias)

Bicycle Model results

<table>
<thead>
<tr>
<th>Category</th>
<th>Variable Name</th>
<th>Estimate</th>
<th>T-Stat.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Roadway characteristics</td>
<td>Posted speed limit</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>48 km/h (30 mph) or less</td>
<td>−0.327</td>
<td>−5.56</td>
</tr>
<tr>
<td></td>
<td>56 km/h (35 mph)</td>
<td>−0.481</td>
<td>−7.22</td>
</tr>
<tr>
<td></td>
<td>64 km/h (40 mph)</td>
<td>−0.298</td>
<td>−4.84</td>
</tr>
<tr>
<td></td>
<td>Roadway type</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Collector</td>
<td>−0.569</td>
<td>−10.39</td>
</tr>
<tr>
<td></td>
<td>Local street</td>
<td>−1.361</td>
<td>−8.05</td>
</tr>
<tr>
<td>Bicycle infrastructure features</td>
<td>Planned bike facilities</td>
<td>0.678</td>
<td>12.44</td>
</tr>
<tr>
<td></td>
<td>Off-street path</td>
<td>1.474</td>
<td>13.54</td>
</tr>
<tr>
<td></td>
<td>Buffered bike lane</td>
<td>1.340</td>
<td>11.16</td>
</tr>
<tr>
<td></td>
<td>Shared lane marking</td>
<td>1.047</td>
<td>6.10</td>
</tr>
<tr>
<td></td>
<td>Bike lane</td>
<td>0.886</td>
<td>10.19</td>
</tr>
<tr>
<td>Topographical attributes</td>
<td>Elevation (100 m)</td>
<td>0.402</td>
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<tr>
<td></td>
<td>Segment slope (%)</td>
<td>0.027</td>
<td>1.85</td>
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<td>Neighborhood demographics</td>
<td>District</td>
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</tr>
<tr>
<td></td>
<td>West Franklin Mt</td>
<td>0.424</td>
<td>4.93</td>
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<tr>
<td></td>
<td>East Franklin Mt</td>
<td>−0.296</td>
<td>−8.84</td>
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<tr>
<td></td>
<td>East downtown</td>
<td>−0.492</td>
<td>−6.59</td>
</tr>
<tr>
<td></td>
<td>South El Paso</td>
<td>−0.585</td>
<td>−6.67</td>
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<tr>
<td></td>
<td>East-South El Paso</td>
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<td>−8.50</td>
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<tr>
<td></td>
<td>Age</td>
<td>0.702</td>
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<tr>
<td></td>
<td>People aged 35-44 (%)</td>
<td>2.030</td>
<td>4.23</td>
</tr>
<tr>
<td></td>
<td>People aged 45-54 (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>0.465</td>
<td>2.72</td>
</tr>
<tr>
<td></td>
<td>Hispanic (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Socioeconomics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Median household income ($)</td>
<td>0.096</td>
<td>7.06</td>
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<tr>
<td></td>
<td>Retail job density (1000 per sq. km)</td>
<td>−0.259</td>
<td>−3.94</td>
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<tr>
<td></td>
<td>Emission exposure measures</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bus frequency (100 times per day)</td>
<td>0.339</td>
<td>7.32</td>
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<tr>
<td></td>
<td>(Natural log of) PM2.5 (gram/min/km)</td>
<td>0.146</td>
<td>9.11</td>
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<tr>
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<td>Constant</td>
<td>−1.496</td>
<td>−2.13</td>
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</table>

https://www.mdpi.com/1660-4601/16/3/371
Using Bicyclist and Pedestrian Count Data

Operations, Maintenance, and TSM Origin Destination (OD) Project Selection

Robert Benz
- Rumble Strip Example
- Rumble Strip Example
- Strava Estimate
- Rumble Strip Example
- Compare Permanent or Short Duration Counts to Strava Estimate
- Rumble Strip Example
- Compare Permanent or Short Duration Counts to Strava Estimate

