Estimating Pedestrian and Bicycle Demand

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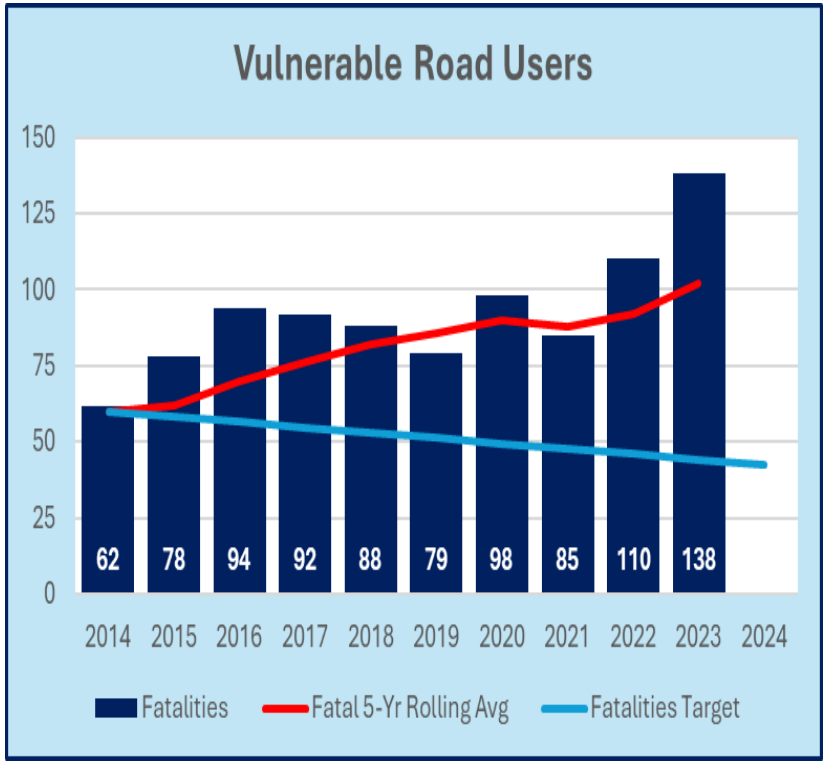
Agenda

- Introduction
  - Previous Efforts
  - Goals
- Pedestrian and Bicycle:
  - Demand Estimation
  - Benefits
- Tool
  - Case study
- Pedestrian and Bicycle Counting Methods
- Q & A

The Need

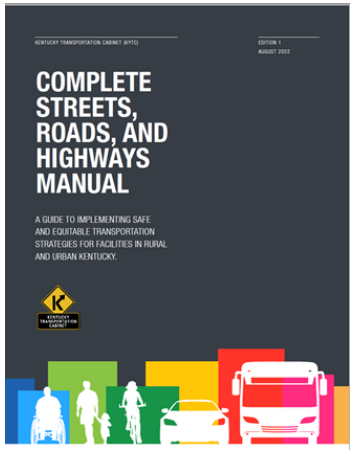
- Walking and biking in the US
  - Walking: 6.8% of all trips
  - Biking: 1.0% of all trips
- Biking trips percentage has not changed since 2001
- Walking trips show a significant decline from 2017 to 2022 (from 11.9% to 6.8%)
- Necessity for greater project-level consideration and accommodation for pedestrians and bicyclists
- Bike Ped fatalities are up

(Source: USDOT National Household Travel Survey, 2022)



- 19% of respondents prioritize increased options for pedestrians and bicyclists—the top category beyond roadway improvements.

KYTC Efforts



- Kentucky Transportation Cabinet (KYTC) policy updates:
  - Complete Streets, Roads and Highways Manual
  - Statewide Bicycle and Pedestrian Master Plan

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KYTC Objectives and Strategies

- Balance all user needs within the roadway network
  - Accommodate pedestrian and bicyclist needs
- Integrate non-motorized transport into the overall transportation planning process
- Systematic assessment of pedestrian and bicyclist needs
- Estimation of benefits of proposed projects

- Development of the Strategic Highway Investment Formula (SHIFT) to evaluate potential projects systematically
- SHIFT inclusion of pedestrian and bicycle scores
- SHIFT benefit-cost methodology

“Demand”

- Demand → reflects the expected usage of the project
- Demand analysis → helps estimate potential project benefits effectively
- Accurate demand estimates → crucial for assessing the benefits of investments in bicycling and walking compared to other transport modes like cars

