ACKNOWLEDGEMENTS

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Phillips Armstrong
Percy H. Dougherty, PhD
Bob Elbich
Ce-Ce Gerlach
Michael Gibson
Steven L. Glickman, RA, CSI, Vice Chair
Michael Harakal Jr.
Kent H. Herman, Esq.
Jamie Johnson
Leonard Lightner (alt.)
Richard Molchan (alt.)
Christina V. Morgan
Ray O’Connell
Owen O’Neil
Kathy Rader
Stephen Repasch
Kevin Schmidt
Joshua Siegel
Donna Wright
Amy Zanelli

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Lamont G. McClure, Jr.
Dr. Christopher R. Amato
Bryan Callahan
Janell Connolly
Malissa Davis
Robert Donchez
Liesel Dreisbach
Charles W. Elliott, Esq.
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Robert A. Lammi
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Pamela Pearson, MBA, Treasurer
Spirit Rutzler
Tina Smith (alt.)
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Greg Zebrowski, Chair

Lehigh Valley Transportation Study

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Pennsylvania Department of Transportation (PennDOT), District 5-0 Executive
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Phillips Armstrong, Lehigh County
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Northampton County
Michael Emili, PE (alt.),
Northampton County
Owen O’Neil,
Lehigh and Northampton Transportation Authority
Thomas Stoudt,
Lehigh-Northampton Airport Authority

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Pennsylvania Department of Transportation (PennDOT), Assistant District 5-0 Executive - Design
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Jim Mosca, PennDOT
Ray O’Connell, City of Allentown
Leonard Lightner (alt.), City of Allentown
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Dariene Heller (alt.), AICP
City of Bethlehem
Salvatore J. Panto Jr., City of Easton
Dave Hopkins (alt.), City of Easton
Ryan Meyer, Lehigh-Northampton Airport Authority

Planning Partners
County of Lehigh
County of Northampton
Delaware & Lehigh National Heritage Corridor
Wildlands Conservancy
Lehigh and Northampton Transportation Authority (LANTA)
Community Bike Works
Coalition for Appropriate Transportation (CAT)

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U.S. Department of Transportation

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Toole Design
Traffic Planning and Design, Inc.

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Multimodal Working Group

Jesse Allentown
Kathy Altmann
Bob Amelio
David Aquadro
Genny Baillie
Laura Baird
Steve Bamford
Charles Barker
Andrew Bartel
Vicky Bastidas
Julie Bator
Carmen Bell
K Belletti
Dominik Bennett
Michael Bennett
Maria Bentzoni
Chris Berg
Ray Bleak
Leslie Billowitch
James Birdsell
Gary Birks
Bob Blanchfield
George Boksan
Greg Bott
Daniel Brodeen
Chip Brown
Justin Burker
Bushkill Stream
Conservancy
Eric Carpio
Robert Cepin
Jesse Check
Jolie Chylack
Hannah Clark
Budd Coates
Scott Cole
John Cool
Bryan Cope

John Gallagher
Cheryl Johnson
Jeff Marshall
Jared Mast
John Mauser
Lou Mazzante
James McAndrew
Kevin McCarthy
Patricia McCloskey
Erik McCormick
Joe McDermott
Michael McGuire
Ed Meehan
Roger Mellin
EJ Mentry
Steve Meredith
Linda Merkel
Bob Michener
Hannah Miller
Curt Miller
Bill Molchan
Jeff Mori
Brooks Mountcastle
Jared Neff
Rob Neitz
John Nissen
Eliott Nolte
Carol Obando-Derstine
Jeanne Ortiz
Mildred Ozoa
Jim Palmquist
Sara Pandl
Peter Paone
Abby Pattishall
Frank Pavlick
Julian K Pelekanakis
Julia Pelekanakis
Sherri Penchishen
Penny
Joshua Pepper
Hayden Phillips
Lynn Pigliacampi
Bob Pitcavage
Gene Porochniak
Lorne Possinger
Nathan Pritchard
Kalyna Procyr
Becky Quinn
Lee Rackus
Anne Robin
Johanna Roche
Brian Rogers
Rochelle Romeo Kane
John Ronca
Diane Rosencrance
Rachel Rosenfeld
Dave Rostron
Doug Roysdon
Debbie Rozear
Zachary Rudd
Alex Ruozzi
Jen Ruth
Bennett Rymon
Jeff Sabo
Claire Sadler
Kristen Sanford
Bernhardt
Kim Schafer
Jarred Schlottman
John Schubert
Amanda Schumacher
Kate Semmens
Melissa Shafer
Shelley
Tom Shortell
Bill Spence
Scott Slingerland

Michael M. Stadulis
Jason Stershic
Mike Stershic
Bob Stiffler
Chris Strohler
Annemarie Superka
Josh Swartley
Lori Sywensky
Rob Takacs
Andrea Tessier
Prakash Thakrar
Mary Tirrell
Town Topics
Scott Unger
Sallie Urffer
Monica Van Haren
Paige Van Wirt
Nelson Varughese
Kyle Walbert
Melissa Wehr
Tiffany Wells
Kristen Wenrich
Marvin Werkheiser
Kevin Westgate
Mary Wilford-Hunt
Tiana Williams
Jim Wilson
Andrea Wittchen
Molly Wood
Josh Wood
Justin Woodring
Al Wurth
J. Yerman
Mark Zakutansky
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**Appendix**

**Appendix A.** Design Toolkit
CHAPTER 1

Introduction
Introduction

The Lehigh Valley is a dynamic region with abundant natural, historical, and cultural assets. People are attracted by a strong job market, relatively low cost of living, and a high quality of life. Proactively planning for and investing in an active transportation system is a key strategy to help the Lehigh Valley become one of the most livable places in Pennsylvania.

Plan Purpose

The purpose of this plan, Walk/Roll LV, is to coordinate public transit, trail, sidewalk, bikeway and roadway systems to create a robust and seamless regional transportation network that is safe and convenient, and that supports pedestrian and bicycle transportation. Multi-modalism is important for achieving the region’s health, safety, mobility, air quality, quality of life, recreation, tourism and environmental goals. This plan creates an executable strategy for developing a seamless, high-quality on and off road trail and sidewalk system for the region integrated with public transit. It also recommends policy and program changes to better support active transportation, including enhanced education and outreach.

Planning Context

The Lehigh Valley Planning Commission (LVPC) and the Lehigh Valley Transportation Study (LVTS) are currently in the process of updating the Long Range Transportation Plan for the region as part of FutureLV—the Lehigh Valley’s Regional Comprehensive Plan. The Long Range Transportation Plan will provide the framework for transportation investment in the region over the next 25 years. Walk/Roll LV is intended to provide a clear vision of how walking, biking and other forms of active transportation fit within the larger transportation network.

Walk/Roll LV builds on a number of previous planning documents related to transportation and land use, including:
- Comprehensive Plan The Lehigh Valley...2030
- Climate + Energy Element
- Livable Landscapes: A Park, Recreation, Open Space, Agricultural and Historic Lands Plan for Lehigh County
- Livable Landscapes: An Open Space Plan for Northampton County
- MOVELV Long Range Transportation Plan
- MOVELV Regional Freight Plan
- Regional Housing Plan
- MOVELV Congestion Management Process
- 1LV
- Coordinated Public Transit – Human Services Transportation Plan
- Green Infrastructure Guidelines
- Traffic Safety Plan
- Expand Trail/Greenway Network
- Support Public Transit Access
- Improve Bicycle and Pedestrian Connectivity

What is Active Transportation?

Active transportation is a form of transportation that relies in whole or part on human energy for locomotion. The most common forms of active transportation are walking and bicycling, but active transportation also includes other modes that depend on human energy, such as running or using a non-motorized scooter or wheelchair.

Active transportation is closely tied to public transit, since people often travel to and from transit stops using active transportation modes. Active transportation is also related to emerging technologies, such as e-scooters, which often use pedestrian and bicycle infrastructure.
## Plan Development

Walk/Roll LV was developed with input from a broad range of Lehigh Valley stakeholders. The process was guided by the Lehigh Valley Transportation Study’s Multimodal Working Group, which includes the following representatives:

- Lehigh County and Northampton County
- Lehigh Valley Planning Commission
- Lehigh Valley municipalities
- Lehigh and Northampton Transportation Authority
- Pennsylvania Department of Transportation (PennDOT) District 5-0 and Central Offices
- Lehigh and Northampton Airport Authority
- Delaware & Lehigh National Heritage Corridor
- Cycling community
- Pedestrian community
- Public transit community
- People with disabilities
- Businesses, organizations and public agencies that depend on bicycle, pedestrian and public transit
- Lehigh Valley residents with an interest in improving the bicycle, pedestrian and public transit movement and have experience with these multimodal issues

The broader public was engaged through an online Wikimap, two public open houses and several other public outreach activities. See Figure 1.1 for the plan development timeline and key meeting dates. See Figure 1.2 for a summary of key feedback from the Wikimap.

<table>
<thead>
<tr>
<th>PHASE 1</th>
<th>PHASE 2</th>
<th>PHASE 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Timeframe</strong></td>
<td><strong>Timeframe</strong></td>
<td><strong>Timeframe</strong></td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td><strong>Description</strong></td>
<td><strong>Description</strong></td>
</tr>
<tr>
<td>- Define plan vision and goals</td>
<td>- Identify Pedestrian Priority Areas</td>
<td>- Update and finalize plan</td>
</tr>
<tr>
<td>- Assess existing conditions</td>
<td>- Identify Visionary Bicycle Network</td>
<td>- Plan adoption</td>
</tr>
<tr>
<td>- Identify gaps</td>
<td>- Identify and assess Bicycle Commuting Corridors and Catalytic Projects</td>
<td></td>
</tr>
<tr>
<td><strong>Meetings</strong></td>
<td><strong>Meetings</strong></td>
<td><strong>Meetings</strong></td>
</tr>
<tr>
<td>- September 26--MMWG</td>
<td>- February 27--MMWG</td>
<td>- January 8--Public Meeting, LVTS, MMWG</td>
</tr>
<tr>
<td>- November 28—MMWG, Public</td>
<td>- March 27--MMWG</td>
<td>- January 22--MMWG</td>
</tr>
<tr>
<td>- January 23--MMWG</td>
<td>- April 22--MMWG</td>
<td>- February 26--MMWG</td>
</tr>
<tr>
<td></td>
<td>- May 20--MMWG</td>
<td>- June 3 -- LVTS</td>
</tr>
<tr>
<td></td>
<td>- June 17--MMWG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- September 25—MMWG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- October 23--MMWG</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- December 4—MMWG, LVTS</td>
<td></td>
</tr>
</tbody>
</table>

MMWG = Multimodal Working Group Meeting  
Public = Public Meeting  
LVTS = Lehigh Valley Transportation Study Technical Coordinating Joint Meeting

Figure 1.1: Plan Development Timeline and Key Meeting Dates
Key Wikimap Feedback

Who did we hear from?
194 Total Wikimap Respondents

Figure 1.2: Key Wikimap Feedback

<table>
<thead>
<tr>
<th>Age</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Over 70</td>
<td>5%</td>
</tr>
<tr>
<td>61-70</td>
<td>16.5%</td>
</tr>
<tr>
<td>51-60</td>
<td>21%</td>
</tr>
<tr>
<td>41-50</td>
<td>23%</td>
</tr>
<tr>
<td>31-40</td>
<td>17%</td>
</tr>
<tr>
<td>21-30</td>
<td>6%</td>
</tr>
<tr>
<td>19-20</td>
<td>1%</td>
</tr>
<tr>
<td>Under 18</td>
<td>8%</td>
</tr>
<tr>
<td>Prefer not to say</td>
<td>1.5%</td>
</tr>
</tbody>
</table>

![Gender Distribution](chart)

- **Female**: 35%
- **Male**: 61%
- **Prefer not to say**: 4%

![Race/Ethnicity Distribution](chart)

- **White**: 92%
- **Other**: 4%
- **Hispanic/Latino**: 1.5%
- **Black/African American**: 1%
- **Asian**: 1%
- **American Indian and Alaska Native**: 0.5%
What did they say?

How would you describe your biking habits and comfort level?

- **37%**
  - I am willing to ride in traffic, but I prefer dedicated bike lanes and routes

- **30%**
  - I prefer not to ride in traffic, so I stay on trails

- **28%**
  - I am willing to ride in mixed traffic with cars on almost any type of street

- **5%**
  - I do not ride a bicycle and am unlikely to ever do so

---

How often do you bike or walk for RECREATION or EXERCISE?

- **37%**
  - A Few Times a Week

- **29%**
  - Daily

- **25%**
  - A Few Times a Month

- **8%**
  - A Few Times a Year

- **1%**
  - Never

---

How often do you bike or walk for TRANSPORTATION, such as commuting to work or running errands?

- **34%**
  - Never

- **22%**
  - A Few Times a Year

- **17%**
  - A Few Times a Month

- **14.5%**
  - A Few Times a Week

- **12.5%**
  - Daily

---

Figure 1.3: Open house participants providing input on bicycle commuting corridors and pedestrian priority areas
Plan Vision and Goals

Vision
The Lehigh Valley is a place where a growing number of people of all ages and abilities choose walking, rolling, bicycling and public transit as a safe and convenient daily option for commuting, enjoyment, exercise or mobility.

Goals
- **Safety and Accessibility** – Reduce crashes and improve personal security for people who walk, roll, bicycle or use public transit. Eliminate barriers for people with disabilities. Provide supportive education, enforcement and public engagement programming.
- **Convenience and Connectivity** – Make it easier for people of all ages and abilities to get to where they want to go by walking, rolling, bicycling and using public transit.
- **Seamless Multimodal Integration** – Provide seamless integration between trails, sidewalks, roads and public transit.
- **Regional Coordination** – Foster regional coordination to improve pedestrian and bicycle conditions and develop a connected regional bicycle network.
- **Culture** – Make walking, rolling, bicycling and public transit use key elements of regional transportation.
- **Equity** – Provide equal access to high-quality, low-stress walking, rolling, bicycling and public transit networks for everyone in the Lehigh Valley.
- **Air Quality and Climate** – Improve air quality and mitigate the impact of the transportation system on climate change.
- **Emerging Technologies** – Leverage emerging technologies to increase the safety, comfort, and convenience of walking, rolling, bicycling and public transit use.

Why now?
The Lehigh Valley Planning Commission (LVPC) is creating the region’s first active transportation plan for a variety of reasons, including:
- The potential economic and health benefits to the region of increasing its investment in active transportation.
- The rapidly evolving transportation landscape, which puts active transportation at the center of several emerging trends.
- The larger context of transportation planning and funding in the Lehigh Valley, which includes the Long Range Transportation Plan currently under development as part of FutureLV—the Lehigh Valley Regional Comprehensive Plan.
**Benefits of Active Transportation**

**Economic Benefits**
Nurturing and maintaining a stable and growing local economy requires supportive transportation systems. In the last 10 to 15 years, communities that have invested in walking, rolling and bicycling for transportation and recreation have seen significant economic benefits, including higher property values and property tax revenues, increased business activity, job creation and enhanced worker productivity.

**Higher Property Values (and Property Tax Revenues)**
Americans increasingly want to live in communities that are walk, bike- and roll-friendly (Figure 1.4), which has led to higher property values and higher property tax revenues in communities that invest in active transportation. Examples include:

- **Lehigh Valley, Pennsylvania** — The Lehigh Valley Return on Environment Study found that houses within ¼ mile of protected open space are worth $14,600 more than houses that are further away from open space. Open spaces are valued partly for the opportunities they provide for walking and bicycling.

- **Delaware County, Pennsylvania** — A 2011 study by the GreenSpace Alliance and Delaware Regional Planning Commission found that properties within ¼ mile of the Radnor Trail were worth almost $70,000 more than properties located further away.

- **Charlotte, North Carolina** — A study found that every point increase in Walk Score correlated with a $2,000 increase in property value. Walk Score is a website that rates how walkable a neighborhood is based on how many stores, restaurants, cafes and other destinations are within walking distance.

- **Denver, Colorado** — A study found that property values for homes in walkable neighborhoods are more than double the property values of homes in auto-oriented neighborhoods.

---

**Walkability and Short Work Commute Most Important in Deciding Where to Live**

**Most Important Factors in Deciding Where to Live:**

- Sidewalks and places to take walks.
- Being within an easy walk of other places and things in a community, such as shops and parks.
- Being within a short commute to work.
- Easy access to the highway.
- Having public transit nearby.
- Bike lanes and paths nearby.
- Separated bike paths or trails.

<table>
<thead>
<tr>
<th>Factor</th>
<th>2017</th>
<th>2015</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sidewalks and places to take walks.</td>
<td>49%</td>
<td>50%</td>
</tr>
<tr>
<td>Being within an easy walk of other places and things in a community, such as shops and parks.</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td>Being within a short commute to work.</td>
<td>41%</td>
<td>41%</td>
</tr>
<tr>
<td>Easy access to the highway.</td>
<td>38%</td>
<td>38%</td>
</tr>
<tr>
<td>Having public transit nearby.</td>
<td>34%</td>
<td>35%</td>
</tr>
<tr>
<td>Bike lanes and paths nearby.</td>
<td>21%</td>
<td>21%</td>
</tr>
<tr>
<td>Separated bike paths or trails.</td>
<td>20%</td>
<td>21%</td>
</tr>
</tbody>
</table>

If you were deciding today where to live, please indicate how important each of the following would be to you:

Figure 1.4: Results from National Association of Realtors 2017 Community and Transportation Preferences Survey.
Increased Business Activity
According to the Bureau of Transportation Statistics, in 2016 16.2 percent of the average household's annual expenditures were transportation-related, making transportation the second largest expense category after housing.\(^1\) Walking, rolling, bicycling and taking public transit are significantly more affordable than owning and driving a private car (Figure 1.5). When people spend less on transportation, they are able to spend more on other things, and more of the money they spend stays local. In addition, many people feel that walkable and rollable places are simply more pleasant. People travel long distances to visit them, bringing in significant revenues from tourism. In addition, local residents tend to gravitate toward the parts of their community that are comfortable for walking, rolling and bicycling, which can also boost spending in these places.

More Jobs
Studies have shown that pedestrian and bicycle infrastructure projects employ more people per dollar spent than road projects. For example, a study by the University of Massachusetts at Amherst found that bicycle-only projects created over 11 jobs per $1 million spent and pedestrian-only projects created about 10 jobs per $1 million spent; however, projects that did not include a pedestrian or bicycle component generated less than 8 jobs per $1 million spent. In the case of pedestrian and bicycle projects, the difference is due to a higher share of project expenditures going to wages and salaries rather than capital expenses, such as asphalt and heavy equipment.