<table>
<thead>
<tr>
<th>Month</th>
<th>2018</th>
<th>2020</th>
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<tbody>
<tr>
<td>January</td>
<td>623</td>
<td>86%</td>
</tr>
<tr>
<td>February</td>
<td>476</td>
<td>23%</td>
</tr>
<tr>
<td>March</td>
<td>735</td>
<td>47%</td>
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<td>April</td>
<td>712</td>
<td>22%</td>
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<tr>
<td>May</td>
<td>1,000</td>
<td>22%</td>
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<tr>
<td>June</td>
<td>858</td>
<td>47%</td>
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<tr>
<td>July</td>
<td>639</td>
<td>22%</td>
</tr>
<tr>
<td>August</td>
<td>653</td>
<td>47%</td>
</tr>
<tr>
<td>September</td>
<td>644</td>
<td>22%</td>
</tr>
<tr>
<td>October</td>
<td>645</td>
<td>47%</td>
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</tbody>
</table>

Monthly Bicycle Volume

**FM 359**
Operations, Maintenance, TSM
TxDOT Houston District

- New right-turn lane for property development
- Strava Metro Data shows 1,069 cyclists during 2016-2017
- Integrated bike lane treatment

If you have a trail and know the count where are people entering and exiting the system?
Where are users accessing the trail between these two permanent counters?
Origin Destination (OD)
Project Selection Criteria

- Multi Source Estimates
- Existing Counts
- Strava
- ACS
- Demand Estimation
- Variation
- Field Visit
### Identifying/Prioritizing/Selecting Projects

- TIP call for projects estimation process
- Selection based on the benefit-cost ratio (safety and reduction of SOV)
- Estimate of non-motorized users per project required

#### Non Motoized Project Volume Estimates

<table>
<thead>
<tr>
<th>#</th>
<th>Project Length</th>
<th>Stava Compnts</th>
<th>Step Vol</th>
<th>Step Increase</th>
<th>Distance Factor</th>
<th>2040 Vol</th>
<th>Existing Count Estimate</th>
<th>Distance Factor</th>
<th>2040 Vol</th>
<th>Conslt Est</th>
<th>Conslt 2025</th>
<th>Conslt 2045</th>
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<tr>
<td>1</td>
<td>0.9337</td>
<td>30</td>
<td>30</td>
<td>1.3</td>
<td>39</td>
<td>72.8</td>
<td>108</td>
<td>35</td>
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<td>97</td>
<td>2090</td>
<td>4,187</td>
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<tr>
<td>2</td>
<td>0.5843</td>
<td>135+175(.3)</td>
<td>187.5</td>
<td>1.2</td>
<td>225</td>
<td>262.9</td>
<td>391</td>
<td>150</td>
<td>175.3</td>
<td>260</td>
<td>2090</td>
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<td>3</td>
<td>0.7911</td>
<td>35+35</td>
<td>70</td>
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<td>84</td>
<td>132.9</td>
<td>198</td>
<td>114</td>
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<td>1585.1</td>
<td>2,355</td>
<td>20</td>
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<td>30.0</td>
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<td>75</td>
<td>1</td>
<td>75</td>
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<td>11</td>
<td>2.2033</td>
<td>(35+25)</td>
<td>60</td>
<td>1.2</td>
<td>72</td>
<td>317.3</td>
<td>471</td>
<td>50</td>
<td>220.3</td>
<td>327</td>
<td>469</td>
<td>552</td>
</tr>
</tbody>
</table>
Module #3: Using Pedestrian and Bicyclist Count Data

- Questions?

- MODULE 3, USING THE DATA
  - Introduction & Overview
  - Before & After Study
  - Trend Monitoring
  - Safety Analysis
  - Demand Estimation
  - Operation, Maintenance, and TSM
  - OD Patterns
  - Planning & Project Selection
  - Other Uses

Phil Lasley
Bonnie Sherman
Shawn Turner
Robert Benz
Ipek N. Sener