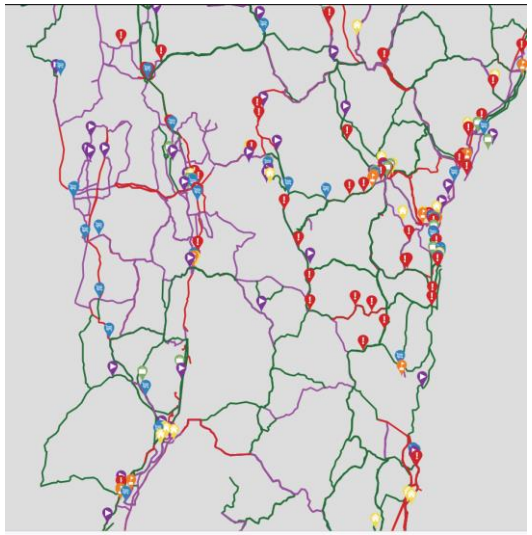
Project Goals

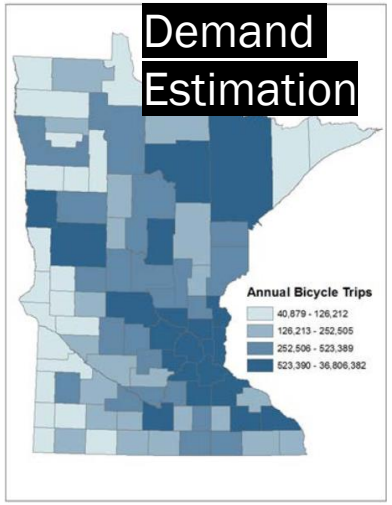
- Develop a process for **demand estimation** for proposed facilities
- Provide a list of **measurable benefits** for assessing and prioritizing pedestrian and bicycle infrastructure projects
- Establish a process for **estimating benefits** for pedestrian and bicyclist infrastructure
- Provide a **methodology** for implementation in Kentucky through SHIFT (and other)

Demand Estimation – State Efforts

VERMONT AGENCY OF TRANSPORTATION

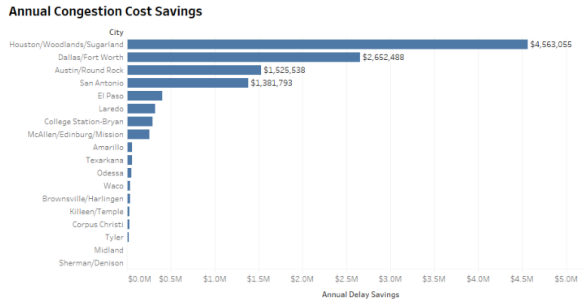
- Vermont:
  - Utilizing the crowdsourced tool “Wiki Map” to gather public input on bicycling preferences
  - E-911 data for land use identification
  - **Categorized** state roads into high-,moderate-, and low-use corridors based on the bicycle demand estimated





Demand Estimation – State Efforts

- Minnesota DOT:
  - Utilizing data from ACS and Met Council TBI, MNDOT Omnibus
  - **Quantified** the economic impact and assessment of the health effects of bicycling
- Texas DOT:
  - Utilized traditional count methods, crowdsourced data and statistical analysis
  - **Estimated** bicycle volume statewide



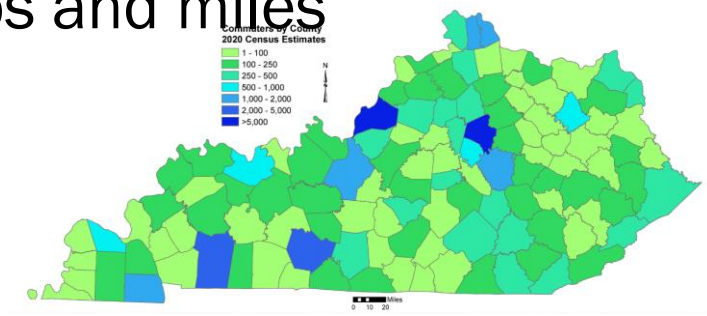
Demand Estimation - Common Data Sources

AMERICAN COMMUNITY SURVEY
U.S. CENSUS BUREAU

TRAVEL BEHAVIOR INVENTORY

1. Traditional count methods
2. Complementary Surveys about cycling behavior:
   - American Community Survey (ACS)
   - Travel Behavior Inventory (TBI)

   which:
   - Provide critical data on bicycle commuting behavior
   - Help estimate the number of bicycle trips and miles traveled annually