Greater Worker Productivity
Employees who engage in regular physical activity have lower healthcare costs, require less sick leave and are more productive at work.\(^2\) Active transportation is one way workers can get the regular physical activity they need to stay healthy and productive. One of the more efficient options is to incorporate active transportation as part of a daily commute route. People who commute to work by active transportation have better attendance records and are more productive on average than those who commute by passive transportation modes (Wen, Kite, & Rissel, 2010; Kitchen, Williams & Chowhan, 2011; Bopp, Kaczynski & Campbell, 2013; Brown et al., 2013). In addition, employees who spend more time actively commuting have a higher degree of mental wellbeing (Humphreys et al., 2013).


Health Benefits
Investments in active transportation support health by encouraging physical activity, reducing air pollution and reducing traffic-related injuries and deaths.

More Physical Activity
In 2015, the U.S. Surgeon General’s Office issued Step It Up! The Surgeon General’s Call to Action to Promote Walking and Walkable Communities. The campaign was motivated by the recognition that walking is one of the easiest ways for people to incorporate physical activity into their daily routines, since it requires no specialized equipment, no special memberships and can be done almost anywhere at any time. Indeed, walking is the most commonly reported physical activity among U.S. adults overall and the most frequently reported activity among adults who meet physical activity guidelines.

Regular physical activity is critical for good health. According to the U.S. Surgeon General:

One out of every two U.S. adults is living with a chronic disease, such as heart disease, cancer or diabetes. These diseases contribute to disability, premature death and health care costs. Increasing people’s physical activity levels will significantly reduce their risk of chronic diseases and related risk factors. Because physical activity has numerous other health benefits—such as supporting positive mental health and healthy aging—it is one of the most important actions people can take to improve their overall health.

However, as of 2018, only 23 percent of U.S. adults reported meeting recommended levels of physical activity.

Diseases related to physical inactivity carry a heavy price tag. According to the American Diabetes Association, in 2017 the cost of treating Americans with diabetes was $327 billion dollars, which equates to about $13 billion dollars annually for the

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diseases related to physical inactivity in the Lehigh Valley compared to the state average and top U.S. performers.

Table 1.1: Comparative Statistics on Physical Inactivity and Related Diseases.

<table>
<thead>
<tr>
<th></th>
<th>Lehigh County</th>
<th>Northampton County</th>
<th>Pennsylvania</th>
<th>Top US Performers</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physical Inactivity</strong></td>
<td>25%</td>
<td>26%</td>
<td>24%</td>
<td>20%</td>
</tr>
<tr>
<td><strong>Access to Exercise Opportunities</strong></td>
<td>70%</td>
<td>74%</td>
<td>74%</td>
<td>91%</td>
</tr>
<tr>
<td><strong>Diabetes prevalence</strong></td>
<td>11%</td>
<td>12%</td>
<td>11%</td>
<td>8%</td>
</tr>
<tr>
<td><strong>Adult Obesity</strong></td>
<td>31%</td>
<td>29%</td>
<td>30%</td>
<td>26%</td>
</tr>
</tbody>
</table>

**Reduced Air Pollution**

Motor vehicles generate air pollutants that are harmful to human health, including carbon monoxide, ozone, sulfur dioxide, nitrogen dioxide, hydrocarbons and particulate matter. These pollutants are associated with a range of health impacts, including asthma and other respiratory symptoms, impaired lung function, total and cardiovascular mortality and cardiovascular morbidity.7

The American Lung Association’s 2019 State of the Air report gives the Lehigh Valley low marks for air quality and identifies significant populations with asthma and other diseases that are impacted by poor air quality (Table 1.2).8

Table 1.2: Grades for ozone and particulate matter, and number of children and adults with asthma, from American Lung Association 2019 State of the Air report

<table>
<thead>
<tr>
<th>County</th>
<th>Grade for Ozone</th>
<th>Grade for Particulate Matter</th>
<th># of children and adults with asthma</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lehigh</td>
<td>D</td>
<td>Inconclusive</td>
<td>36,400</td>
</tr>
<tr>
<td>Northampton</td>
<td>F</td>
<td>C</td>
<td>29,933</td>
</tr>
</tbody>
</table>

Walking, rolling and bicycling are zero-emission transportation modes. When people walk, roll and bicycle instead of driving, motor vehicle-related air pollution goes down, thereby reducing the harmful effects of motor vehicle pollution on human health. The 1996 Olympics in Atlanta provides an example of potential health benefits of reduced motor vehicle emissions. During the 1996 games, the City of Atlanta restricted single occupant cars in downtown Atlanta to prevent gridlock. As a result, morning rush hour traffic volumes decreased by 23 percent, morning peak ozone decreased by 28 percent, and emergency room visits for asthma events in children decreased by 42 percent.9

**Fewer Traffic-Related Injuries and Deaths**

Traffic-related injuries and deaths directly impact human health and are significantly lower in communities that support active transportation, including walking, rolling, bicycling and public transit. According to a 2016 study by the American Public Transit Association:

Public transit-oriented communities are five times safer because they have about a fifth the per capita traffic casualty rate as automobile-oriented communities. Two factors help explain these large safety impacts. First, many factors that increase public transit use, such as good walking and cycling conditions, and compact development, also tend to increase traffic safety. Second, higher-risk groups, including youths, seniors, alcohol drinkers and compulsive texters, are more likely to reduce their driving if alternatives, such as public transit, are convenient and attractive.10

---


Traffic-related injuries and deaths have significant human and economic costs. A 2015 study by the National Highway Transportation Administration estimated the economic cost of traffic crashes in the United States at $242 billion, the equivalent of $784 per U.S. resident or 1.6 percent of U.S. gross domestic product. The economic costs of traffic-related injuries and deaths include costs associated with emergency response, medical care, legal proceedings, lost productivity, lost wages and numerous other costs.11

**Climate Benefits**

According to the U.S. Environmental Protection Agency, greenhouse gases from human activities are the most significant driver of observed climate change, and the transportation sector is the largest single contributor to greenhouse gas emissions in the United States (Figure 1.6). Additionally, emissions from the transportation sector are on the rise, due largely to an increase in vehicle miles traveled from passenger cars and light-duty trucks.12 In October 2018, the Intergovernment Panel on Climate Change released a report estimating that net carbon pollution worldwide would need to fall to zero by mid-century to avoid catastrophic climate change, the potential effects of which include food shortages, increased poverty, and the dislocation of millions of people due to sea level rise and other climate-related effects.13 Supporting the use of zero-emission transportation modes is a key strategy for reducing greenhouse gas emissions and avoiding the most dangerous climate change scenario.

**Equity Benefits**

When thinking about the transportation system, it is important to remember that many people cannot drive or do not have access to a car. In fact, approximately 1 in 3 Americans do not have a driver’s license. This includes children, who are too young to drive, seniors who may have had a license at one point but have now given it up, people with disabilities that prevent them from driving and others who choose not to drive. In addition, there are many people who for financial reasons or by choice do not own a car or live in households that have a limited number of cars. Access to travel alternatives, such as walking, rolling, bicycling and public transit, are particularly important to these people. The availability of such alternatives can, for example, be the difference between having a job versus being unemployed, receiving needed medical treatment versus letting health problems worsen, and maintaining contacts with friends and family members versus social isolation.

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Quality of Life Benefits

Communities that are walkable, rollable and bikeable foster a sense of place and social connections among neighbors. For example, a 1982 study by Donald Appleyard found that people who live on lower traffic streets tend to have more friends on the street—3 friends compared to 0.9 on high traffic streets (Figure 1.7). Appleyard also found that residents of low-traffic streets tended to consider the entire block on which they lived their home territory, whereas people on higher traffic streets tended to think of their home territory as their building or apartment.

Nationally, almost half of trips made daily are three miles or less (Federal Highway Administration, University Course on Bicycle and Pedestrian Transportation [FHWA-HRT-05-085]). When communities invest in a truly multimodal transportation network, they increase the choices for these shorter trips. Whether out of necessity or choice, living in a community where walking or biking to the store, work or church is a viable option makes life easier and more enjoyable.

Space Benefits

Finally, pedestrians, bicyclists and public transit riders take up far less space than private motor vehicles (Figure 1.8). In places with growing populations, such as the Lehigh Valley, investing in walking, rolling, bicycling and public transit can be the difference between gridlock and a transportation system that gets people where they need to go and supports the local economy. In addition, the relative space-efficiency of walking, rolling, bicycling and public transit, could have significant implications for land use if more people used these modes for transportation instead of private cars. It is estimated that in automobile-dependent cities 35-50 percent of the city’s land use footprint is taken up by roads and parking lots. If more people walk, roll, bicycle and use public transit, some of this space could be dedicated to other purposes, such as housing, businesses, parks, community gardens and other amenities that enhance people’s lives, simultaneously preserving farmland and open space that might otherwise be consumed for these purposes.

Figure 1.7: Social Interactions on Three Streets—Neighboring and Visiting (Source: Livable Streets by Donald Appleyard)

Figure 1.8: People per hour in a 12-foot travel lane. (Source: Botma & Papendrecht)
Emerging Trends

The transportation sector is rapidly evolving in response to new technologies and changing cultural values. Key trends in this evolution are impacting or may in the future impact pedestrian and bicycle transportation in the Lehigh Valley.

Growth of Online Retail

Since 2007, the share of total U.S. retail sales accounted for by online retail has nearly tripled, a trend that is expected to continue, if not accelerate, in the coming years. The growth of online retail is particularly evident in the Lehigh Valley, which has become a hub for online shipping, with large distribution centers for FedEx, UPS, the U.S. Postal Service, Amazon, Walmart, Zulily, Stitch Fix and others. The growth in online retail is also impacting brick and mortar retail in the Lehigh Valley and across the country. In the first quarter of 2019, over 5,800 stores announced closures nationwide. An additional 75,000 closures were expected by 2026 due to competition from online retail. These closures have pushed up vacancy rates at U.S. malls and shopping centers to near all-time highs.

The growth of online retail impacts active transportation in two key ways. First, the large distribution centers that power online retail are often in locations that are difficult for people to get to without a personal vehicle. At the same time, they employ large numbers of low skilled workers, many of whom may not have access to a car. Therefore, better pedestrian, bicycle and public transit access to these sites is needed. Second, the growth of online retail has prompted communities and retailers to consider how brick-and-mortar retail can compete. An increasingly common response is to transform underutilized retail locations into walkable, mixed-use, transit-oriented developments. Walmart, which is pursuing an ambitious strategy to transform a dozen of its big box locations into mixed-use town centers, is an example of this trend (Figure 1.9).

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Gentrification and the Suburbanization of Poverty

For much of the latter half of the 20th Century, one of the dominant internal migration trends was a move away from city centers and toward suburban and exurban environments where walking, rolling and bicycling are challenging. That trend has reversed in recent decades, particularly among people who are college-educated (Figure 1.10).

There are a variety of reasons for the shift, but research suggests that proximity to amenities like restaurants, gyms, concert venues and other personal services is likely a key reason. This proximity makes walking, bicycling, public transit and other alternatives to single occupancy vehicle travel more feasible, creating pressure on local jurisdictions to improve access to these modes in downtown areas to better accommodate and attract college-educated residents.

A side-effect of re-urbanization is the suburbanization of poverty (Figure 1.11). The influx of wealthier, college-educated people to some downtown areas has resulted in increasing rents and a higher cost of living, making these areas unaffordable for people with lower incomes. This has resulted in more lower income people moving to auto-centric suburban areas, where streets often do not prioritize pedestrian and bicycle comfort or safety, making travel particularly difficult and perilous for those who do not have ready access to a private car.

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Figure 1.10: Where college graduates moved in the 50 largest U.S. metros by decade (Source: Couture & Handbury, 2016)

Figure 1.11: Change in Suburban Poor Population in the Largest 95 Metro Areas (Source: U.S. Census)
Safe System (Vision Zero)
Traffic safety paradigms are shifting in the United States, from a focus on influencing individual behavior through education and marketing to a more systemic approach in which street designers and political leaders bear primary responsibility for traffic safety. This new paradigm is called Safe System and is regularly marketed as “Vision Zero” or “Toward Zero” after one of its key tenants, which is that zero loss of life is acceptable in the transportation system. Vision Zero is relevant for pedestrian and bicycle transportation because of its focus on vulnerable roadway users, which include people who walk, roll and bicycle; its emphasis on street design and infrastructure; and its recognition that mode choices influence the safety of the transportation system, i.e. the higher the proportion of people who drive in private cars, the less safe the transportation system is for all users.

Shared Micromobility
The term “shared micromobility” refers to shared-use fleets of small, fully or partially human-powered vehicles such as bikes, e-bikes and e-scooters. These devices have rapidly increased in popularity due to their convenience for short trips. This convenience relates to the small size of the vehicle, which makes it easy to park, the fact that the vehicle is often motorized, and the fact that the vehicle is often available on-demand through rental or subscription services.

Shared micromobility has great potential to support access to public transit, reduce reliance on private motor vehicle travel, and support sustainability goals. However, there are concerns about how shared micromobility devices interact with other transportation system users, particularly pedestrians on the sidewalk and motor vehicle traffic on roads with high speeds and volumes. On roads with high motor vehicle volumes or speeds, dedicated infrastructure, such as bike lanes separated by a physical barrier from the vehicle lanes, may be needed to accommodate shared micromobility users.

Ride-Hailing Services
Ride-hailing services such as Uber and Lyft pair drivers using private vehicles as taxis with customers via a mobile app or website. The effect of ride-hailing services on active transportation is not yet established and may depend heavily on how they are regulated at the local and regional level. On the one hand, ride-hailing services have the potential to support a care-free or car-light lifestyle by providing safe, reliable and affordable connections to transit, as well as flexibility for certain types of trips, such as trips that require carrying heavy loads. On the other hand, ride-hailing can undermine active transportation if it replaces walking, rolling and transit trips or if it makes walking and rolling seem less safe and appealing due to increased traffic or unsafe conditions at pick-up and drop-off locations.
**Electric Assist Bicycles**

Electric assist bicycles are bicycles with a small electric motor that helps bicyclists with pedaling. Electric assist bicycles are an exciting technology, because they address some of the key barriers that prevent people from bicycling, such as physical challenges, steep hills, the need to carry cargo and the desire not to show up sweaty to work, while preserving many of the health benefits of traditional, non-motorized bicycling.\(^{18}\)

In 2013, the Pennsylvania General Assembly legalized the operation of electric-assist bicycles on Pennsylvania streets. The law refers to electric assist bicycles as "pedalcycles with electric assist" and stipulates that the electric assist motor must be smaller than 750 watts and must cut out when the bicycle reaches a speed of 20 mph. It also stipulates that electric assist bicycle operators must be at least 16 years old.

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Autonomous vehicles

Autonomous vehicles, or vehicles that can be operated without a human driver, are currently being tested in a number of U.S. cities, including Pittsburgh, and are likely to be introduced on a broader scale in the coming decades. These vehicles offer a range of potential advantages and disadvantages for active transportation. Potential advantages include improved traffic safety, increased roadway space for active transportation facilities and conversion of space devoted to parking to other, more pedestrian and bicycle-friendly uses. Potential disadvantages, which relate primarily to personal autonomous vehicles and taxis, include increased vehicle miles traveled and sprawl development, as autonomous vehicles circle to avoid parking charges and people’s tolerance for longer commutes increases.

A focus on autonomous rapid transit could help some regions capture the advantages of autonomous vehicles for active transportation while avoiding the downsides. An autonomous rapid transit system would operate much like bus rapid transit with public transit vehicles operating in a dedicated lane to avoid traffic delays but would have lower operating costs due to the lack of drivers. An autonomous rapid transit system would also be more flexible and efficient, since public transit capacity could be more easily tailored to match demand and could cut travel times by going directly to destinations instead of stopping only at prescribed stops. Finally, a more efficient public transit system would boost the use of active transportation modes, as people roll and bicycle to access the service.

Mobility as a Service

Mobility as a service (MaaS) is a new way of thinking about transportation service that emphasizes multimodal connections. Rather than treating transportation modes as separate and competing, MaaS seeks to integrate them in a way that enables transportation consumers to identify the mobility solutions that best meet their needs in a given context on demand. Examples of the MaaS approach include: mobile applications that bring multiple transportation modes and services together in a single interface, multimodal journey planning and multimodal service bundles for a fixed monthly subscription.

Figure 1.12: An autonomous rapid transit vehicle being tested in Zhuzhou City, China [Photo/IC]

Figure 1.13: The Whim app enables users in several European cities to plan and pay for multimodal trips that include one or more of the following modes: public transit, bikeshare, taxi, car rental and car share.
CHAPTER 2

Existing Conditions
Existing Conditions

Active transportation has a long tradition in the Lehigh Valley, which is home to the headquarters of Bicycling Magazine and Runner’s World, the D&L Trail, and one of the nation’s finest velodromes, the Valley Preferred Cycling Center. This chapter covers existing conditions for walking, rolling and bicycling in the Lehigh Valley, including demographic and population trends, travel behaviors, land use characteristics, active transportation infrastructure, public transit service and policies and programs.

Population

The Lehigh Valley is one of the most populous regions of Pennsylvania and the fastest growing. As of 2018, Lehigh County and Northampton County had a combined population of 672,907 according to American Community Survey estimates. The LVPC estimates that Lehigh Valley’s population will grow over 20% between 2020 and 2045.

The Valley’s projected future rise in population brings both opportunities and challenges. A potential challenge relates to the functioning of the transportation system. Since the public right-of-way is limited, how can it be allocated in a way that meets the needs of the Lehigh Valley’s growing population most efficiently? (Figure 2.1)

Existing conditions were assessed based on:

- A review of existing documents.
- Feedback from the Multimodal Working Group and online Wikimap survey.
- Analysis of available data related to pedestrian and bicycle transportation in the Lehigh Valley.
- Fieldwork assessments for proposed projects contained in this plan.

Summary feedback from the Wikimap data is incorporated where relevant.

Figure 2.1: Estimated future Lehigh Valley population
**Travel Behavior**

Walking, rolling, bicycling and public transit are more space-efficient than driving alone in a private vehicle. However, single occupancy vehicle travel remains the dominant form of transportation in the Lehigh Valley, and the number of miles traveled by motor vehicles on Lehigh Valley roads is rising.

In 2017, an estimated 91 percent of Lehigh Valley commuters traveled to work by car, truck or van, while 2 percent walked, 0.2 percent bicycled, and 1.5 percent took public transit (Figure 2.2). The share of Lehigh Valley residents who commute by walking, bicycling and public transit is substantially below the statewide average in Pennsylvania, where approximately 3.8 percent of commuters walked, 0.5 percent bicycled and 5.6 percent took public transit.

Data regarding how people travel for non-work trip purposes is not currently available for the Lehigh Valley. However, non-work trips, including recreational and social trips, trips for shopping and errands, and trips to school, are an important part of the Lehigh Valley’s transportation picture. Nationally, more than 60 percent of all trips are not work-related, according to the 2017 National Household Travel Survey.