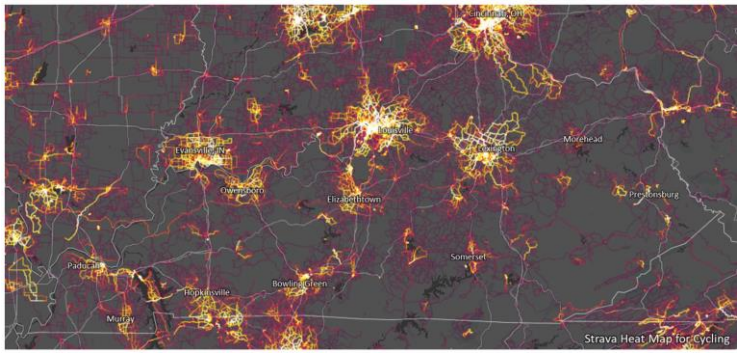
Source: KY Bike Ped Plan

Demand Estimation - Common Data Sources

3. Crowdsource data from platforms such as:
   - Strava Metro
   - Wikimap

   which:
   - Allow public engagement
   - Supplement traditional data sources, capturing real-time usage patterns and recreational trip information
   - Correlate to census data

Source: KY Bike Ped Plan



STRAVA | METRO

Modeling Demand

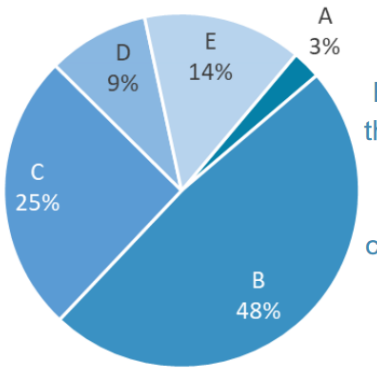
Direct-Demand Modeling

- Estimates peak-hour cyclist counts based on trip generation and attraction factors
- Identifies locations with high anticipated cyclist presence and areas with potential for cycling enhancement
- A Negative Binomial model can be used to assess cycling demand
  - Factors Influencing demand: separated bike paths, employment and destinations, population density, roadway conditions
- Primary application: Urban planning and transportation infrastructure development

Modeling Demand

Spatial Varying Coefficients Regression Model

- Captures the effects of various factors on bike-sharing demand across different locations



By mileage, most of the state-maintained highway network scores in BCI category B, with just 3% rising to BCI A.

Source: KY Bike Ped Plan

Bikeability Index

- Measures the influence of built environment features on cycling suitability
- Incorporates variables like route length, comfort, and connectivity
- Higher Bikeability index correlates with increased cycling activity

Modeling Demand

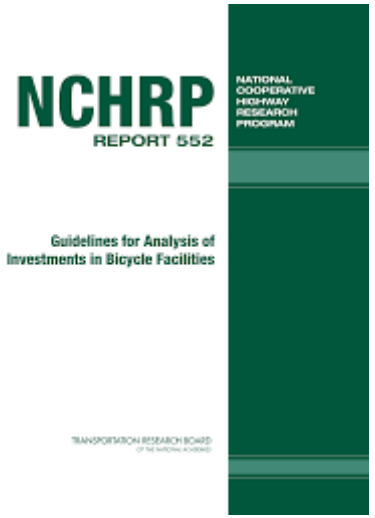
Bicycle and Pedestrian Sketch Method

- Simple and straightforward approach
- Leverages existing data sources (i.e., ACS) and regional traffic counts to understand current travel patterns
- Useful in areas with limited direct data
- Requires existing counts

Four-step transportation models

- Require specific mode split estimates

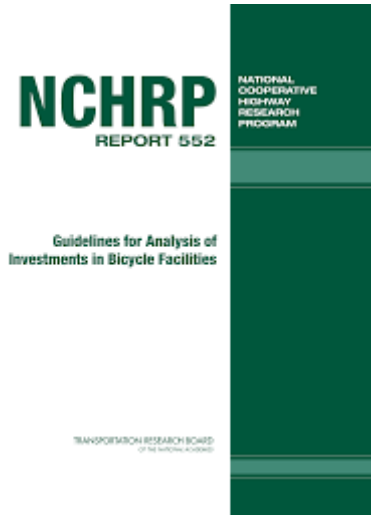
Demand Estimation – NCHRP Report 552



- Objectives:
  - Bicycle demand forecasting tool for specific areas or facilities
  - Identifies latent demand, namely areas with insufficient facilities that limit potential cycling activity
  - Use of transferable demand models based on relationships between demand and underlying factors