In 2017, Lehigh Valley drivers logged 14,344,599 vehicle miles daily, up from 13,693,885 in 2013, an increase of approximately 5 percent. This amounts to approximately 21.4 daily vehicle miles traveled per capita, slightly below the statewide average of 21.7. (PennDOT 2017 Highway Statistics Report and U.S. Census Bureau, American Community Survey 2017)

**Demographics**

Approximately one third of the Lehigh Valley’s population is concentrated in the region’s three cities, Allentown, Bethlehem and Easton, with much of the remainder living in adjacent areas. The population groups most likely to walk, roll and bicycle for transportation are also generally concentrated in these locations, including zero car households, households in poverty, people under 30 years old and people with disabilities. (Figure 2.3 - Figure 2.6).

In addition, the Lehigh Valley is home to 12 institutions of higher education. The largest by enrollment are Northampton Community College (10,666), Lehigh Carbon Community College (7,128) and Lehigh University (6,955) (U.S. News and World Report, Education Rankings 2019). College students are also among the population segments most likely to walk and bicycle for transportation.
Figure 2.3: Concentration of active transportation commuters
Data Source: US Census Bureau American Community Survey 5 year estimates, 2017.

Figure 2.4: Zero Car Households
Figure 2.5: Population Under 30
Data Source: US Census Bureau American Community Survey 5 year estimates, 2017.

Figure 2.6: Households in Poverty
Land Use and Street Connectivity

The Lehigh Valley includes core communities that were developed at a time when walking was a primary mode of transportation. These communities feature connected, grid-like street networks and a mix of land uses within the same neighborhood.

Subsequent growth and development occurred in the post-World War II era. These places often feature a curvilinear or cul-de-sac street pattern and greater separation between land uses, with residential zones separated from commercial and industrial uses. Since automobiles were the most common form of transportation, these communities also feature greater distance between buildings, with buffers of vegetation and parking lots separating buildings and neighborhoods from each other.

In recent years the region has experienced, and continues to experience, substantial growth in the transportation and logistics industry. The large size and scale of many warehouses and distribution centers increases the separation between land uses. Combined with the elevated levels of heavy truck traffic, an increasing number of local residents work in environments that are difficult to access without a personal automobile.

Topography

Significant portions of the Lehigh Valley are characterized by steep slopes and low rolling hills. This topography can be challenging for active transportation users, particularly those who are rolling or bicycling.1

Active Transportation Infrastructure

Sidewalks

Sidewalks are essential to the Lehigh Valley’s transportation system and quality of life. Almost every Lehigh Valley resident is a pedestrian at some time and almost every Lehigh Valley resident uses a sidewalk at some point in their day.

An estimated 4,848 miles of non-freeway roads and approximately 2,075 miles of sidewalk exist in the two-county Lehigh Valley region. Regionwide, even in denser urban areas, there are sidewalk gaps that may present challenges for people who walk and roll, especially people with disabilities affecting mobility.

Figure 2.7 shows roads with sidewalks on both or one side of the street. For the purposes of this map, sidewalks were defined as a concrete, brick or asphalt-like surface with the clear intended use for pedestrian mobility.

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Table 2.1 summarizes regional sidewalk mileage by municipality type. As expected, sidewalks are most common in the region’s urbanized areas, which are characterized by denser street networks and higher concentrations of population, employment and destinations. As locations become less urban, the ratio of sidewalk mileage to roadway mileage decreases.

Table 2.1: Sidewalk mileages by municipality type

<table>
<thead>
<tr>
<th>Municipality Type</th>
<th>Sidewalk Mileage</th>
<th>Roadway Mileage (excludes controlled-access roads)</th>
<th>Roadway with Sidewalk</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>% Both Sides</td>
</tr>
<tr>
<td>Cities and Boroughs</td>
<td>786</td>
<td>1,457</td>
<td>42.33%</td>
</tr>
<tr>
<td>Suburban</td>
<td>392</td>
<td>1,933</td>
<td>7.88%</td>
</tr>
<tr>
<td>Rural</td>
<td>27</td>
<td>1,537</td>
<td>0.85%</td>
</tr>
</tbody>
</table>

Bicycle Infrastructure

There are approximately 375 miles of existing bikeways and 44 miles of proposed bikeways in the Lehigh Valley.² Bikeways are any facility intended for bicycle travel which designate space for people bicycling that is distinct from motor vehicle traffic. A bikeway does not include paved shoulders, signed routes or streets with shared lane markings because these treatments do not materially improve operating conditions for people bicycling. Close to ninety-nine percent of bikeway mileage (approximately 370 miles) is off-road in the form of paved or unpaved shared-use paths, also known as trails. About 1 percent of bikeways are on-street. In addition, the Lehigh Valley has approximately 57 miles of on-street bicycle supportive infrastructure, such as signed bicycle routes, streets with shared lane markings and paved shoulders. See Figure 2.8 for a map of existing bikeways and on-street bicycle supportive infrastructure.

² Mileage calculations refer to centerline mileages. For example, bike lanes on both sides of the road count only as the mileage of the dual bike lanes’ extents and are not double counted. Bi-directional trail mileage is also measured in this way.
Trails and Sidepaths

Trails are defined as a bikeway physically separated from motor vehicle traffic by an open space or barrier and within an independent right of way. Sidepaths are bikeways that are physically separated but within the roadway right of way. Trails and sidepaths may also be used by people who are walking, rolling or jogging.

The Lehigh Valley’s system of approximately 285 miles of paved and unpaved trails (excluding the inter-regional Appalachian Trail) creates regional connections between and within neighborhoods.

### Table 2.2: Regional Trails

<table>
<thead>
<tr>
<th>Trail Alignment</th>
<th>Surfaces</th>
<th>Key Connections or Destinations</th>
<th>Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bushkill Township Trail</td>
<td>Crushed Limestone</td>
<td>Jacobsburg State Park, E Moorestown Road</td>
<td>2.0</td>
</tr>
<tr>
<td>D&amp;L Trail</td>
<td>Asphalt, Crushed Limestone, Natural</td>
<td>All municipalities adjacent to the Lehigh River, Hugh Moore Park &amp; Museum, Lehigh Mountain Park, Canal Park</td>
<td>59.6</td>
</tr>
<tr>
<td>Forks Township Trail Network</td>
<td>Asphalt, Concrete, Natural</td>
<td>Forks Community Park, Metzgar Athletic Fields, Riverview Country Club</td>
<td>1.4</td>
</tr>
<tr>
<td>Hackett’s Park Trail</td>
<td>Asphalt</td>
<td>Hackett Park, Two Rivers Trailway</td>
<td>1.2</td>
</tr>
<tr>
<td>Ironton Rail Trail</td>
<td>Asphalt, Concrete, Natural</td>
<td>Ironton, Coplay</td>
<td>9.0</td>
</tr>
<tr>
<td>Jordan Creek Greenway Trail</td>
<td>Crushed Limestone, Natural</td>
<td>Jordan Creek Parkway, Jordan Park</td>
<td>42.5</td>
</tr>
<tr>
<td>Karl Stirner Arts Trail</td>
<td>Asphalt, Crushed limestone, Concrete, Other</td>
<td>Easton, Easton Cemetery, Lafayette College</td>
<td>1.3</td>
</tr>
<tr>
<td>Little Lehigh Parkway Path</td>
<td>Asphalt, Crushed Limestone</td>
<td>Lehigh Parkway</td>
<td>7.4</td>
</tr>
<tr>
<td>Lower Macungie Trail Network</td>
<td>Asphalt, Crushed limestone, Natural, Concrete</td>
<td>Macungie, Swabia Creek, Little Lehigh Creek, Brookside Country Club</td>
<td>10.4</td>
</tr>
<tr>
<td>Monocacy Way</td>
<td>Concrete, Crushed Limestone, Natural</td>
<td>Bethlehem Golf Club, Moravian College, Sand Island Park</td>
<td>2.9</td>
</tr>
<tr>
<td>Nor-Bath Trail</td>
<td>Crushed Limestone</td>
<td>D&amp;L Trail, Bicentennial park, Wayne Grube Memorial Park</td>
<td>5.7</td>
</tr>
<tr>
<td>Palmer-Bethlehem Township Bikeway</td>
<td>Asphalt</td>
<td>Riverview Park and Fairview Park</td>
<td>9.9</td>
</tr>
<tr>
<td>Palmer Township Bike Path</td>
<td>Asphalt, Concrete</td>
<td>Bushkill Creek, Lion’s Park, Keystone Park, Palmer Heights</td>
<td>3.2</td>
</tr>
<tr>
<td>Pennsylvania Highlands Trail</td>
<td>Asphalt, Crushed Limestone, Natural, Other</td>
<td>Hugh Moore Park &amp; Museum, Central Park, Lehigh University</td>
<td>29.0*</td>
</tr>
<tr>
<td>Plainfield Township Recreation Trail</td>
<td>Asphalt, Natural, Concrete, Other</td>
<td>Stockertown, West Pen Argy! Little Bushkill Creek</td>
<td>6.9</td>
</tr>
<tr>
<td>Saucon Rail Trail</td>
<td>Asphalt, Crushed Limestone</td>
<td>Hellertown, Saucon Park, Saucon Creek</td>
<td>7.3</td>
</tr>
<tr>
<td>September 11th National Memorial Trail</td>
<td>Asphalt, Crushed Limestone, Natural</td>
<td>Most municipalities adjacent to the Lehigh River, Stockertown, Lincoln School Park, Bushkill Creek, Lion’s Park, Keystone Park, Palmer Heights</td>
<td>57.1*</td>
</tr>
<tr>
<td>Slate Heritage Trail</td>
<td>Asphalt, Crushed limestone</td>
<td>Slatedale to Slatington</td>
<td>3.3</td>
</tr>
<tr>
<td>South Bethlehem Greenway Trail</td>
<td>Asphalt</td>
<td>South Bethlehem, Lehigh University</td>
<td>3.6</td>
</tr>
<tr>
<td>Stockertown Recreation Trail</td>
<td>Crushed limestone</td>
<td>Stockertown, Lincoln School Park</td>
<td>1.1</td>
</tr>
<tr>
<td>Tatamy Rail Trail</td>
<td>Crushed Limestone</td>
<td>Tatamy neighborhood</td>
<td>0.5</td>
</tr>
<tr>
<td>Two Rivers Trail</td>
<td>Asphalt, Crushed Limestone</td>
<td>Hugh Moore Park, Gerald Gross Community Park, surrounding neighborhoods</td>
<td>30.0*</td>
</tr>
<tr>
<td>Wilson Borough Bike Path</td>
<td>Asphalt</td>
<td>Meuser Park, West Easton</td>
<td>1.1</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>180.3</strong></td>
</tr>
</tbody>
</table>

* Trail is comprised of other trails in this table. Mileage not included in total.
Local Trails

Local trails (Table 2.3) are more isolated trail segments, park loops or rugged paths that provide intra-neighborhood connections, connect to a regional trail or facilitate short-distance recreational activities. Local trails in the Lehigh Valley serve as a final connection to common destinations or function as compact recreational destinations themselves.

Table 2.3: Local Trails

<table>
<thead>
<tr>
<th>Trail Alignment</th>
<th>Surfaces</th>
<th>Key Destinations</th>
<th>Length (miles)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alburtis Trail Network</td>
<td>Asphalt, Crushed limestone, Natural, Concrete</td>
<td>Lock Ridge Park</td>
<td>0.6</td>
</tr>
<tr>
<td>Applewood Trail</td>
<td>Natural</td>
<td>Upper Macungie Park</td>
<td>1.1</td>
</tr>
<tr>
<td>Bethlehem Township Trail Network</td>
<td>Asphalt, Concrete</td>
<td>Green Pond Country Club, North Side Athletic Complex</td>
<td>9.3</td>
</tr>
<tr>
<td>Cedar Creek Trail</td>
<td>Asphalt, Crushed limestone</td>
<td>Cedar Creek Park, Trexler Memorial Park</td>
<td>3.9</td>
</tr>
<tr>
<td>Forks Township Trail Network</td>
<td>Asphalt, Concrete, Natural</td>
<td>Forks Community Park, Riverview Country Club, Meco Fields, Vista Drive Park</td>
<td>16.2</td>
</tr>
<tr>
<td>Hanover Township Trail Network</td>
<td>Asphalt, Concrete</td>
<td>Crawford Park, Hanover Township Municipal Park</td>
<td>4.5</td>
</tr>
<tr>
<td>Jacobsburg Environmental Education Center Trails</td>
<td>Natural</td>
<td>Jacobsburg Environmental Education Center</td>
<td>17.0</td>
</tr>
<tr>
<td>Lehigh Gap Nature Center Trails</td>
<td>Natural</td>
<td>Lehigh Gap Nature Center, Blue Mountain Loop</td>
<td>0.7</td>
</tr>
<tr>
<td>Lower Mount Bethel Trail</td>
<td>Crushed limestone</td>
<td>PPL Martins Creek Environmental Preserve</td>
<td>2.8</td>
</tr>
<tr>
<td>Martin Luther King Parkway Trail</td>
<td>Asphalt, Concrete, Natural</td>
<td>Fountain Park Path, Little Lehigh Creek</td>
<td>0.7</td>
</tr>
<tr>
<td>Palmer Township Trail Network</td>
<td>Asphalt, Concrete</td>
<td>Hugh Moore Park, Meuser Park, Hacket Park, Fairview Park, Old Orchard neighborhood</td>
<td>1.6</td>
</tr>
<tr>
<td>Talen Martins Creek Environmental Preserve Trails</td>
<td>Natural</td>
<td>PPL Martins Creek Environmental Preserve</td>
<td>4.3</td>
</tr>
<tr>
<td>South Mountain Gateway Trail</td>
<td>Crushed limestone, Other</td>
<td>South Mountain Preserve</td>
<td>0.7</td>
</tr>
<tr>
<td>South Mountain Preserve Trails</td>
<td>Natural, Crushed limestone, Other</td>
<td>South Mountain Preserve</td>
<td>5.2</td>
</tr>
<tr>
<td>Trexler Nature Preserve Trails (mountain bicycling)</td>
<td>Natural</td>
<td>Trexler Nature Preserve</td>
<td>17.1</td>
</tr>
<tr>
<td>Trout Creek Parkway Trail</td>
<td>Crushed limestone</td>
<td>Trout Creek Parkway</td>
<td>1.0</td>
</tr>
<tr>
<td>Upper Macungie Township Trail Network</td>
<td>Asphalt, Natural, Concrete</td>
<td>Upper Macungie, Earl Adams Memorial Park</td>
<td>2.2</td>
</tr>
<tr>
<td>Upper Mount Bethel Trail</td>
<td>Natural</td>
<td>Minsi Lake</td>
<td>0.8</td>
</tr>
<tr>
<td>Upper Saucon Township Trail Network</td>
<td>Crushed limestone</td>
<td>Upper Saucon Township Community Park, DeSales University</td>
<td>0.3</td>
</tr>
<tr>
<td>Valley Green Trail</td>
<td>Crushed limestone, Natural</td>
<td>Saucon Creek</td>
<td>1.4</td>
</tr>
<tr>
<td>Walking Purchase Park Trails</td>
<td>Natural</td>
<td>Walking Purchase Park</td>
<td>10</td>
</tr>
<tr>
<td>Wayne Grube Trail Network</td>
<td>Asphalt</td>
<td>Wayne Grube Memorial Park</td>
<td>1.1</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td>102.5</td>
</tr>
</tbody>
</table>
On-Road Bikeways

On-road bicycle facilities are infrastructure dedicated for bicycle use within the street right-of-way. This can include bike lanes, buffered bike lanes, separated or protected bike lanes and bike boulevards. As of 2019, bike lanes are located on Hamilton Boulevard in Upper Macungie/Lower Macungie Townships, North Krock’s Road in Lower Macungie Township, Mack Boulevard in the City of Allentown, and Chain Dam Road in Palmer Township, but no buffered bike lanes, separated or protected bike lanes, or bike boulevards exist in the Lehigh Valley. This plan provides a roadmap to develop these facility types, which facilitate safe, comfortable, and convenient utilitarian cycling for people of all ages and abilities.

On-Road Bicycle-Supportive Infrastructure

On-road bicycle-supportive infrastructure (Table 2.4) is infrastructure intended to support bicycling that does not provide dedicated space for use by people who are bicycling in the street right-of-way. This category of infrastructure includes streets with shared lane markings, on-street bicycle routes and paved shoulders.

Table 2.4: Mileage of On-Road Bicycle-Supportive Infrastructure

<table>
<thead>
<tr>
<th>Type</th>
<th>Length (miles)*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shared Lane Marking or On-Street Bicycle Route</td>
<td>55.5</td>
</tr>
<tr>
<td>Paved Shoulders</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*Based on data provided by municipalities. Actual mileage may be higher.

Public Transit

Convenient and efficient public transit is a vital part of the Lehigh Valley’s active transportation system. In the Lehigh Valley, public transit service is provided by the Lehigh and Northampton Transportation Authority (LANta). LANta operates the LANtaBus system, a network of 23 fixed bus routes, and 10 special routes throughout the Lehigh Valley, providing weekday, later evening and Saturday and Sunday service. It also operates the LANtaVan system, which provides special door-to-door transportation services for people with disabilities and the elderly who cannot use the LANtaBus system.

Currently more than 5 million annual rides are taken on the LANtaBus system and more than 485,000 people live within walking distance of a LANtaBus route. In addition, most LANta buses have bike racks. Efforts are underway to improve access to LANta’s public transit services and to enhance and expand LANta service, including through introducing enhanced bus or bus rapid transit (BRT) service. LANta is also in the process of upgrading its bus fleet from diesel to diesel-electric hybrid and compressed natural gas-powered buses. Finally, most LANta buses currently have bicycle racks, such as the one shown in the photo below.
**Programs and Initiatives**

The following are existing programs and initiatives in the Lehigh Valley region that support pedestrian and bicycle transportation.

- **THE LINK**: In November 2018, the existing and proposed trail network in the Lehigh Valley was branded as THE LINK, which aims to fill gaps in the current network and facilitate construction of a continuous trail system from the Lehigh Valley to Philadelphia. In 2017, THE LINK was awarded $750,000 from the William Penn Foundation, which has funded efforts related to branding, site studies and feasibility. The push to develop THE LINK could provide valuable momentum for ensuring that trails in the Lehigh Valley become high-quality facilities accessible for both recreation and daily transportation.

- **Coalition for Appropriate Transportation (CAT)** is a non-profit that aims to improve mobility through facilitation of events, activities, public engagement strategies and education about safe pedestrian access, bicycling, public transit and trail systems. CAT aims to improve bikability and walkability through: bicyclist, pedestrian and driver education; organizing Bike to Work events; managing a bicycle cooperative; encouraging enforcement of appropriate speed limits; encouraging municipalities to install Americans with Disabilities Act (ADA) compliant transportation facilities; and encouraging engineering using traffic calming methods.

- **Community Bike Works** is an organization based in the City of Allentown that supports and runs bicycle education programs throughout the region. Each year, Community Bike Works engages more than 500 youth through its flagship Earn a Bike and Junior Earn a Bike programs, where students learn bike mechanics and safety while practicing teamwork, communication and other life skills. Once engaged, youth have access to recreational rides, which connect students and adults for trail and road rides across the Lehigh Valley. Teens can also participate in road riding with the Lehigh Wheelmen Association, as well as track and mountain bike programs. All opportunities are provided at no cost to families.

- **Lehigh University and Muhlenberg College Bikeshare**: Local bikeshare programs currently exist at the Lehigh University and Muhlenberg College campuses. The Lehigh University system is for students, faculty and staff only. The Muhlenberg system is open to the public and co-sponsored by Allentown Parking Authority. Both bikeshare programs are run by Zagster, a national provider of bikesharing services. The Lehigh University program began in 2015 and the Muhlenberg College program launched towards the end of 2018. Riders join the program by signing up for an annual membership plan. The annual plan includes two free hours for each ride, with a small additional fee for each additional 30 minutes. An hourly program is also available.

- **The Valley Preferred Cycling Center**: Also known as the Lehigh Valley Velodrome or T-Town, the Valley Preferred Cycling Center promotes competitive cycling, youth fitness and adult wellness activities. The Valley Preferred Cycling Center also hosts VeloFest, the largest cycling marketplace in the United States.
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CHAPTER 3

Characteristics and Key Issues for People Walking, Rolling and Bicycling
This chapter provides a summary of pedestrian and bicyclist characteristics and covers key issues that may influence a person’s choice to walk, roll or bicycle in the Lehigh Valley, such as safety, land use, and pedestrian and bicycle network gaps. Understanding these characteristics and issues is an important first step toward achieving the goals of Walk/Roll LV.

Characteristics

Many factors may influence a person’s choice to walk, roll or bicycle including:

- Their age and ability
- Their previous experience walking, rolling and bicycling
- How much time they have available
- The purpose of their trip
- Whether the trip is linked to other trips (also known as "trip chaining") and the purpose of those trips
- How much time it would take to complete the trip by walking and bicycling versus other modes
- How safe they perceive walking and bicycling to be versus other modes (including perceived crash risk and personal security considerations)
- Whether or not an accessible route is available to their destination
- Whether or not they have appropriate equipment, such as a bicycle
- Whether or not they have access to alternative modes, such as driving
- The availability of end of trip facilities, such as bicycle racks, showers and lockers

The following pages provide a summary of pedestrian and bicyclist user types and trip patterns. The characteristics summarized on these pages provide context for understanding pedestrian and bicycle user needs; however, they should not be understood in isolation but rather as the product of the complex decision-making process described above.
Characteristics of People Who Walk and Roll (Pedestrians)

Trip Characteristics

Figure 3.1: Percentage of Pedestrian Trips by Trip Purpose—Metropolitan Statistical Areas with 500,000 to 999,999 residents

Social and recreational trips are the most common type of pedestrian trip other than trips to home, which are not shown.

31%

7%

5%

11%

13%

14%

19%

Figure 3.2: Percentage of Pedestrian Trips by Distance—All Trips

Almost two-thirds of pedestrian trips are less than a half mile and 91% are less than 1.5 miles.

62% 28% 6%

< 0.50 miles 0.50 - 1.49 miles ≥3.5 miles

2% 2.5 - 3.49 miles 2% 1.5 - 2.49 miles

Source: 2017 National Household Travel Survey

Pedestrian Types

Social/Recreational
Shopping/Errands
Work
School/Daycare/Religious Activity
Meals
Other
Transport Someone
Medical/Dental Services - 0%

Seniors People with stroller or carts Children Adults People with disabilities

Source: 2017 National Household Travel Survey
Demographics

Figure 3.3: Percentage of people who walk to work in the Lehigh Valley by gender.

Females are more likely to walk to work than males.

Source: US Census, ACS 5-Year Estimates 2017

Figure 3.4: Percentage of people who walk to work in the Lehigh Valley by age.

Younger people are more likely to walk to work than older people.

Source: US Census, ACS 5-Year Estimates 2017

Figure 3.5: Percentage of people who walk to work in the Lehigh Valley by income.

People with lower incomes are more likely to walk to work than people with higher incomes.

Source: US Census, ACS 5-Year Estimates 2017
Characteristics of People Who Bike

Trip Characteristics

Figure 3.6: Percentage of Bicycle Trips by Trip Purpose—Metropolitan Statistical Areas with 500,000 to 999,999 residents

- Social and recreational trips are the most common type of bicycle trip other than trips to home, which are not shown.

- 47% Social/Recreational
- 15% Shopping/Errands
- 11% Work
- 6% School/Daycare/Religious Activity
- 5% Meals
- 3% Other
- 1% Transport Someone
- 0% Medical/Dental Services

Source: 2017 National Household Travel Survey

Figure 3.7: Percentage of Bicycle Trips by Distance—All Trips

- 59% < 1.50 miles
- 17% 1.50 - 2.49 mi
- 8% 2.5 - 3.49 mi
- 8% ≥ 5.50 mi

- More than three in four bicycle trips are less than 2.5 miles.

Source: 2017 National Household Travel Survey
Demographics and User Types

Figure 3.8: Percentage of people who bicycle to work in the Lehigh Valley by gender.

Source: US Census, ACS 5-Year Estimates 2017

Males are more likely to bicycle to work than females.

Figure 3.9: Bicyclist User Types

Bicyclist User Types

- **Interested but Concerned**
  - 51%-56% of the total population
  - Often not comfortable with bike lanes, may bike on sidewalks even if bike lanes are provided; prefer off-street or separated bicycle facilities or quiet or traffic-calmed residential roads. May not bike at all if bicycle facilities do not meet needs of perceived comfort.

- **Somewhat Confident**
  - 5%-9% of the total population
  - Generally prefer more separated facilities, but are comfortable riding in bicycle lanes or on paved shoulders if need be.

- **Highly Confident**
  - 4%-7% of the total population
  - Comfortable riding with traffic; will use roads without bike lanes.

Source: Federal Highway Administration Bikeway Selection Guide
Key Issues

Safety

Safety is a critical issue for active transportation. If walking, rolling and bicycling are perceived to be unsafe, people are likely to choose other modes. There is also a significant human and financial cost attached to the lack of safety—grieving families, lives transformed by debilitating injury, expensive healthcare services, trips not made, jobs not taken, purchases not made at local businesses to name a few.

Crash data were evaluated to understand traffic safety, especially where pedestrian and bicycle crashes are concentrated and key traffic safety issues exist. Personal security is another important safety issue for people who walk, roll and bicycle; however, data on personal security were not evaluated as part of the planning process.

A total of 210 people walking, rolling and bicycling were killed or seriously injured in traffic crashes between 2012 and 2017 in the Lehigh Valley, including 192 pedestrians and 18 bicyclists (Figure 3.10). To gain an understanding of where pedestrian and bicycle crashes are concentrated in the region, killed and seriously injured (KSI) crash locations were plotted on a map and all crashes, including KSI and non-KSI crashes, were analyzed using a technique called “moving windows,” which calculates the number of crashes per ¼ mile roadway segment.

Figure 3.11 - Figure 3.13 focus on the City of Allentown, City of Bethlehem and City of Easton, where most crashes resulting in fatalities or serious injuries to bicyclists and pedestrians are located.

In the City of Allentown (Figure 3.11), North Seventh Street, Tilghman Street, West Gordon Street and South Fifteenth Street had the highest concentrations of bicycle and pedestrian crashes (19-25 total crashes per segment). North 17th Street, West Chew Street, West Hamilton Street and West Linden Street also had segments with relatively high crash concentrations (14-19 crashes per segment).

The City of Bethlehem (Figure 3.12) had fewer quarter-mile segments with high crash volumes than the City of Allentown, although there were a similar number of crashes...
that resulted in bicyclist or pedestrian fatalities or serious injuries. Only Wyandotte Street and West 4th Street in South Bethlehem ranked highly in terms of bicycle and pedestrian crash volumes (between 14 and 19 crashes on each segment).

The City of Easton (Figure 3.13) and its immediate surroundings had the lowest bicycle and pedestrian crash densities of the three Lehigh Valley cities. Still, 18 people who were walking, rolling or bicycling were killed or seriously injured in crashes in the Easton area between 2012 and 2017.

Crashes involving people walking, rolling or bicycling are more likely where there are more pedestrians and bicyclists (e.g., urban areas). However, it is also helpful to understand crash risk. To gain a general understanding of crash risk, crashes were normalized by population density (Figure 3.14). This analysis makes it possible to identify areas with lower population density that may have a high concentration of crashes relative to their population.

The results show that crashes tended to be concentrated in downtown urban areas even when normalized. There are a few census blocks in more suburban areas with higher normalized crash rates; however, crashes are rare events and these outliers are likely explained by random variation. A separate safety analysis would be required to more fully identify additional systemic causes of crash risk, but the overall takeaway remains that crash risk is elevated in the Lehigh Valley’s denser urban areas.
Parks

All Crashes Involving Bicyclists and Pedestrians

Number of Crashes Per 100,000 People

4780

INSET MAP

Figure 3.14

Figure 3.14

MONROE COUNTY

SCHUYLKILL COUNTY

New Jersey

BUCKS COUNTY

0

5

10 miles

Parks

Municipal Boundaries
**Inappropriate Speed/Speeding**

Inappropriate speed or speeding is a factor in almost every crash, increasing both the likelihood that a crash will occur and its severity. Higher motor vehicle speeds increase the likelihood of a crash by narrowing the driver’s cone of vision, lengthening stopping distances and limiting the driver’s ability to maneuver around obstacles. Higher motor vehicle speeds increase crash severity by producing greater kinetic force. People who are walking, rolling or bicycling are particularly vulnerable due to their lack of protection (Figure 3.15). Notably, only six percent of all killed or seriously injured crashes involving a bicyclist or pedestrian in the Lehigh Valley were flagged by law enforcement as speeding related. This may reflect a reluctance to indicate speeding as a contributing factor in the absence of direct evidence such as skid marks, witness statements or admissions from the involved parties. A review of the criteria for reporting speed as a contributing crash factor may determine if modifications are necessary to ensure future reporting accurately reflects crash conditions. Potential countermeasures for inappropriate speed and speeding include traffic calming, posted speed limit reduction, and coordinated safety education and enforcement campaigns.

Figure 3.15: Relationship between motor vehicle speed and factors contributing to fatality risk

Source: National Highway Traffic Safety Administration
Impairment

Impairment of some kind was either verified or suspected in 68 percent of all pedestrian and bicyclist crashes in the Lehigh Valley that resulted in fatalities or serious injuries.

Almost all these crashes involved alcohol. Specifically, in 89 percent of killed or seriously injured crashes involving a bicyclist and 61 percent of killed or seriously injured crashes involving a pedestrian, at least one party in the crash was determined or suspected to be under the influence of alcohol.

Meanwhile, drugs or medication were suspected to be involved in very few killed or seriously injured crashes with a bicyclist or pedestrian—0 percent of bicyclist killed or seriously injured crashes and 5 percent of pedestrian killed or seriously injured crashes. It should be noted that detecting drug influence in crashes is much more complicated than detecting alcohol involvement, which has an established legal limit and roadside warrantless detection methods. Initial underreporting of drug involvement in crashes is often suggested by final toxicology results from fatal crash investigations.

Potential countermeasures for impairment include alcohol vendor compliance checks and coordinated safety education and enforcement campaigns.
Poor Visibility

Full and even illumination of roadway facilities is essential not only to prevent crashes, but also to ensure the personal safety and comfort of bicycle and pedestrian facility users. Over half of all killed or seriously injured crashes involving people walking, rolling or bicycling occurred outside daylight hours, underscoring the importance of lighting to ensure safe conditions for walking and bicycling. Seventy-one percent of bicyclists and 52 percent of pedestrians killed or seriously injured occurred in dark conditions without street lights present. The remainder (29 percent of bicyclists and 48 percent of pedestrians) occurred when lights were present. In these cases, a lighting assessment could determine if sufficient illumination exists or if lighting improvements are needed to enhance safety.

Lack of Separation

People walking, rolling and bicycling generally travel more slowly than motor vehicles and have minimal to no physical protection in the event of a crash. One way to enhance bicyclist and pedestrian safety is to separate people who are walking, rolling and bicycling from motor vehicle traffic spatially or using protected traffic signal phases, particularly in areas with high speed differentials between modes or high traffic volumes.

Table 3.1 shows the percentage of KSI crashes that occur at intersection locations versus non-intersection locations in the Lehigh Valley. Table 3.2 shows how the pre-crash movements of motor vehicles involved in pedestrian and bicycle killed or seriously injured crashes relates to the frequency of those crashes. Both tables offer insight into where additional separation may be most needed.

Table 3.1: Share of bicycle and pedestrian killed or seriously injured crashes by intersection or non-intersection location.

<table>
<thead>
<tr>
<th></th>
<th>Intersection</th>
<th>Non-Intersection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bicycle killed or seriously injured (KSI) crashes</td>
<td>83.3%*</td>
<td>16.7%</td>
</tr>
<tr>
<td>Pedestrian killed or seriously injured (KSI) crashes</td>
<td>41.2%</td>
<td>58.8%</td>
</tr>
</tbody>
</table>

* This percentage is high compared to those indicated by the Fatality Analysis Reporting System (FARS), which indicates that most fatalities occurred at non-intersection locations (57 percent).

Table 3.2: Share of bicycle and pedestrian killed or seriously injured crashes by motor vehicle movement

<table>
<thead>
<tr>
<th>Motor Vehicle Movement</th>
<th>Bicycle killed or seriously injured crashes</th>
<th>Pedestrian killed or seriously injured crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Going straight</td>
<td>70.0%**</td>
<td>75.7%</td>
</tr>
<tr>
<td>Slowing or stopping</td>
<td>0.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Passing or overtaking</td>
<td>0.0%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Turning right</td>
<td>20.0%</td>
<td>4.3%</td>
</tr>
<tr>
<td>Turning left</td>
<td>0.0%</td>
<td>7.1%</td>
</tr>
<tr>
<td>Backing up</td>
<td>0.0%</td>
<td>2.9%</td>
</tr>
<tr>
<td>Changing lanes or merging</td>
<td>10.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Negotiating curve right</td>
<td>0.0%</td>
<td>1.4%</td>
</tr>
<tr>
<td>Negotiating curve left</td>
<td>2.9%</td>
<td>2.9%</td>
</tr>
</tbody>
</table>

** Bicycle and pedestrian crashes where the vehicle is going straight ahead can occur when a bicyclist or pedestrian does not have a separated facility and must walk, roll or bicycle in a motor vehicle travel lane. These can be mitigated by providing separated bike lanes and sidewalks to avoid active transportation users being hit from behind or during vehicle merging or lane changing movements. While the “Going Straight” statistic provides insight, the high percentage of bicycle and pedestrian KSI's occurring during “Going Straight” vehicle movements may also be a result of ambiguous reporting procedures or challenges in retrospectively identifying vehicle movements.

Separation is also important at intersections to reduce bicyclist and pedestrian crash exposure. Pedestrian crossing islands and protected intersections channelize vehicle movements and reduce the total number of conflict points between active transportation users and vehicles.
Accessibility

For people with disabilities, a sidewalk that is obstructed, in poor repair or not compliant with Americans with Disabilities Act (ADA) standards can represent a significant mobility barrier. Basic things like getting from home to a nearby bus stop or parked car may be impossible or nearly impossible. This is true even for what may seem like relatively minor defects to a non-disabled person.

Accessible street design features, such as curb ramps, accessible sidewalks, accessible pedestrian signals and longer pedestrian signal times are critical for people with disabilities. Yet, there is currently no information at a regional scale on where these features are present and missing.

ADA Transition Plans

Implementing regulations for the Americans with Disabilities Act (ADA) requires local governments with 50 or more employees to develop an ADA transition plan. Among other things, the plan must include an evaluation of crosswalk and sidewalk accessibility and a strategy for addressing deficiencies. Many municipalities have not developed such plans, and those that have often do not give adequate attention to sidewalk accessibility beyond provision of curb ramps.

Sidewalk Repair Policies

Sidewalks with heaves, cracks, missing panels and other sidewalk repair issues are a significant safety and accessibility issue in many Pennsylvania municipalities. These issues are often related to municipal policies on sidewalk repair.

In Pennsylvania, most municipalities require property owners to repair sidewalks. This requirement is made possible by Section 11 of the Pennsylvania Statute titled “Municipal Roads, Laying Out and Maintaining” enacted in 1891 (Act of May 16, 1891, P.L. 75, sec. 11), which enables municipal authorities to require private property owners to install and maintain sidewalks and curbs.

The challenge with property owner responsibility policies is that municipalities often do not do enough to enforce them or provide guidance to property owners. Another issue is that these policies were developed in a pre-automobile age when conditions were quite different. In the 19th Century, sidewalks were effectively a luxury. Where sidewalks were available, pedestrians could use them if they so desired, but they could just as easily (and legally) walk in the street. With the advent of the automobile, sidewalks went from being a luxury item to a necessary piece of civic infrastructure.

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**Convenience and Connectivity**

Convenience and connectivity are critical for pedestrian and bicycle transportation. Like all travelers, people who are walking, rolling or bicycling are sensitive to the amount of time and effort required to accomplish a trip, particularly if the trip has a transportation purpose, such as traveling to work, going to school or running an errand. If the time and effort required for a pedestrian and bicycle trip compare unfavorably to the time and effort required for other modes, then people are likely to choose other modes, regardless of the inherent benefits of pedestrian and bicycle travel. In addition, just as motor vehicle travel is contingent upon a continuous and connected network that links people to where they want to go, so too is connectivity a key attribute for pedestrian and bicycle travel.

**Land Use and Street Connectivity**

Some parts of the Lehigh Valley are characterized by widely separated land uses and disconnected street patterns. These areas discourage walking and bicycling for transportation purposes. Where land uses are separated, the destinations people want to go to are often further away. Disconnected street networks exacerbate this dynamic and can lengthen trip distances even when a desired destination is nearby “as the crow flies” (Figure 3.16). In addition, a street network that lacks connectivity often directs all traffic to a major arterial roadway. Such roadways are uncomfortable and frequently unsafe for people who are walking, rolling or bicycling due to high motor vehicle speeds and volumes. Auto-oriented uses, large street-facing parking lots, buildings set-back significantly from the street and frequent driveway curb cuts add to the unpleasantness of walking and bicycling on arterial roadways.