Demand Estimation – NCHRP Report 552

(2/3)



Demand prediction approach:

Relates cycling demand to factors such as population density and income

- Transferable across locations using generalized data
- Employs statistical models for demand forecasting

Demand Estimation – NCHRP Report 552

(3/3)

Step 1: Estimate existing Commuters

- Use of ACS data to find the number of current bicycle commuters in the area

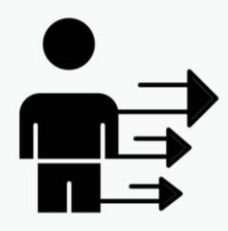
Step 2: Calculate Cyclists

- Analyze the attraction area of the facility type to estimate total cyclists considering factors like proximity to homes and jobs that influence cycling

Step 3: Identify New Cyclists

- Estimate new cyclists expected from the new facility through shifts from other facilities and new cyclists attracted by improved infrastructure

Demand Estimation – Recommended Approach (1/2)



- NCHRP Report 552 model for predicting bicycle demand is straightforward and feasible to implement
- Requires the number of people within certain distances from the proposed facility and the existing bicycle commuter mode share for the locality

Demand Estimation – Recommended Approach (2/2)

GIS-Based Analysis

Develop a GIS-based process to identify the number of people within specified distances from the project.

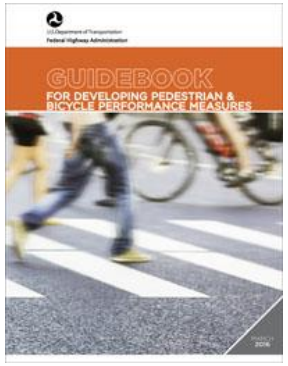
Buffer Creation

Create buffers for 0.25, 0.50, 0.75, and 1.00 miles from the project centerline. Use of the 2020 Census data to estimate the population within each buffer

Data Processing

Calculate the area for each Census block and use a ratio of buffered area to block to estimate population. Export data to CVS and convert to Excel for analysis

Pedestrian and Bicycle Benefits



- Major efforts:
  1. Federal Highway Administration (FHWA) 2016 Guidebook on performance measures for ped/bike facilities
     - Performance measures tied to community goals: Connectivity, equity, livability, safety, health, economy, environment
  2. Victoria Transport Policy Institute (VTPI) 2023 Active Transportation benefits
     - Metrics for quantifying performance measures for goals like FHWA

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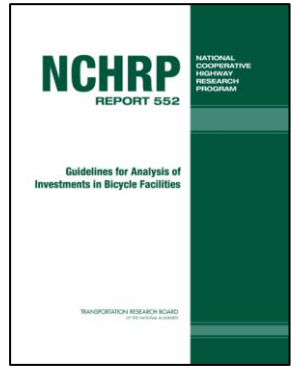
Pedestrian and Bicycle Benefits

- Major efforts:
  3. U.S. DOT 2023 Benefit-Cost analysis guidance
     - Detailed methodologies for assessing the economic impacts of transportation projects, including active transportation.
  4. Colorado, Kansas, Texas DOT
     - Evaluation, quantification and analysis of economic and health benefits
  5. NCHRP Report 552 benefit estimation (bicycles)
     - Methodologies for forecasting and quantifying benefits: mobility, health, recreation, reduced automobile use