Figure 3.16: Example of a Lehigh Valley subdivision with a disconnected street network. Houses A and house B are separated by 96 feet “as the crow flies” but require a trip of .75 miles along the street network.
Pedestrian Network

The street network provides the “bones” for much of the active transportation network, but separated pedestrian and bicyclist facilities are critical for the safety and comfort of people who are walking, rolling or bicycling. Sidewalks provide safe pedestrian access to jobs, shopping and essential services. They offer room for children to play, adults to socialize and people to wait for public transit. In addition, the sidewalk and the buffer area between the sidewalk and the street can be used to accommodate street trees and other plantings, stormwater infrastructure, street lights and bicycle racks.

Sidewalks are most common in the Lehigh Valley’s cities and boroughs. Cities and boroughs also have the greatest potential for walking, and hence greatest need for sidewalks, due to their higher population densities and shorter distances to jobs and other destinations. However, sidewalks are also needed in rural small towns to enable safe walking and rolling. Table 3.3 shows the municipalities with the lowest ratio of sidewalk to roadway mileage by municipality type.

<table>
<thead>
<tr>
<th>Municipality Type</th>
<th>Name</th>
<th>% of Roadway Mileage With Sidewalk on One Side</th>
<th>% of Roadway Mileage With Sidewalk on Both Sides</th>
<th>% of Roadway Mileage on One or Both Sides</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities and Boroughs</td>
<td>Chapman Borough</td>
<td>3.52%</td>
<td>1.67%</td>
<td>5.19%</td>
</tr>
<tr>
<td></td>
<td>Glendon Borough</td>
<td>0.44%</td>
<td>5.53%</td>
<td>5.97%</td>
</tr>
<tr>
<td></td>
<td>Portland Borough</td>
<td>12.82%</td>
<td>4.12%</td>
<td>16.95%</td>
</tr>
<tr>
<td></td>
<td>Walnutport Borough</td>
<td>11.82%</td>
<td>7.35%</td>
<td>19.16%</td>
</tr>
<tr>
<td></td>
<td>Slatington Borough</td>
<td>8.09%</td>
<td>19.96%</td>
<td>28.05%</td>
</tr>
<tr>
<td>Rural Municipalities</td>
<td>Bushkill Township</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Lowhill Township</td>
<td>0.00%</td>
<td>0.00%</td>
<td>0.00%</td>
</tr>
<tr>
<td></td>
<td>Moore Township</td>
<td>0.11%</td>
<td>0.13%</td>
<td>0.23%</td>
</tr>
<tr>
<td></td>
<td>Weisenberg Township</td>
<td>0.27%</td>
<td>0.00%</td>
<td>0.27%</td>
</tr>
<tr>
<td></td>
<td>Lower Mt. Bethel Township</td>
<td>0.32%</td>
<td>0.00%</td>
<td>0.32%</td>
</tr>
<tr>
<td>Suburban Municipalities</td>
<td>Lower Saucon Township</td>
<td>1.46%</td>
<td>1.48%</td>
<td>2.94%</td>
</tr>
<tr>
<td></td>
<td>South Whitehall Township</td>
<td>2.22%</td>
<td>1.27%</td>
<td>3.49%</td>
</tr>
<tr>
<td></td>
<td>Upper Milford Township</td>
<td>1.08%</td>
<td>2.48%</td>
<td>3.66%</td>
</tr>
<tr>
<td></td>
<td>Lower Nazareth Township</td>
<td>2.15%</td>
<td>1.46%</td>
<td>3.61%</td>
</tr>
<tr>
<td></td>
<td>Salisbury Township</td>
<td>3.21%</td>
<td>1.07%</td>
<td>4.28%</td>
</tr>
</tbody>
</table>

Sidewalks on Arterial and Collector Streets

Sidewalks are critical for pedestrian safety along arterial and collector streets, particularly in urban, suburban and small-town locations, where they provide access to bus stops, shopping centers, parks and other destinations. Since these destinations are typically located on both sides of the street, sidewalks are also generally needed on both sides.

Sidewalk gaps along arterial and collector streets were mapped and prioritized as part of the Walk/Roll LV planning process. The gaps were prioritized based on population and intersection density, variables which are strongly related to the potential for pedestrian activity.

A map (Figure 3.17) showing sidewalk gaps on arterial and collector streets throughout the Lehigh Valley is shown on page 48. A map and table (Figure 3.18) showing the top 20 gaps based on population and street density is shown on page 49. These gaps should be prioritized for further study to facilitate the addition of sidewalks as needed. It is recognized that constructing sidewalks on arterial and collector may be challenging for some municipalities due to the need to coordinate with PennDOT and public utilities, ongoing maintenance costs and other factors.
## Sidewalk Gaps Analysis

### Table 3.18

<table>
<thead>
<tr>
<th>Rank</th>
<th>Street Name</th>
<th>1 or 2 sides</th>
<th>Length in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Martin Luther King Jr. Drive (west)</td>
<td>1</td>
<td>1,851</td>
</tr>
<tr>
<td>2</td>
<td>Hamilton Street</td>
<td>1</td>
<td>1,618</td>
</tr>
<tr>
<td>3</td>
<td>Martin Luther King Jr. Drive (east)</td>
<td>1</td>
<td>1,343</td>
</tr>
<tr>
<td>4</td>
<td>American Parkway</td>
<td>2</td>
<td>5,130</td>
</tr>
<tr>
<td>5</td>
<td>West Union Street</td>
<td>2</td>
<td>1,814</td>
</tr>
<tr>
<td>6</td>
<td>Club Avenue</td>
<td>1</td>
<td>1,350</td>
</tr>
<tr>
<td>7</td>
<td>Front Street</td>
<td>1</td>
<td>1,331</td>
</tr>
<tr>
<td>8</td>
<td>Parkway Boulevard</td>
<td>2</td>
<td>1,999</td>
</tr>
<tr>
<td>9</td>
<td>Fairmont Avenue</td>
<td>2</td>
<td>1,551</td>
</tr>
<tr>
<td>10</td>
<td>Roth Avenue</td>
<td>1</td>
<td>1,642</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rank</th>
<th>Street Name</th>
<th>1 or 2 sides</th>
<th>Length in Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>11</td>
<td>Whitehall Avenue</td>
<td>1</td>
<td>1,641</td>
</tr>
<tr>
<td>12</td>
<td>Riverside Drive</td>
<td>2</td>
<td>1,861</td>
</tr>
<tr>
<td>13</td>
<td>Bath Pike</td>
<td>2</td>
<td>1,411</td>
</tr>
<tr>
<td>14</td>
<td>Whitehall Avenue</td>
<td>2</td>
<td>1,726</td>
</tr>
<tr>
<td>15</td>
<td>Howertown Road</td>
<td>1</td>
<td>1,502</td>
</tr>
<tr>
<td>16</td>
<td>Lehigh Street</td>
<td>1</td>
<td>1,542</td>
</tr>
<tr>
<td>17</td>
<td>Cambria Street</td>
<td>2</td>
<td>1,659</td>
</tr>
<tr>
<td>18</td>
<td>Mauch Chunk Road</td>
<td>2</td>
<td>2,344</td>
</tr>
<tr>
<td>19</td>
<td>Canal Street</td>
<td>1</td>
<td>1,386</td>
</tr>
<tr>
<td>20</td>
<td>South Ott Street</td>
<td>1</td>
<td>1,547</td>
</tr>
</tbody>
</table>
Sidewalk Access to Public Transit

Sidewalks expand the “catchment area” for public transit service by making walking to bus stops easy and comfortable and providing protected spaces for public transit users to stand or sit while waiting for the bus. An analysis of sidewalk accessibility to public transit stops is provided in Walk LV. (See Walk LV for details on how this analysis was performed.) The analysis found that most public transit stops (76 percent) were located on pedestrian corridors, defined as streets with sidewalks on one or both sides.

On streets with public transit service, it is important to provide sidewalks on both sides of the street. The sidewalks should establish a seamless, pedestrian connection to bus stops and pedestrian crossings and should be ADA-compliant and clear of snow and debris. Crossings should be convenient and safe, incorporating high-visibility crosswalk markings, enhanced lighting, and other countermeasures to enhance safety. Where sidewalks and convenient, safe pedestrian crossings are not available, people who are walking or rolling are exposed to potentially unsafe conditions. In addition, people who are walking or rolling may have difficulty accessing stops, which can limit the mobility of people who do not have access to a private car and lead others to drive themselves instead of taking public transit.

The problem of poor sidewalk access to public transit is most acute in rural municipalities, where 86.7 percent of public transit stops are not on streets with sidewalks. Suburban municipalities have the largest share of such stops, with 85 percent of the total region-wide (Table 3.4).

Table 3.4: Public transit stops not adjacent to streets with sidewalks on both sides by municipal classification

<table>
<thead>
<tr>
<th>Municipal Classification</th>
<th>Share of Municipal Classification Total</th>
<th>Share of Regional Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities and Boroughs</td>
<td>4.7%</td>
<td>12.9%</td>
</tr>
<tr>
<td>Suburban Municipalities</td>
<td>59.6%</td>
<td>85.0%</td>
</tr>
<tr>
<td>Rural Municipalities</td>
<td>86.7%</td>
<td>2.1%</td>
</tr>
</tbody>
</table>

Sidewalk Access to Schools

Sidewalks can make it possible for children to walk to school. In addition, school-adjacent sidewalks confer mobility benefits to members of the community in which the school is situated, by making important pedestrian connections and providing pedestrian access to community events and resources located on or near school grounds (e.g., ball fields, playgrounds, basketball courts). Where sidewalks are unavailable, parents often drive their children to school, which can contribute significantly to neighborhood traffic congestion. In fact, research has shown that school-related traffic can account for up to 15-20 percent of morning traffic in some places.

An analysis of sidewalk accessibility to schools was conducted for this plan. The analysis found that 25.5 percent of schools region-wide are not adjacent to streets with sidewalks. The problem of poor sidewalk access to schools is most acute in rural municipalities, where 66.7 percent of schools are not on streets with sidewalks. Suburban municipalities have the largest share of such schools, with 63 percent of the total region-wide (Table 3.5).

Table 3.5: Schools not adjacent to sidewalk by municipal classification

<table>
<thead>
<tr>
<th>Municipal Classification</th>
<th>Share of Municipal Classification Total</th>
<th>Share of Regional Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities and Boroughs</td>
<td>3.9%</td>
<td>7.5%</td>
</tr>
<tr>
<td>Suburban Municipalities</td>
<td>40.0%</td>
<td>63.0%</td>
</tr>
<tr>
<td>Rural Municipalities</td>
<td>66.7%</td>
<td>29.5%</td>
</tr>
</tbody>
</table>

Sidewalk Access to Trails

The Lehigh Valley has an extensive network of trails that provide recreational opportunities and transportation connections to people who are walking, rolling or bicycling. Pedestrian access to these trails is dependent upon the presence of connecting sidewalks.

An analysis of sidewalk accessibility to trails is provided in Walk LV. (See Walk LV for details on how this analysis was performed.) The analysis found that approximately 35 miles of trail in the Lehigh Valley are adjacent to neighborhoods with sidewalks. The City of Allentown, the City of Bethlehem, Forks Township and other areas with relatively high sidewalk coverage have the greatest opportunity to improve sidewalk access to trails (Figure 3.19). Improving sidewalk access to trails could open the trails up to more pedestrians, who could use them for a variety of trip purposes, including leisure, work, school and shopping.
Bicycling Network

There are two ways of thinking about an existing bicycling network. One way is to consider only the facilities specifically dedicated for bicycling, that is, bike lanes, separated bike lanes and trails (or shared use paths), collectively referred to as “bikeways” in this document (See Figure 2.8 for a map of Lehigh Valley bikeways.) By this measure, the Lehigh Valley’s existing bicycling network is largely defined by major trails, such as the D&L Trail and a number of local recreational trails. The local trails frequently do not connect to the major trails or to each other, and there are significant gaps in some of the major trails. For example, the gap between the South Bethlehem Greenway in the City of Bethlehem and the Saucon Rail Trail in Hellertown Borough interrupts the trail alignment connecting Coopersburg Borough north to Bethlehem. THE LINK project is working to fill these gaps and create an interconnected trail network in the Lehigh Valley.

Another way of thinking about the existing bicycle network is to consider where the average person would be comfortable bicycling. This can be understood using a technique called Bicycling Level of Traffic Stress, which takes into account motor vehicle speeds and volumes, the presence of separated bicycling facilities and other factors, to compute a score representing how comfortable or stressful a particular route might be for the average person who is bicycling.

In Figure 3.20 blue lines indicate streets on which the average bicyclist would be comfortable riding, while red lines indicate streets the average bicyclist would likely avoid. These red lines represent gaps in the existing bicycling network. What is difficult to see on a map at this scale is that in most cases locations where blue lines intersect red lines also represent gaps in the bicycling network, because there isn’t a protected crossing at the intersection, such as a traffic signal or pedestrian hybrid beacon, and the average bicyclist is uncomfortable riding along an arterial roadway if a separated bicycling facility is not available. Figure 3.20 and Figure 3.21 portray this dynamic.

Using a Bicycling Level of Traffic Stress measure, the Lehigh Valley’s bicycling network is far more extensive than it is using the “bikeways” method, because it includes neighborhood streets with low motor vehicle speeds and volumes where most people would feel comfortable riding. However, this low-stress network is comprised of multiple isolated “islands,” as illustrated in Figure 3.20 and Figure 3.21, which significantly limits their usefulness for accessing destinations. Adding separated bicycle facilities to the high-stress roadways would close these gaps and provide greater accessibility. A map showing Bicycling Level of Traffic Stress scores throughout the Lehigh Valley is provided in Figure 3.22.
Seamless Multimodal Integration

Active transportation and public transit have a symbiotic relationship. Public transit ridership levels often depend on people’s ability to walk, roll and bicycle to public transit stops. Walking, rolling and bicycling levels are also much higher where there is convenient and efficient public transit service. Public transit is most attractive for moderate and long-distance trips, while walking, rolling and bicycling are most attractive for shorter trips. Combining transit with walking, rolling and bicycling can provide a high level of mobility comparable to automobile travel, but this synergy depends on good pedestrian and bicycle access to public transit and convenient, comfortable and efficient public transit service.

Sidewalk access to public transit in the Lehigh Valley is reviewed on page 50. Bicycle access to public transit depends on a comfortable bicycling route that connects to the public transit stop, secure bicycle parking at public transit stops and bicycle racks on buses. Most LANtaBus stops are located on arterial roadways without protected bicycling facilities, making them difficult to access by bicycle. In addition, although most LANtaBus vehicles include bicycle racks, these racks sometimes fill up on high-ridership routes. In addition, few LANta stops provide bicycle parking. Because LANta does not own property, it relies on private developers for their installation.

Finally, the LANta system does not connect to every corner of the Lehigh Valley and existing headways (or time between each bus on the same line) on most routes are an hour or more, making them relatively inconvenient for most potential users. Improving the ability to use public transit to reach industrial jobs will be critical. In the warehouse-centric neighborhoods especially, accommodating a wide range of work hours (e.g. late-night shifts) and accounting for travel behaviors by different levels of workers (i.e. management vs. hourly employees) is a high priority.

Regional Coordination

Residents and visitors to the Lehigh Valley frequently travel between multiple municipalities over the course of a day. For example, U.S. 22 traverses through 12 different municipalities within Lehigh and Northampton counties. A person bicycling or driving has no knowledge of where these municipal boundaries begin and end – nor should they need to know. Yet, some high-quality trail plans in the region only went as far as the municipal border, which created discontinuities in the network. It is essential that the active transportation network seamlessly continue across municipal boundaries, which highlights the need for ongoing regional coordination among the Lehigh Valley Planning Commission (LVPC), the Pennsylvania Department of Transportation (PennDOT), LANta, non-profits and the 62 municipalities in the Lehigh Valley.

Culture

Merriam-Webster defines culture as a “set of shared attitudes, values, goals and practices.” Culture is an important factor in transportation, because it influences local government decisions about land use regulation and transportation system investments, which in turn affect people’s transportation habits as well as their attitudes about what modes should be valued in public policy. For example, single-use zoning often results in a wide separation of land uses, making walking, rolling and bicycling inconvenient for many trip purposes and discouraging use of these modes. Single use zoning may also increase public support for auto-oriented policies, as people perceive a private car as the most convenient way to navigate this environment.
As in most communities across the United States, the transportation culture of the Lehigh Valley has been dominated by an auto-oriented perspective for the past several decades, although it is in the process of changing. Some of the tangible outcomes of this culture have already been noted, including:

- Land use patterns that discourage active transportation.
- Street designs that prioritize private motor vehicle speed and throughput.
- Gaps in the pedestrian network that affect access to public transit, schools and trails.
- Relatively low investment in on-street bicycling infrastructure.
- Relatively low active transportation commute share.

Public sector decision-makers have the greatest leverage to shift the transportation culture in the Lehigh Valley toward active transportation, since they can directly influence decisions about land use, site design, street design, transportation infrastructure funding and other matters relevant for active transportation. At the regional level, the LVPC has worked to foster support among public-sector decision makers for active transportation by establishing the Multimodal Working Group, developing model ordinances and guidance documents and other activities. However, there is a need to provide additional education and guidance to local government decision-makers and transportation professionals on active transportation issues.

Transportation system users, businesses, non-profits and community organizations can also influence the Lehigh Valley’s transportation culture by advocating for active transportation-supportive policies and investments and by supporting active transportation in other ways, such as through education and encouragement initiatives or private investments in bicycle parking. A number of private-sector organizations are already working to support active transportation in the Lehigh Valley, including the Delaware & Lehigh National Heritage Corridor, Discover Lehigh Valley, St. Luke’s Hospital, CAT, Community Bike Works, Genesis Bikes, The Valley Preferred Cycling Center, Bicycling Magazine, Runner’s World and others. THE LINK provides a way for some of these organizations to coordinate with the public sector on trail development. However, there is a need for greater coordination on other active transportation issues and to broaden the base for active transportation advocacy.

### Equity

Research has shown that people from historically disadvantaged groups, such as people of color, low-income people and people with disabilities, are often underserved by pedestrian and bicycle infrastructure and disproportionately exposed to traffic safety and personal security risks. An analysis was conducted of pedestrian and bicycle infrastructure and crashes in Census Block Groups where people from historically disadvantaged groups are concentrated to better understand potential equity-related gaps and needs in the Lehigh Valley.

The infrastructure analysis found that Census Block Groups with higher poverty rates were relatively well-served by pedestrian and bicycle infrastructure compared to the overall rate (Table 3.6). It is important to note that this assessment did not consider the quality or repair of existing pedestrian and bicycle infrastructure. The infrastructure analysis also found that sidewalk coverage in high-poverty parts of cities, boroughs and suburban areas were close to the overall area’s coverage (Table 3.7).