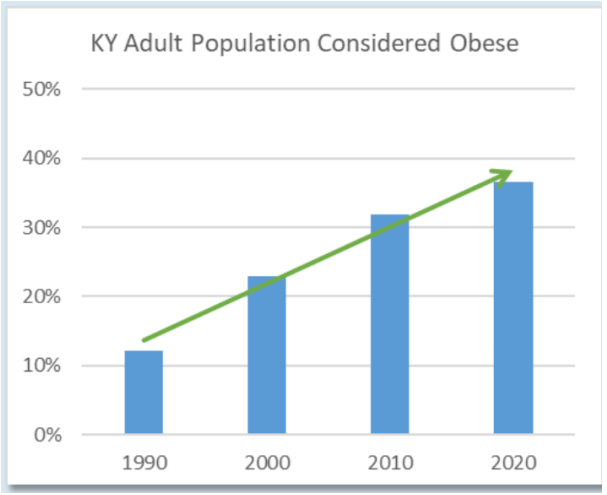


Benefit Summary

Benefits

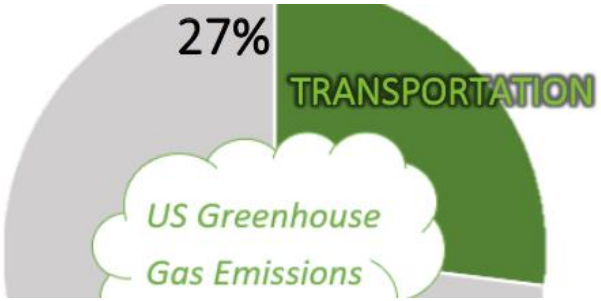
Bicycle commuting prevents 12 to 61 deaths per year in MN.

- Mobility
- Health
- Safety
- Reduced auto use
  - Congestion
  - Environmental
- Livability/Recreation
- Fiscal/Economy
- Connectivity
- Equity



Source: KY Bike Ped Plan

- Agencies use a combination based on data availability



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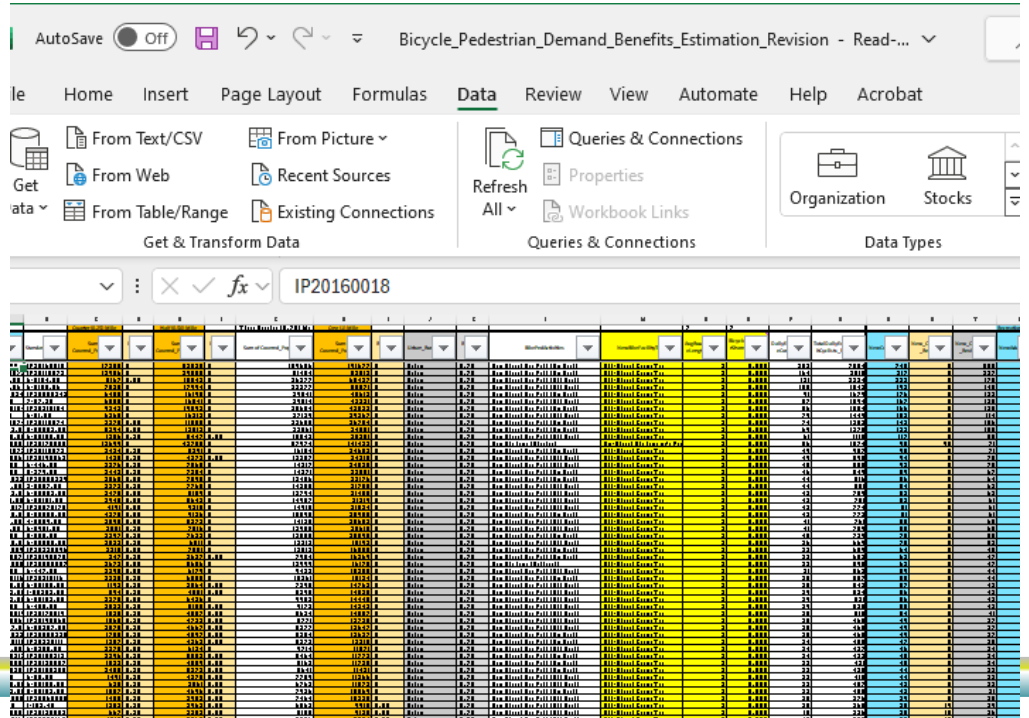
Benefit Analysis Spreadsheet Tool

- Developed a spreadsheet tool based on NCHRP Report 552
- Identified metrics for benefits considering KYTC data availability
  - Livability/Recreation
  - Mobility
  - Health
  - Reduced auto use



Spreadsheet Variables

New Bicycle Facility Type
Off-Street Cycling Trail
On-Street Bike Lane w/o Parking
On-Street Bike Lane w/ Parking
Sharrow/ Shared Lane
None