#### Table 3.6: Census Blocks Within ½ Mile of Existing Bikeway—All v. Top 25% for Percent of Households in Poverty

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Within 1/2 Mile of Bikeway</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Census Blocks</td>
<td>448</td>
<td>51</td>
<td>11%</td>
</tr>
<tr>
<td>Census Blocks in Top 25% of Poverty</td>
<td>112</td>
<td>28</td>
<td>25%</td>
</tr>
</tbody>
</table>

#### Table 3.7: Ratio of Sidewalks to Roads in City, Suburban and Rural Areas—All Census Block Groups v. Top 25% for Percent of Households in Poverty

<table>
<thead>
<tr>
<th></th>
<th>Sidewalk miles</th>
<th>Roads miles</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cities and Boroughs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Census Block Groups</td>
<td>1,402.9</td>
<td>1,269.0</td>
<td>1.1</td>
</tr>
<tr>
<td>Top 25% in Poverty</td>
<td>487.8</td>
<td>400.4</td>
<td>1.2</td>
</tr>
<tr>
<td>Suburban Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Census Block Groups</td>
<td>631.7</td>
<td>2,001.3</td>
<td>0.3</td>
</tr>
<tr>
<td>Top 25% in Poverty</td>
<td>38.5</td>
<td>45.2</td>
<td>0.9</td>
</tr>
<tr>
<td>Rural Areas</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Census Block Groups</td>
<td>21.8</td>
<td>1,575.0</td>
<td>~0</td>
</tr>
<tr>
<td>Top 25% in Poverty</td>
<td>0</td>
<td>40.2</td>
<td>0</td>
</tr>
</tbody>
</table>
The crash analysis found that Census Block Groups with concentrations of people in poverty and Hispanic and African American populations were disproportionately affected by pedestrian and bicycle crashes (Table 3.8).

### Table 3.8: Bike/Ped Crashes by Demographic Factor—Top 25% of Census Block Groups for Demographic Factor v. Bottom 75%

<table>
<thead>
<tr>
<th>Demographic Factor</th>
<th>Percent of Bike/Ped KSI Crashes</th>
<th>Percent of All Bike/Ped Crashes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic/Latino</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 25%</td>
<td>39.7%</td>
<td>54.7%</td>
</tr>
<tr>
<td>Bottom 75%</td>
<td>60.3%</td>
<td>45.3%</td>
</tr>
<tr>
<td>African American</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 25%</td>
<td>42.2%</td>
<td>47.7%</td>
</tr>
<tr>
<td>Bottom 75%</td>
<td>57.8%</td>
<td>52.3%</td>
</tr>
<tr>
<td>Zero-Car Households</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 25%</td>
<td>38.7%</td>
<td>53.8%</td>
</tr>
<tr>
<td>Bottom 75%</td>
<td>61.3%</td>
<td>46.2%</td>
</tr>
<tr>
<td>Poverty Status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Top 25%</td>
<td>40.2%</td>
<td>54.9%</td>
</tr>
<tr>
<td>Bottom 75%</td>
<td>59.8%</td>
<td>45.1%</td>
</tr>
</tbody>
</table>

In terms of racial equity, the locations with the greatest concentrations of Hispanic and African American individuals accounted for 55 percent and 48 percent of all bicycle and pedestrian crashes, respectively. Moreover, 41 percent of all killed or seriously injured bicycle and pedestrian crashes occurred in these locations.

Similarly, the areas with greatest concentrations of zero-car households accounted for 54 percent of all bicycle and pedestrian crashes and 39 percent of killed or seriously injured bicycle and pedestrian crashes. Areas with the greatest concentration of individuals in poverty accounted for 55 percent of all bicycle and pedestrian crashes and 40 percent of killed or seriously injured bicycle and pedestrian crashes.

Robust bicycle, pedestrian, and vehicle count data are required to conduct a safety analysis based on the number of individuals walking or bicycling in a given area, also referred to as crash exposure risk. However, the available data indicate that the highest concentrations of crashes for those walking, rolling and bicycling are co-located with the highest concentrations of African American, Hispanic, low-income and carless households.

**Emerging Technologies**

LANta is working to implement an enhanced bus service (EBS) line between the City of Bethlehem, the City of Allentown and Whitehall Township. Another EBS line is planned between the City of Bethlehem and the City of Easton but is at an earlier stage of development. Implementing these two EBS lines, along with other planned improvements to LANta service, could result in substantial LANta ridership increases, which could in turn increase walking, rolling and bicycling as people access the new EBS stops. These efforts, therefore, require continued support and investment. In addition, emerging public transit technologies, such as autonomous rapid transit, should be explored as a way to lower public transit costs and increase the convenience and efficiency of public transit service.

In addition, there is a need to plan ahead and prepare strategically for other emerging technologies, such as autonomous vehicles, bikeshare and scootershare (Figure 3.23). These technologies are evolving quickly and usage is rapidly expanding across the United States. It is only a matter of time before they are introduced in the Lehigh Valley. Regional coordination is needed to leverage the potential benefits of these technologies for mobility, quality of life and pedestrian and bicycle access and safety, while avoiding potential negative impacts, such as traffic congestion and increased sprawl development.
Pedestrian Network Recommendations

Walk/Roll LV is an important stepping stone on the way to developing a higher-quality pedestrian network in the Lehigh Valley by identifying Priority Pedestrian Areas and providing generalized recommendations for these areas by type. This plan also includes a toolkit with guidance on pedestrian facility design and crosswalk improvement selection. The toolkit is included as Appendix A.

A high-quality pedestrian network is:

- **Safe**—Crashes involving people walking and rolling are rare and conflicts with motor vehicles are limited.
- **Comfortable**—People feel comfortable walking and rolling at all hours of the day and night. Personal security is not a concern.
- **Connected**—People have direct and convenient pedestrian access to destinations for work, school, errands, recreation and other purposes.
- **Accessible**—The pedestrian network is accessible to people with disabilities, parents with strollers and others.
- **Attractive**—The pedestrian network is more than a means of getting from point A to point B. It is interesting and aesthetically pleasing in its own right.
- **Intuitive**—The best way of getting from point A to point B by walking or rolling is clear and easy to understand.
- **Well-maintained**—Pedestrian facilities are in good repair and kept free of snow and debris.1

### Priority Pedestrian Areas

A Priority Pedestrian Area is a location with high existing or potential pedestrian activity. Thirty (30) Priority Pedestrian Areas were identified as part of the Walk/Roll LV planning process based on input from the Project Team and Multimodal Working Group. Priority Pedestrian Areas are grouped into types based on shared characteristics, including:

- **City Downtown**—Dense areas of commercial activity where many people frequently walk between destinations. Primary destinations may include locations of employment or commercial destinations such as restaurants or retail. These qualities can lead to high levels of pedestrian activity, especially if connected sidewalks and public transit service are present.
- **City Neighborhood**—Primarily residential areas where people live. Some shops oriented toward residents’ daily needs may be present, such as grocery and convenience stores, restaurants and pharmacies. Parks or other recreational areas may also generate pedestrian activity in these neighborhoods. Pedestrian activity in these areas may be for either practical purposes—such as running errands or traveling to work—or for recreational purposes.
- **Small Town Main Street**—Similar to city downtowns, but with commercial uses clustered along a single corridor and generally smaller buildings. Making it possible for people to safely and conveniently walk to the main street area from adjacent neighborhoods can catalyze economic development and enhance residents’ quality of life.

---

1 Adapted from the FHWA Bikeway Selection Guide.
• **Major Public Transit Stop/Corridor**—Areas near public transit stops or corridors that are well-served by public transit. Most people who ride the bus, walk or roll to get to and from public transit stops. Safe and convenient pedestrian connections are, therefore, critical for people who use public transit as well as public transit providers. These connections are particularly needed along and across streets where public transit stops are located, which tend to be arterial roadways with higher motor vehicle speeds and volumes.

• **Trail Connection**—Areas near where the roadway or sidewalk network intersects off-road trails. Trails provide high-quality, low-stress pedestrian connections that can be used for a range of recreational and utilitarian purposes (e.g., the D&L Trail). However, the ability for people who are walking and rolling to leverage these connections depends on safe and convenient pedestrian access between trails and adjacent commercial or residential neighborhoods. Pedestrian infrastructure and amenities are particularly needed at trail access points.

• **Neighborhood Schools**—Schools where busing may not be provided for most students in the areas immediately surrounding them (within approximately ½ mile). Pedestrian improvements near schools can enable students to walk to school safely and benefit other members of the community by providing better access to school sites, which often host community events or are co-located with community recreation facilities. When considering pedestrian needs near schools, it is important to consider the characteristics and abilities of children, which differ significantly from adults. For example, younger children are often much shorter (and therefore more difficult to see) than adults, may behave unpredictably (e.g., darting out into the street after a ball) and are less able to judge traffic-related situations, such as the speed of oncoming vehicles or whether a driver can see them. Pedestrian improvements that increase pedestrian visibility and slow motor vehicle speeds are, therefore, particularly important adjacent to the school site and along student walking routes.

The Priority Pedestrian Areas identified through the Walk/Roll LV planning process are shown in Figure 4.2. While Priority Pedestrian Area boundaries were not defined as part of Walk/Roll LV, they could be identified as part of a future planning process.

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**Recommended Priority Pedestrian Area Strategies**

The following pages provide recommended strategies for improving pedestrian safety, comfort and access in the Pedestrian Priority Areas. The strategies are grouped by category (Figure 4.1). Within each category, direction is provided regarding the applicability of recommended strategies to each Pedestrian Priority Area type.

**Applicability to Locations not Selected as Pedestrian Priority Areas**

The strategies discussed in this section could be applied to other areas with similar characteristics. For example, a major transit stop or neighborhood school that was not selected as a PPA may benefit from the same strategies as those that were identified as pedestrian priority areas.

---

**Figure 4.1: Priority Pedestrian Area Strategy Groupings**

- Connected, accessible and comfortable sidewalks
- Safe and frequent crossings
- Traffic calming
- Pedestrian supportive parking policies and management
- Pedestrian-supportive roadway operations
- Pedestrian-supportive land use regulation and development review
Figure 4.2

**City Downtowns**
- D1 Center City Allentown
- D2 Historic Downtown Bethlehem
- D3 South Bethlehem
- D4 Downtown Easton

**City Neighborhoods**
- N1 19th Street/Fairgrounds
- N2 West Ward Easton
- N3 St. John’s Hill/South Side
- N4 College Hill/Lafayette College

**Major Public Transit Stops/Corridors**
- T1 Dorney Park
- T2 South 4th Street
- T3 Stefko Boulevard
- T4 Broad & Guetter Streets
- T5 Schoenersville Road
- T6 Walbert & Cedar Crest

**Neighborhood School**
- S1 Building 21 High School in Allentown
- S2 Paxinosa Elementary School

**Small Town Main Streets**
- M1 Downtown Emmaus
- M2 Downtown Hellertown
- M3 Downtown Northampton
- M4 Downtown Catasauqua
- M5 Downtown Nazareth
- M6 Downtown Bangor

**Trail Connections**
- R1 D&L Trail Crossing
- R2 Proposed Ped Bridge – Bethlehem
- R3 Larry Holmes Drive Karl Stirner Arts Trail / Bushkill Connection
- R4 Easton Cemeteries
- R5 Easton Central Street
- R6 West Center Street
- R7 Broadway
- R8 Proposed Ped Bridge - Easton

**Priority Pedestrian Areas**
- City Downtown
- City Neighborhood
- Small Town Main St
- School
- Neighborhood
- Major Transit Stop/Corridor
- Sidewalk
- Municipal Boundaries
## Connected, Accessible and Comfortable Sidewalks

Sidewalks are essential transportation infrastructure. They provide safe spaces for walking and rolling, access to jobs, shopping and essential services, and room for children to play and adults to socialize.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>City Downtown</th>
<th>City Neighborhood</th>
<th>Neighborhood School</th>
<th>Small Town Main Street</th>
<th>Trail Connection</th>
<th>Transit Stop/Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connected Sidewalk Networks—Construct sidewalks on both sides of the street and address existing sidewalk gaps. Prioritize locations with high existing or potential pedestrian activity or known pedestrian safety issues. See Appendix A: Design Toolkit for additional guidance on sidewalk design.</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
</tr>
<tr>
<td>Sidewalk repair and maintenance—Prioritize sidewalk repair and maintenance, including fixing sidewalk heaves and cracks, vegetation management and snow removal, to ensure pedestrian facilities are accessible and safe.</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
</tr>
<tr>
<td>Streetscape Amenities—Provide streetscape amenities such as benches, bus shelters, waste containers and planters to create a more pleasant and comfortable walking experience.</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
<td>🌟🌟🌟🌟🌟</td>
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<td>🌟🌟🌟🌟🌟</td>
</tr>
<tr>
<td>Pedestrian-Scale Lighting—Provide continuous pedestrian-scale lighting to enhance personal security, improve pedestrian safety and reduce pedestrian trip and fall injuries at night.</td>
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<td>🌟🌟🌟🌟🌟</td>
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</tr>
<tr>
<td>Tree Canopy—Preserve or plant full-size street trees to provide shade in summer months, shelter from precipitation, better visual enclosure and a buffer between the sidewalk and motor vehicle traffic.</td>
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<td>🌟🌟🌟🌟🌟</td>
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<td>🌟🌟🌟🌟🌟</td>
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</tr>
</tbody>
</table>

- Often Applicable
- Sometimes Applicable
Figure 4.3: Sidewalk with full tree canopy on a small town main street.

Figure 4.4: Sidewalk maintenance is essential to provide access for all people who walk and roll.

Figure 4.5: This sidewalk provides plenty of space for people to walk and roll, ample access to retail amenities, street furniture, lighting, and a landscape and parking buffer from vehicular traffic.
**Safe and Frequent Crossings**

The need for pedestrians to cross streets with oncoming motor vehicle traffic creates exposure to safety risk. As a result, the design and location of pedestrian crossings is extremely important. It is often necessary to apply multiple strategies to improve safety outcomes. See the Crosswalk Improvement Selection Matrix in Appendix A.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>City Downtown</th>
<th>City Neighborhood</th>
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<th>Trail Connection</th>
<th>Transit Stop/Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marked Crosswalks—Install marked crosswalks at intersections and mark all crosswalk legs across each approach. Use high-visibility crosswalk markings near schools and other locations where higher pedestrian volumes are expected or where visibility is a concern.</td>
<td>●</td>
<td>●</td>
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</tr>
<tr>
<td>Curb Ramps—Install ADA-compliant curb ramps where they are missing and upgrade existing curb ramps to meet current ADA guidelines. If space allows, two curb ramps should be provided on each intersection corner and should generally be aligned with the crosswalk they serve.</td>
<td>●</td>
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<td>●</td>
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</tr>
<tr>
<td>Daylighting—Limit parking or other visual obstructions close to intersections to ensure drivers and pedestrians can see each other.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Curb Extensions—Implement curb extensions to reduce pedestrian crossing distance, improve pedestrian visibility at crossings and slow motor vehicle traffic. Use reclaimed roadway space for green infrastructure or bicycle/scooter parking.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<td>●</td>
</tr>
<tr>
<td>Pedestrian Crossing Islands—Install pedestrian crossing islands to shorten crossing distance, slow motor vehicle traffic and enable pedestrians to focus on one direction of motor vehicle traffic at a time. Pedestrian crossing islands are particularly important at uncontrolled locations with more than one motor vehicle lane in each direction.</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tr>
<tr>
<td>Signalization—Investigate adding signals at intersections with pedestrian safety concerns, such as those with high-motor vehicle speeds or volumes. Add pedestrian signal heads and accessible pedestrian signals where missing.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Signal Timing—Optimize signalization for pedestrian access and safety by increasing pedestrian crossing times, decreasing pedestrian waiting times, separating pedestrian and vehicular movements and/or providing automatically activated pedestrian signals.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Rectangular Rapid Flashing Beacons (RRFBs)—Provide RRFBs at uncontrolled marked crosswalks to increase yielding. RRFBs are not recommended on streets with speed limits above 35 mph.</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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</tr>
</tbody>
</table>

Figure 4.6: A curb extension provides a safer crossing.

Figure 4.7: A rectangular rapid flashing beacon alerts drivers to the presence of crossing pedestrians and encourages yielding.

Figure 4.8: Example of a pedestrian crossing island used to support a mid-block crossing near a school.
# Traffic Calming

Traffic calming is an umbrella term that refers to a range of physical design strategies used for reducing motor vehicle operating speeds and, in some cases, traffic volumes. Both motor vehicle speeds and traffic volumes have a significant impact on pedestrian safety and comfort.

<table>
<thead>
<tr>
<th>Strategy</th>
<th>City Downtown</th>
<th>City Neighborhood</th>
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<th>Trail Connection</th>
<th>Transit Stop/Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Diets¹— Reduce the total number of lanes on multi-lane roads to slow vehicle speeds and reduce pedestrian exposure to traffic.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
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</tr>
<tr>
<td>Low Speed Zones—Establish low speed zones with speed limits of 15 or 20 mph and special signage to reduce the frequency and severity of crashes.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Gateway Treatments²—Use large signage, landscaping, curb extensions or roundabouts to indicate the beginning of a residential or commercial district with higher pedestrian volumes.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Tight Turn Radii—Set a tight curb radius at intersections to reduce turning speeds.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
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<td>● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Reduce lane widths—A 10’ maximum lane width is recommended, 11’ on roads with public transit/frequent heavy trucks. This reduces motor vehicle speeds to increase pedestrian safety.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
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</tr>
<tr>
<td>Slow Flow and Yield Flow Streets—Create slow flow streets by narrowing travel lanes to 8’. Create yield flow streets by providing a single bi-directional travel lane that is 12’ wide.</td>
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</tr>
<tr>
<td>Neighborhood Traffic Circles—Install neighborhood traffic circles to discourage high-speed through traffic.</td>
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<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
<td>● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Traffic Diversions—Traffic diversions close a street to through traffic by motor vehicles but allow bicyclists and pedestrians to pass. These require motor vehicles to use preferred through routes.</td>
<td>● ● ● ● ●</td>
<td>● ● ● ●</td>
<td>● ● ● ● ● ●</td>
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<td>● ● ● ● ● ● ● ● ●</td>
</tr>
<tr>
<td>Vertical Deflection—Install speed humps, raised crosswalks or raised intersections to slow drivers as they travel along low-speed roads or approach crosswalks or intersections.</td>
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</tr>
</tbody>
</table>

Often Applicable  Sometimes Applicable

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Figure 4.9: A neighborhood traffic circle reduces motor vehicle through speeds.

Figure 4.10: A traffic diversion requires through motor vehicles to use preferred routes and avoid residential streets.

Figure 4.11: This four-to-three lane road lane configuration change created space for bicycle lanes and calmed traffic.
Pedestrian-Supportive Parking Policies and Management

Parking impacts people walking and rolling in multiple ways. On-street parking is generally beneficial to pedestrians, because it provides a physical buffer from motor vehicle traffic. Off-street parking can undermine the pedestrian experience by increasing distances between destinations and introducing potential conflicts at driveways. In addition, the availability and price of parking can influence mode choice and driving behavior. For example, if parking is free or relatively inexpensive, people are more likely to choose driving over more sustainable transportation options. Also, drivers will often cruise to find free or available parking, which can increase traffic.

<table>
<thead>
<tr>
<th>Strategy</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Off-Street Parking Minimums—Minimize off-street parking minimums, which require the provision of off-street parking spaces as a condition for new development. Use parking studies to determine actual parking needs to prevent oversupply, and potentially free up space for additional development, parks or public plazas.</td>
<td>5</td>
<td>6</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>On-Street Parking—Balance provision of on-street parking with other potential uses of roadway space, such as dedicated public transit or bike lanes, wide sidewalks and green infrastructure, which can calm traffic and make walking more pleasant.</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Parking Price—Raise parking rates as needed to encourage use of active transportation and public transit and discourage cruising. In the High Cost of Free Parking, Donald Shoup recommended pricing parking to achieve an 85 percent space occupancy rate.</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Parking Benefit Districts—Establish parking benefit districts, where revenue collected from parking fees is reinvested in the area where it is collected. Use revenue to pay for sidewalk and streetscape improvements.</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Often Applicable</th>
<th>Sometimes Applicable</th>
<th>Rarely Applicable</th>
</tr>
</thead>
</table>

5 If additional parking is needed, build a municipal parking structure, located several blocks away from key destinations to promote patronizing smaller businesses between the lot and the destination.

6 Zoning codes for school campuses often have high parking minimums that can encourage driving at the expense of other modes. In addition, meeting off-street parking minimums requires space that could be used of other purposes (e.g., playgrounds and ballfields) and can undermine pedestrian safety and access.
Figure 4.12: A parking space converted to a parklet provides space for people to sit.

Figure 4.13: Metered parking spaces encourage parking turnover in retail areas.
Pedestrian-Supportive Roadway Operations

Roadway operations include how space within the roadway right-of-way is allocated (e.g., one-way or two-way travel) and signs and signals that affect the movement of roadway users. Pedestrian-supportive roadway operations improve safety for crossing pedestrians, discourage unsafe driver behaviors and ensure a more orderly pedestrian environment.

<table>
<thead>
<tr>
<th>Strategy</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Loading Zones—Provide loading and unloading zones for taxis, transportation network companies (e.g., Uber and Lyft), buses and/or delivery vehicles to prevent double parking or blocked crosswalks.</td>
<td>⬤ ✧ 7</td>
<td>☘️</td>
<td>☯️</td>
<td>☯️</td>
<td>8</td>
<td>☯️</td>
</tr>
<tr>
<td>Two-Way Conversions—Consider converting multi-lane, one-way streets to two-way to improve traffic safety, increase personal security, boost economic development and reduce vehicle miles traveled.</td>
<td>☯️ ☯️ ☯️ ☯️</td>
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</tr>
<tr>
<td>Leading Pedestrian Intervals—Implement Leading Pedestrian Intervals (LPIs) to enable pedestrians to establish themselves in the crosswalk before motor vehicles start turning. LPIs can be particularly effective when paired with No Turn on Red restrictions.</td>
<td>☯️ ☯️ ☯️ ☯️</td>
<td>☯️</td>
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<td>☯️</td>
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</tr>
<tr>
<td>No Turn on Red—Implement No Turn on Red restrictions to reduce conflicts between crossing pedestrians and right-turning vehicles. Consider adopting a broader No Turn on Red policy in dense commercial or residential areas and near neighborhood schools to increase driver compliance.</td>
<td>☯️ ☯️ ☯️ ☯️</td>
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<td>☯️</td>
</tr>
<tr>
<td>Speed Cameras—Install speed cameras in commercial and school areas to reduce speeding behavior and enhance pedestrian safety.</td>
<td>☯️ ☯️ ☯️ ☯️</td>
<td>☯️</td>
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</tr>
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</table>

Often Applicable  ♦ Sometimes Applicable

7 Zoning codes for school campuses often have high parking minimums that can encourage driving at the expense of other modes. In addition, meeting off-street parking minimums requires space that could be used for other purposes (e.g., playgrounds and ballfields) and can undermine pedestrian safety and access.


9 Note that the Pennsylvania Code currently authorizes use of speed cameras in only one location—Roosevelt Boulevard in Philadelphia—however, it is possible the law will be expanded if the Roosevelt Boulevard example test case pilot is successful.
Figure 4.14: Leading pedestrian intervals can reduce pedestrian crashes and injuries at crossings.

Figure 4.15: No Turn on Red restrictions can also improve pedestrian safety.
Pedestrian-Supportive Land Use Regulation and Development Review

The land use regulation and development review processes strongly influence the shape of the built environment and how pedestrian-friendly it is. Land use regulation determines whether different land uses are segregated or mixed, how buildings relate to the street and each other, and whether transportation facilities such as sidewalks are required as well as their specific dimensions. Through the development review process, local governments can review the design details of proposed new development, including elements that impact pedestrian access, safety and comfort, such as on-site pedestrian circulation routes and driveway curb cut locations. The development review process can also be used to require developers to provide off-site transportation improvements that mitigate anticipated negative impacts, under specific circumstances allowed by law.

<table>
<thead>
<tr>
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<th>Trail Connection</th>
<th>Transit Stop/Corridor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pedestrian-Compatible Building Design—Require street-level windows and frequent doors to provide eyes on the street and activate the areas where pedestrians may be present. Avoid large blank walls.</td>
<td>⬤</td>
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</tr>
<tr>
<td>Form Based Code—Implement a form-based land use code. Form based codes establish design parameters that harmoniously integrate a mix of land uses and support multimodal access.</td>
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</tr>
<tr>
<td>Mixed Use Zoning—Establish mixed-use zones that enable residents to accomplish many daily needs through a short walking or rolling trip.</td>
<td>⬤</td>
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<td>⬤</td>
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</tr>
<tr>
<td>Building Setback—Set a small maximum setback for new construction and place surface parking lots in back, reducing walking and rolling distances and parking lot vehicle-pedestrian conflicts. Ensure enough width is preserved for sidewalks, buffers, streetscape amenities and other pedestrian-supportive infrastructure when determining the minimum setback.</td>
<td>⬤</td>
<td>⬤</td>
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</tr>
<tr>
<td>Sidewalk Requirements—Require sidewalk repairs or completion of gaps as part of development review and property sales. For new development expected to generate high pedestrian traffic, wide sidewalks should be required, and safety and accessibility improvements at crossings should be considered. Consider requiring sidewalks granted prior deferrals through the land development process to be built for closing important sidewalk gaps.</td>
<td>⬤</td>
<td>⬤</td>
<td>⬤</td>
<td>☐</td>
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</tr>
<tr>
<td>Mixed-Income Housing—Support or require affordable housing in mixed-use, transit-oriented neighborhoods to enable people with lower incomes to access jobs, groceries and other needs.</td>
<td>⬤</td>
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</table>
H. Specific to the mixed-use building type – A mixed-use building is a multiple-story building that allows for a vertical mixing of uses. They are permitted in the 4b General Urban Open, 5a Downtown, and 5b Montgomery Avenue districts.

Figure 4.16: Example of pedestrian-supportive mixed-use development.

Figure 4.17: Pages from Narbeth Borough Form Based Zoning Code developed by the Montgomery County Planning Commission.
CHAPTER 5

Bicycle Network Recommendations
Bicycle Network Recommendations

A high-performance bicycle network is safe, comfortable and connected. It provides a way for people of all ages, abilities, and skill levels to seamlessly and efficiently accomplish their daily travel needs by bicycle without fear of traffic or personal security risks. It is also well-maintained and easy for people to understand and navigate. Walk/Roll LV presents the region’s planned bicycle network, which is comprised of:

A) The Priority Bicycle Network includes ten Bicycle Commuting Corridors and five Catalytic Projects. Bicycle Commuting Corridors have the potential to facilitate bicycling to work or bicycling to public transit as a part of a work trip. Catalytic Projects have significant potential to spark interest and use of active transportation in the Lehigh Valley—not just for work trips but also for errands and social and recreational trips. Bicycle Commuting Corridors and Catalytic Projects should be prioritized for implementation. recognizing that some may take longer to develop due to their complexity and the need for supporting land use changes. In addition, although the recommendations developed for the Priority Bicycle Network are based on a careful field assessment, municipalities will need to review and refine them based on public input, constraints, coordination with adjacent jurisdictions, and other considerations.

A map showing the Priority Bicycle Network, including the Bicycle Commuting Corridors and Catalytic Projects selected for field assessment, is provided on page 76. Bicycle Commuting Corridor recommendations begin on page 79. Catalytic Project recommendations begin on page 101. The Catalytic Project pages also include guidance on funding and implementation.
B) The Visionary Bicycle Network:
the long-term network of trails and on-road facilities that is envisioned for the region. The Visionary Bicycle Network is presented on page 124. It includes the Priority Bicycle Network, Existing and Previously Proposed Regional Trails, and Visionary Connections. Visionary Connections were not evaluated in the field as part of the Walk/Roll LV process and should be prioritized for further study to confirm alignments and identify appropriate bicycle facility recommendations. Additional guidance on bicycle facility selection and design is provided in Appendix A.

In total, the Priority and Visionary Bicycle Network includes 157.7 miles of bikeways that would serve 57% of jobs and 49% of houses in the region (within ½ mile). Together, they present both a priority action plan and a long-term vision that will result in improved safety, access and mobility choices for Lehigh Valley residents into the future.
**Bicycle Commuting Corridors**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
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</thead>
<tbody>
<tr>
<td>1</td>
<td>Hamilton Boulevard (Mosser Road to Kressler Road)</td>
</tr>
<tr>
<td>2</td>
<td>Mack Boulevard/Emmaus Avenue (Hamilton Street to Chestnut Street)</td>
</tr>
<tr>
<td>3</td>
<td>Hamilton Street (Ott Street to Sixth Street)</td>
</tr>
<tr>
<td>4</td>
<td>Liberty Street (Cedar Crest Boulevard to 4th Street)</td>
</tr>
<tr>
<td>5</td>
<td>Hamilton Street/Hanover Avenue (Sixth Street to Eaton Avenue)</td>
</tr>
<tr>
<td>6</td>
<td>New Street (Washington Avenue to New Street)</td>
</tr>
<tr>
<td>7</td>
<td>Easton Avenue (Linden Street to Emrick Boulevard)</td>
</tr>
<tr>
<td>8</td>
<td>Northampton Street (Greenwood Avenue to Larry Holmes Drive)</td>
</tr>
<tr>
<td>9</td>
<td>12th Street/13th Street (From Butler Street to Karl Stirner Arts Trail)</td>
</tr>
<tr>
<td>10</td>
<td>Route 512 (Buss Street to Main Street)</td>
</tr>
</tbody>
</table>

**Catalytic Projects**

<table>
<thead>
<tr>
<th>ID</th>
<th>Name</th>
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**Priority Bicycle Network Project Recommendations**

- **Priority Bicycle Network**
  - Catalytic Projects
  - Bicycle Commuting Corridors

- **Existing Trails**
  - Open
  - Proposed

- **Municipal Boundaries**

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**Figure 5.1**

- Map showing bicycle commuting corridors and catalytic projects.
Bicycle Commuting Corridors

A Bicycle Commuting Corridor is a corridor that has the potential to facilitate bicycling to work or bicycling to public transit as a part of a work trip. A preliminary list of 66 candidate Bicycle Commuting Corridors was developed as part of the Walk/Roll LV planning process. The corridors were selected based on their potential to connect people to jobs, their ability to overcome existing barriers to bicycling to work if improved, and existing bicycling patterns and topography (i.e., hills). The selected corridors were prioritized based on five factors: 1) potential demand for commuting, 2) safety and accessibility, 3) convenience and connectivity, 4) seamless multimodal integration, and 5) equity. The results informed selection of ten Bicycle Commuting Corridors for field assessment—five in Lehigh County and five in Northampton County.
Hamilton Boulevard (Mosser Road to Kressler Road)

Corridor Characteristics
- **Length:** 3.8 miles
- **Speed Limit:** 35–45 mph
- **Curb-to-Curb Width:** Varies
- **A ADT:** Ranges from 12,000 to 19,000
- **Land Use:** Suburban Corridor

Benefits
- Connects key employment centers in Upper Macungie and Lower Macungie Townships.
- Enhances recently installed bike lanes and connects with shared-use paths that extend into the surrounding neighborhoods.
- Builds connection between Valley Preferred Cycling Center, Bob Rodale Cycling and Fitness Park, and the surrounding communities.
- Provides access to retail and services along the corridor.

Considerations
- The posted speed limit for much of the corridor is 40 or 45 mph. Travel speeds above 30 mph negatively impact the safety and comfort of potential bicyclists in adjacent bike lanes.
- Channelized right-turn lanes encourage higher traffic speeds at conflict points between motorists and cyclists.
- By providing both on-road bike lanes and parallel shared-use paths, the recommended facilities can accommodate both confident cyclists who prefer to ride in the roadway and potential cyclists with a lower stress tolerance. The shared-use paths are intended to connect to the growing network of pathways in Lower Macungie Township.
- The railroad underpass east of Trexlertown Road requires special consideration. The cartway width narrows to less than 25 feet. Improved lighting, shared lane markings, and warning signs should be installed. Alternatively, a traffic study may be conducted to evaluate the impact of converting the underpass to a single-lane underpass with all-way stop control to create space for wide shoulders.
- Additional future planning is needed to provide bicycle connectivity between Wescosville and Allentown. Based on the traffic speeds and volumes along Route 222, a dedicated shared use path would likely be needed to attract "interested but concerned" cyclists.

Recommendations

General
1.1 Calm Traffic Speeds – East of Continental Way, implement design changes along Hamilton Boulevard to target a consistent operating speed of 30 mph. Design changes should include reduced lane widths, the elimination of channelized right-turn lanes, landscaped medians, and additional street trees. The posted speed limit should be reduced to 30 mph in conjunction with the design changes.
1.2 Roundabouts – Replace signalized intersections with modern single-lane roundabouts. Roundabouts safely and efficiently move traffic through an intersection at lower speeds than a signalized intersection. When a roundabout replaces a traffic signal it often eliminates the need for designated turn lanes at the intersection.
1.3 Upgrade Bike Lanes – Restripe the existing bike lanes where necessary to provide a minimum five-foot wide bike lane with a two-foot wide buffer from Continental Way to Kressler Road.
1.4 Eliminate Bike Lane Gaps – There are gaps in the existing bike lanes in locations where the width is constrained and at intersections with right-turn lanes. The gaps should be eliminated by narrowing the width of existing travel lanes and eliminating turning lanes.
1.5 Shared Use Path – Provide shared-use paths along the roadway in place of sidewalks. There are existing shared-use paths on the north side of Hamilton Boulevard near Krocks Road and Mill Creek Road.
1.6 Cetronia Road Alternative – If improvements at the railroad underpass are not feasible, an alternative bicycling route should be considered along Cetronia Road between Trexlertown Road and Mill Creek Road. The existing sidepath along the west side of Mill Creek Road and the south side of Cetronia Road could be extended west to Trexlertown Road. Upper Macungie Township may also wish to consider future extensions to the west of Trexlertown Road to connect with the Bob Rodale Cycling and Fitness Park, Fred Jaindl Elementary School, and other destinations.
Recommendations Overview

Figure 5.2: Graphic from 2015 Hamilton Boulevard Corridor Study showing roundabout at existing Air Products driveway (Map A). It is recommended that signalized intersections along this corridor be replaced by modern single-lane roundabouts like this.

Figure 5.3: The existing cross-section on Hamilton Boulevard west of Lower Macungie Road includes conventional bike lanes. It is recommended that these bike lanes be upgraded to include a minimum five-foot wide bike lane and a two-foot buffer (Map B).

Figure 5.4: A cyclist travels in the westbound direction in the right-turn deceleration lane approaching Mill Creek Road. There is an eastbound bike lane at this location but the westbound bike lane ends approximately 400 feet in advance of the intersection (Map C). To address gaps like this, it is recommended that space for a bike lane be created by narrowing the width of the existing travel lanes and eliminating turn lanes.

Figure 5.5: The existing bike lane east of Continental Way (Map D) is adjacent a wide travel lane with a posted speed limit of 45 mph. It is recommended that design changes be implemented along this segment to produce a consistent operating speed of 30 mph. Potential design changes include reducing the width of the travel lanes.
BICYCLE COMMUTING CORRIDOR (2)

Mack Boulevard/ Emaus Avenue (Hamilton Street to Chestnut Street)

Corridor Characteristics
- **Length**: 5.1 miles
- **Speed Limit**: 25–40 mph
- **Curb-to-Curb Width**: Varies
- **AADT**: Ranges from 7,000 to 17,000
- **Land Use**: Urban Neighborhood/Suburban Corridor

Benefits
- Connects several major employment centers with dense residential neighborhoods.
- Downtown Allentown and Downtown Emmaus provide major destinations at either end of the corridor.
- Builds upon recently implemented road diet with bike lanes on Mack Boulevard.

Considerations
- Between Lee Street and State Avenue, Emaus Avenue/E. Main Street is approximately 30 feet wide. A 5-foot wide bike lane can be provided between a 10-foot wide travel lane and the existing guiderail. This section has an ADT of more than 10,000 vehicles per day, so the level of traffic stress may discourage less confident users.
- To provide bike lanes on Main Street in Emmaus, on-street parking would need to be restricted for two blocks north of Keystone Avenue. Additionally, several on-street parking spaces would be lost on E. Main Street immediately north of State Avenue.
- To avoid the loss of parking, an alternative trail routing may be considered between Alpine Street and Klines Lane. There is an existing trail that connects the Wildlands Conservancy South Mountain Preserve to Klines Lane.

Recommendations

**Location-Specific**

**2.1 Downtown Bike Lanes** – Provide separated bike lanes on Eighth Street and Ninth Street to connect the Eighth Street Bridge to Hamilton Street. On Jackson Street, provide an eastbound protected bike lane between Eighth Street and Hamilton Street by eliminating the second westbound lane. (Map A)

**2.2 Eighth Street Bridge** – Provide separated bike lanes in each direction on the Eighth Street (Albertus L. Meyers) Bridge (Map B). This may be accomplished by eliminating the second northbound lane on Eighth Street between St. John Street and Jackson Street. The preferred configuration would be to significantly widen the sidewalks and provide sidewalk level separated bike lanes.

**2.3 Connect Bridge to Mack Boulevard** – Provide shared lane markings on S. Eighth Street between St. John Street and the railroad underpass (Map C). Traffic calming measures should also be considered.