Area Type	Avg. commute time in min)
Urban	20.38
Suburban	18.03
Rural	15.83

V: hourly value of time	$18.72
D: daily recreational benefit	$15.60
B: annual health benefit	$199.68
S_Urban: congestion/pollution savings/mile	$0.20
S_Urban: congestion/pollution savings/mile	$0.12
S_Urban: congestion/pollution savings/mile	$0.02

Application

- Bicycle Demand forecasting
  - Estimate existing bicycle commuters and recreational users
  - Total new users based on facility type and population surrounding facility
- Pedestrian demand
  - Modified bicycle demand approach
  - Use 0.25-mile catchment

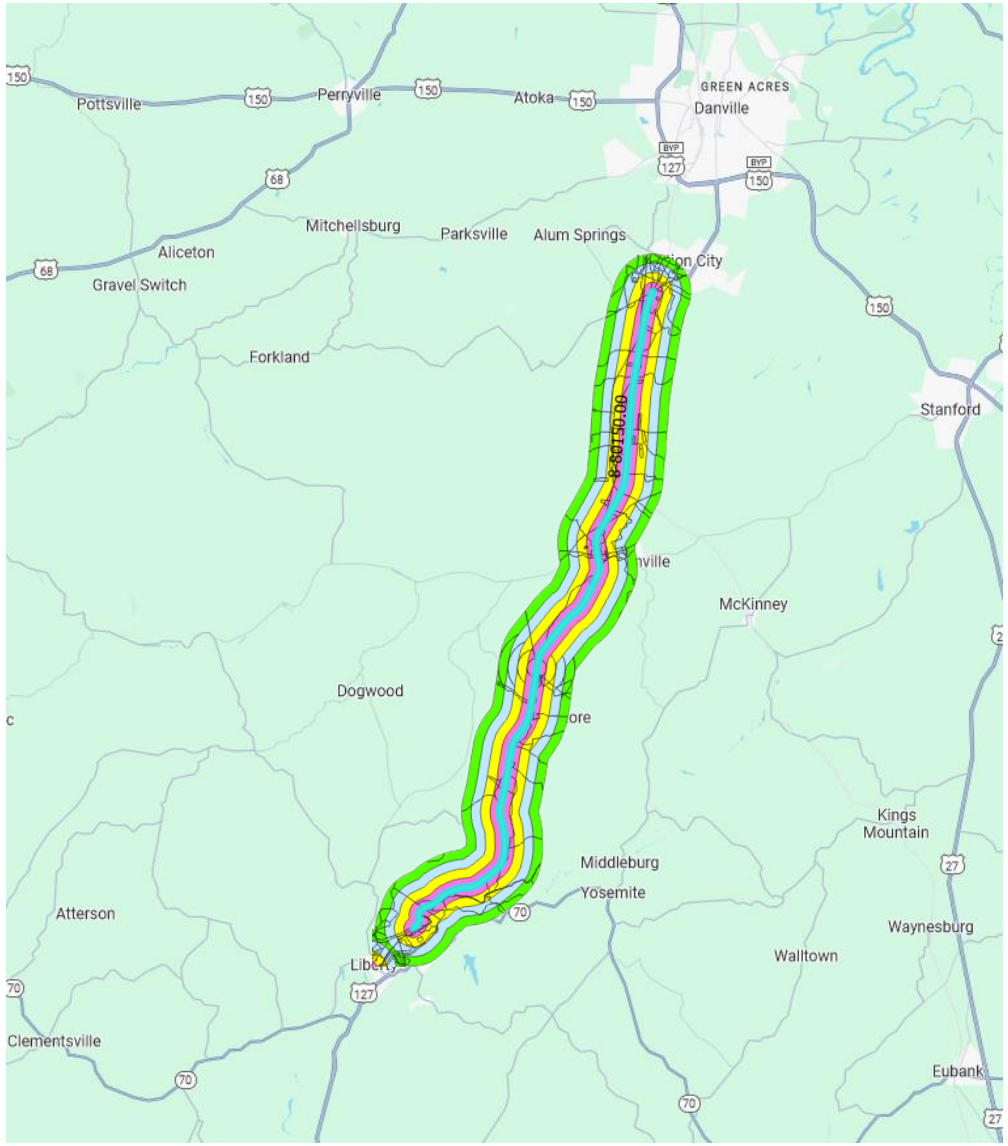
Pilot Test

- Evaluated 2024 SHIFT projects using NCHRP 552
  - Developed population estimates
  - Estimated demand
  - Calculated benefits (values adjusted to 2024 $)

Pilot Example-Bicycle

(1/3)

- Project
  - ID: 8-80150.00
  - Lincoln and Casey Counties
  - 18 miles of US127
- Proposed facility
  - Bicycle lane (on shoulder)



Pilot Example-Bicycle (2/3)

- Data input
  - Population 0.5 mi: 2,838
  - Bicycle commuter share: 0.5%
- Output
  - Demand: 116 new recreational cyclists/day (6 new commuters/day)
  - Benefit: $682,000 ($145,000 weekends over 50 degrees)

Pilot Example-Bicycle (3/3)

- What if scenarios

Sharrows	22 (1)	$128,000 ($27,000)
New bike lane buffered	391 (21)	$2,300,000 ($478,000)

Tool

SHIFT 22 Bike and Ped Projects

MN: $780M of economic activity in 2014
Texas: $3.4B in impact

		Annual Benefit Estimate				
2	New Adult Cyclists	Mobility Benefit	Health Benefit	Recreation Benefit	Reduced Auto Use Benefit	Total Benefit
3	103	$29,886	$21,653	$553,805	$567	$605,911
4	83	$24,190	$17,526	$448,252	$459	$490,427
5	5	$1,443	$1,045	$26,732	$2	$29,222
6	19	$5,872	$4,091	$104,633	$107	$114,703
7	4	$1,223	$852	$21,798	$2	$23,875
8	625	$164,024	$131,645	$3,366,943	$3,446	$3,666,059
9	704	$184,731	$148,265	$3,792,002	$3,881	$4,128,879
10	33	$9,579	$6,940	$177,506	$14	$194,039
11	20	$5,675	$4,112	$105,159	$8	$114,953
12	59	$17,184	$12,450	$318,421	$326	$348,381
13	238	$62,491	$50,155	$1,282,760	$101	$1,395,507
14	5	$1,415	$1,025	$26,212	$2	$28,653
15	4	$1,282	$893	$22,847	$2	$25,024
16	1031	$270,508	$217,109	$5,552,746	$5,683	$6,046,046
17	37	$10,758	$7,795	$199,355	$204	$218,112
18	409	$107,210	$86,047	$2,200,716	$2,252	$2,396,225
19	607	$159,303	$127,856	$3,270,021	$3,347	$3,560,526

$100-$79.8M

		Annual Benefit Estimate				
2	Ped Trips	Improved AT Conditions	Increased Activity	Reduced Auto Use	Community Impact	Total
3	9733	$4,077	$2,548	$12,615	$395	$19,635
4	17397	$7,288	$4,555	$22,548	$706	$35,098
5	41446	$17,364	$10,852	$53,719	$1,682	$83,617
6	15788	$6,614	$4,134	$20,463	$641	$31,853
7	19732	$8,267	$5,167	$50,117	$2,325	$65,875
8	60285	$25,257	$15,785	$153,118	$7,103	$201,263
9	108132	$45,302	$28,314	$274,643	$12,741	$360,999
10	34044	$14,263	$8,914	$86,468	$4,011	$113,657
11	9669	$4,051	$2,532	$24,559	$1,139	$32,281
12	39617	$16,598	$10,374	$51,349	$1,608	$79,928
13	60806	$25,474	$15,922	$154,439	$7,165	$203,000
14	8696	$3,643	$2,277	$22,087	$1,025	$29,032
15	25826	$10,820	$6,762	$33,473	$1,048	$52,103
16	272415	$114,128	$71,330	$691,902	$32,099	$909,458
17	127238	$53,306	$33,316	$323,170	$14,992	$424,785
18	110583	$46,329	$28,955	$280,868	$13,030	$369,182

$280-$2.1M

Bicycle and Pedestrian Counting Methods (new project)

- Good data on pedestrian and bicycle travel is crucial for effective multimodal transportation planning and management.
- Recognizing the need for guidance on nonmotorized traffic counts, FHWA updated the Traffic Monitoring Guidance in 2013
- Guidance developed by municipalities, states, as well as state of practice syntheses

Planning a Count Program

Defining Purpose

Guides decisions such as when, where, and how to conduct counts

Identifying Resources

Determine the scale of the counting program

Select locations and time frame

Short-duration counts, continuous or both

Select counting methods and technologies

Physical, user characteristics of the site and types of data required

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Estimating Pedestrian and Bicycle Demand 8:00am