**2.4 Railroad Underpass** – Install improved lighting and bicycle warning signs at the railroad underpass. (Map D)

**2.5 Mack Boulevard** – Mack Boulevard was restriped a few years ago to include buffered bike lanes on each side of the street north of Fountain Street (Map E). However, the bike lane width is less than five feet at some locations. Mack Boulevard should be restriped to provide a five foot wide bike lane on each side of the street with a three foot wide buffer. The buffered bike lanes on Mack Boulevard should be extended south between Fountain Street and Emaus Avenue.

**2.6 Intersection of Mack Boulevard & Emaus Avenue** – Reconfigure the intersection (Map F) to eliminate channelized rights and provide a clear path for turning bicyclists. A single lane roundabout should be considered.

**2.7 Emaus Avenue Lane Reduction** – Emaus Avenue is primarily a two-lane road, but the section between Mack Boulevard and 27th Street SW (Map G) has additional travel lanes in one or both directions. This section may be restriped to provide buffered bike lanes in each direction, with supplemental turn lanes provided at signalized intersections as needed.

**2.8 Emaus Avenue Bike Lanes** – Continue the bike lanes south on Emaus Avenue/Main Street (Map H). Provide buffered bike lanes north of Lee Street. South of Lee Street, Main Street narrows to a typical width of 30 feet with no shoulders. A minimum bike lane width of five feet should be maintained.

**2.9 Intersection of State Avenue/Ridge Street** – Reconfigure the intersection of State Avenue/Ridge Street (Map I) to provide a clear path for turning bicyclists and reduce conflicts between bicyclists and turning traffic. The roadway width narrows to less than 25 feet under the railroad underpass. The existing sidewalks may be widened to provide a shared use path on each side of the road through the underpass. Improved lighting should be installed.

**2.10 Emmaus Bike Lanes** – Install bike lanes on Main Street in Emmaus between Ridge Street and Chestnut Street (Map J). This would require the elimination of on-street parking north of Keystone Avenue.

**2.11 Southern Alternative** – To avoid the loss of parking, an alternative routing may be considered south of Route 78. There is an existing trail between Alpine Street and Klines Lane that connects several parks. The bicycle routing could be extended along Fernor Street/ Glenwood Street north of Alpine Street and along Minor Street/Second Street in Emmaus (Map K).
Recommendations Overview

Figure 5.6: The Albertus L. Meyers Bridge (Map B) currently has two northbound lanes and one southbound lane. It is recommended that the bridge be reconfigured to significantly widen the sidewalks and provide sidewalk level separated bike lanes.

Figure 5.7: The railroad underpass on S. Eighth Street/Emaus Avenue (Map D) operates as an all-way stop. It is recommended that improved lighting and bicycle warning signs be installed at this location.

Figure 5.8: A recently implemented roadway diet on Mack Boulevard (Map E) included new bike lanes. It is recommended that Mack Boulevard be restriped to provide a five foot wide bike lane on each side of the street with a three foot wide buffer.

Figure 5.9: Emaus Avenue is primarily a two-lane road, but the section between Mack Boulevard and 27th Street SW (Map G) has additional travel lanes in one or both directions. It is recommended that this section be restriped to provide buffered bike lanes in each direction.
Corridor Characteristics

- **Length:** 2.4 miles
- **Speed Limit:** 25–40 mph
- **Curb-to-Curb Width:** 50 feet west of 10th Street; 42 feet east of 10th Street.
- **AADT:** Ranges from 7,000 to 18,000
- **Land Use:** Town Center/Urban Core
- **Travel Direction:** Two-way west of 10th Street; one-way eastbound east of 10th Street.

Benefits

- Provides a direct bicycling connection to one of the densest employment centers in the Lehigh Valley.
- Converting a four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a two-way center left-turn lane is a proven low cost safety solution that benefits all road users.
- Enhances pedestrian connectivity between Cedar Beach Park and the neighborhoods to the south by upgrading the crosswalk where the trail crosses Hamilton Street.

Considerations

- Downtown Allentown is an excellent candidate for sidewalk level separated bike lanes due to the wide sidewalks and high density of destinations. All significant intersections are signalized, with leading pedestrian intervals and fewer conflicts with turning vehicles than a similar two-way street.
- Since a westbound bike lane will be installed on a one-way eastbound street in downtown, the intersection design should maximize the visibility of westbound cyclists. Although motorists are accustomed to looking for pedestrians, bicyclists travel at faster speeds. There are no conflicts between turning vehicles and westbound bicycle traffic at 7th Street or 9th Street.

- The improvements will require significant changes to the existing streetscape. While this presents opportunities for improvements, it also may require the relocation or replacement of existing street trees and other features. Street trees are vital to the comfort of bicyclists and pedestrians.
- If the City determines that it is not feasible to provide separated bike lanes on Hamilton Street, then an alternative would be to provide low-stress bicycle accommodations on Linden Street and/or Turner Street. Each of these streets has high ridership potential due to the number of people who live and work along these corridors.

Recommendations

**Location-Specific**

3.1 Restripe Four Lane Section – From Ott Street to Lafayette Street *(Map A)*, restripe Hamilton Boulevard to provide one travel lane in each direction with a two-way center left-turn lane. Provide a one-way separated bike lane on each side of the street.

3.2 Enhanced Trail Crossing – Upgrade the existing crosswalk at the intersection of Hamilton Boulevard & Yocco Drive *(Map B)* to include a median refuge island and bike crossing markings. Replace the existing flashing beacon with a rectangular rapid flashing beacon.

3.3 Parking Separated Bike Lanes – From Lafayette Street to 10th Street *(Map C)*, restripe Hamilton Street to provide one travel lane in each direction, with a buffered bike lane and on-street parking on each side. The bike lanes may be upgraded to parking-separated bike lanes when legislative changes clarify the status of parking-separated bike lanes in Pennsylvania. Left-turn lanes may be provided at the intersections with 17th Street and 15th Street.

3.4 Sidewalk Level Separated Bike Lanes – From 10th Street to 6th Street *(Map D)*, provide sidewalk level separated bike lanes on each side of the street. The bike lanes should be five feet wide with a two-foot buffer on either side.
**Recommendations Overview**

**Figure 5.10:** Restriping this four lane section of Hamilton Street (Map A) with one lane in each direction and a center-left turn lane would reduce speeding, improve access to Cedar Beach Park, and create space for bike lanes on each side of the street.

**Figure 5.11:** In Center City Allentown (Map D) expanding the sidewalks as part of a larger streetscape upgrade would create space for sidewalk level separated bike lanes on each side of the street.
Corridor Characteristics

- **Length**: 3.3 miles
- **Speed Limit**: 25 mph
- **Curb-to-Curb Width**: 22–28 feet
- **AADT**: Varies
- **Land Use**: Town/Village Neighborhood

Benefits

- There is high ridership potential, as Liberty Street provides a direct, flat connection through some of the densest and most job-rich neighborhoods in the Lehigh Valley.
- By minimizing traffic speeds and volumes, bicyclists of all ages and abilities can enjoy a low-stress riding experience. Unlike a narrow bike lane, a neighborhood greenway allows families and friends to ride side-by-side.
- Calmer traffic speeds benefit everyone who lives, walks, and parks on Liberty Street.

Considerations

- To provide a comfortable bike ride for people of all ages and abilities, vehicular speeds should be under 20 mph and the average daily traffic should be less than 2,000 vehicles per day.
- During final design targeted traffic counts and speed studies should be conducted to confirm where traffic calming is needed to meet targets.
- Liberty Street and the surrounding neighborhoods are home to many businesses. Low-speed automobile access should be maintained for all destinations.
- Coordination is needed with first responders to determine if any locations on the corridor overlap with key emergency response routes. If necessary speed humps may be designed with wheel cutouts that permit large vehicles to pass unaffected.

Recommendations

### General

#### 4.1 Neighborhood Greenway

Liberty Street should be converted into a neighborhood greenway, also known as a bicycle boulevard, where people walking and biking are prioritized over motorized traffic. Neighborhood greenways feature low traffic speeds, reduced cut-through traffic, and streetscape improvements. Utilize custom street signs, directional signs, and pavement markings to establish and enhance the neighborhood greenway branding.

#### 4.2 Streetscape Improvements

Install streetscape improvements such as street trees, improved street lighting, and enhanced curbside plantings. Residential blocks that lack street trees and high visibility locations such as the area between 19th Street and 16th Street should be prioritized for streetscape improvements.

#### 4.3 Traffic Calming

The posted speed limit should be reduced to 15 mph. Speed reduction measures such as speed humps or neckdowns should be installed approximately every 300 to 400 feet to maintain a low-speed environment.

#### 4.4 Median Island Traffic Diverters

At the intersection of Liberty Street & Ott Street, install median islands to divert cut-through traffic so the only permitted turning movements are right-turns to and from Liberty Street. Median islands/diverters should also be considered at the intersection of Liberty Street & 15th Street.

#### 4.5 Mini Traffic Circles

Speed reduction measures such as mini traffic circles may be installed in residential areas where low speeds are desired on both streets, such as the intersection of Liberty Street & 13th Street. [Map C](#)

#### 4.6 Signalized Intersections

Curb bump-outs and high-visibility crosswalks should be installed at all signalized intersections. Right-turns on red should be prohibited, and leading pedestrian intervals should be utilized.

### Location-Specific

#### 4.7 All-Way Stop Control

The intersections of Liberty Street with 5th Street and 4th Street should be converted to all-way stop control with high-visibility crosswalks.
Recommendations Overview

Figure 5.12: At the intersection of Liberty Street & Ott Street (Map A), install median islands to divert cut-through traffic so the only permitted turning movements are right-turns to and from Liberty Street. (Graphic from Federal Highway Administration publication Small Town and Rural Multimodal Networks).

Figure 5.13: Some sections of Liberty Street, such as this block near 22nd Street (Map B), already have relatively low traffic speeds and volumes. Design changes that reduce speeding and discourage cut-through traffic can provide a low-stress cycling experience and improve pedestrian safety.

Figure 5.14: Speed reduction measures should be installed approximately every 300 to 400 feet to maintain a low-speed environment. Speed humps should be considered at midblock locations. This photo example from Portland Oregon is taken from the National Association of City Transportation Officials Urban Bikeway Design Guide.

Figure 5.15: Mini traffic circles may be installed in residential areas where low speeds are desired on both streets, such as the intersection of Liberty Street & 13th Street.
Corridor Characteristics

- **Length:** 3.1 miles
- **Speed Limit:** 25–35 mph
- **Curb-to-Curb Width:** 48 to 56 feet
- **AADT:** Ranges from 12,000 to 24,000
- **Land Use:** Urban Core and Urban Neighborhood

Benefits

- Connects the East Allentown and West Bethlehem neighborhoods to Downtown Allentown.
- Provides a low-stress connection over the Lehigh River, which is a major barrier to bicycling.
- Improves bicycle access for Dieruff High School students.
- The corridor intersects with the D&L Trail, which increases the potential commuting value of both this corridor and the trail.
- Converting a four-lane undivided roadway to a three-lane roadway consisting of two through lanes and a two-way center left-turn lane is a proven low cost safety solution that benefits all road users.
- Hanover Avenue was identified as a high priority for bicycle and pedestrian safety improvements based on the crash history on the corridor.

Considerations

- There are many minor intersections along Hanover Avenue. The design of the separated bike lanes should minimize conflict points and maximize the visibility of bicyclists in accordance with best practices.
- There are several locations along Hanover Avenue where the roadway width is constrained and on-street parking may be lost with the installation of separated bike lanes. On blocks with low left-turn demand and high parking demand it may be desirable to provide a short left-turn lane rather than a full center lane to maximize the number of parking spaces. Eliminating the median island between Jasper Street and Irving Street would also mitigate the parking loss. Another alternative to minimize parking loss would be to provide a two-way separated bike lane on the north side of the street instead of a one-way bike lane on each side of the street.

If the City determines that it is not feasible to provide separated bike lanes on Hamilton Street or Hanover Avenue, then a feasibility study should be expanded to include parallel routes. The Hamilton Street Bridge is a key connection, so the addition of a separated bike lane on the bridge and the approaches should remain a top priority.

Recommendations

Location-Specific

- **5.1 Sidewalk Level Separated Bike Lanes** – From 6th Street to 4th Street *(Map A)*, provide sidewalk level separated bike lanes on each side of the street. This may be accomplished by eliminating one of the eastbound travel lanes.
- **5.2 Separated Bike Lanes** – From 4th Street to Front Street, provide separated bike lanes on each side of the street. This may be accomplished by eliminating one of the eastbound travel lanes.
- **5.3 Hamilton Street Bridge** – On the Hamilton Street Bridge *(Map B)*, replace the narrow sidewalk on the north side of the bridge with a wide shared use path. The preferred minimum width is 14 feet. If a cantilevered sidepath is not feasible then an alternative approach would be to reallocate space by eliminating one westbound travel lane. Conduct traffic and feasibility studies to determine next steps.
- **5.4 Intersection of Hamilton Street & Albert Street** – At the intersection of Hamilton Street & Albert Street the two-way shared use path should transition to separated bike lanes on each side of the street. The intersection also provides a connection to the Albert Street on-road section of the D&L Trail connecting Allentown’s Lehigh Canal Park toward Overlook Park and North Bradford Street.
- **5.5 Separated Bike Lanes** – Between Albert Street and Irving Street *(Map C)* provide separated bike lanes on each side of Hanover Avenue. This may be accomplished by restriping Hanover Avenue to provide one travel lane in each direction with a two-way center left-turn lane. Median islands should be installed at some locations within the center lane to provide traffic calming and pedestrian refuges.
- **5.6 Buffered Bike Lanes** – East of Irving Street *(Map D)* there is an existing three-lane cross section. The existing center left-turn lane should be eliminated to provide a buffered bike lane and on-street parking on each side. The bike lanes may be upgraded to parking-separated bike lanes when legislative changes clarify the status of parking-separated bike lanes in Pennsylvania.
Figure 5.16: Hamilton Street (Map A) has one westbound lane and two eastbound lanes on the west side of the Lehigh River. Eliminating one of the eastbound lanes would create space for separated bike lanes on each side of the street.

Figure 5.17: The Hamilton Street Bridge (Map B) has two travel lanes in each direction. The average daily traffic on the bridge is 17,170 vehicles per day. It is recommended that the narrow sidewalk on the north side of the bridge be replaced with a wide shared use path.

Figure 5.18: Hanover Avenue (Map C) has two travel lanes in each direction. On-street parking is permitted on the south side of the street west of Irving Street. It is recommended that Hanover Avenue be reconfigured between Albert Street and Irving Street to create space for separated bike lanes.

Figure 5.19: On Hanover Avenue east of Jasper Street (Map D), it is recommended that the existing center left-turn lane should be eliminated to provide separated bike lanes in each direction. Between Irving Street and Jasper Street, it may be necessary to relocate parking spaces or eliminate the median island.
New Street (Washington Avenue to South Bethlehem Greenway)

Corridor Characteristics

- **Length**: 1.8 miles
- **Speed Limit**: 25–30 mph
- **Curb-to-Curb Width**: 50 feet
- **AADT**: Varies
- **Land Use**: Urban Neighborhood

Benefits

- Connects Downtown Bethlehem and Southside Arts District with surrounding neighborhoods.
- Creates a low-stress bicycling connection over the Lehigh River.
- Potential traffic calming in residential neighborhood by eliminating unnecessary travel lane.
- Connects to South Bethlehem Greenway.
- Provides access to Bethlehem City Hall and Main Branch of Bethlehem Area Public Library.
- Can be extended to Liberty High School and Moravian College via Laurel Street.

Considerations

- There are two southbound travel lanes on N. New Street. The second travel lane is unnecessary and may encourage aggressive driving in a residential neighborhood.
- There are stairs on the east side of Fahy Bridge leading to Sand Island and the D&L Trail.
- The neighborhoods on either side of the river (Downtown Bethlehem and the Southside Arts District) are both centers of activity where many people live, work, shop, and gather. There is significant potential for short bicycle commuting trips. However, there are no low-stress bicycle routes across the Lehigh River.
- Currently cyclists on the Fahy Bridge share a lane with motor vehicle traffic. The posted speed is 35 mph and the average daily traffic (ADT) is approximately 10,700 vehicles per day. Therefore, the addition of a physically separated bike lane would greatly reduce the level of traffic stress for cyclists, if feasible.
- It is possible to eliminate one southbound lane on the Fahy Bridge without having a significant impact on roadway capacity. Traffic capacity and delay on the bridge is primarily determined by the two signalized intersections at either end of the bridge. Minor intersection modifications would be needed at the intersection on the north side of the bridge, but no significant changes would be needed to the intersection on the south side.
- Approximately ten parking spaces would be eliminated on Second Street and Adams Street. As an alternative a direct bicycling connection can be provided on S. New Street to connect the Fahy Bridge and South Bethlehem Greenway. It may be possible to incorporate this change into the South New Street Streetscape Enhancement Project.

Recommendations

Location-Specific

6.1 Separated Bike Lanes – Provide buffered bike lanes in each direction on N. New Street from Washington Avenue to Church Street (Map A). The bike lanes may be upgraded to parking-separated bike lanes when legislative changes clarify the status of parking-separated bike lanes in Pennsylvania. On New Street west of City Hall, a separated bike lane can be provided by eliminating the second travel lane or redesigning the existing sidewalk as a shared use path.

6.2 Fahy Bridge – Investigate modifications to Fahy Bridge (Map B) or a stand-alone pedestrian and bicycle bridge to provide a low-stress bicycling facility across the Lehigh River.

6.3 Two-Way Separated Bike Lane – Widen Second Street off-ramp (Map C) to accommodate two-way separated bike lane. The two-way separated bike lane would continue on the south side of Second Street beneath the bridge.

6.4 Shared Use Path – Provide a shared use path approaching the intersection of Second Street & Adams Street. (Map D)

6.5 Adams Street/Webster Street – Consider alternative bicycle routing along Adams Street/Webster Street.
Recommendations Overview

Figure 5.20: There are two southbound travel lanes on N. New Street (Map A). The second travel lane is unnecessary and may encourage aggressive driving in a residential neighborhood. Eliminating the second southbound lane would create space for bike lanes on each side of the street.

Figure 5.21: During the Fahy Bridge rehabilitation project Second Street was temporarily narrowed under the bridge. This photo was captured by Google Street View and is dated August 2016. It is recommended that this adjustment be made permanent to create space for a two-way separated bike lane under the bridge (Map C).

Figure 5.22: A shared use path could pass between the trees shown in this photo. (Map D)
**Corridor Characteristics**

- **Length:** 4.9 miles
- **Speed Limit:** 35–45 mph
- **Curb-to-Curb Width:** 32–65 feet west of Butztown Road and 24–40 feet east of Butztown Road.
- **AADT:** Ranges from 8,000 to 21,000
- **Land Use:** Town/Village Neighborhood and Suburban Corridor

**Benefits**

- Connects dense residential neighborhoods in Bethlehem to employment center along Emrick Boulevard.
- Provides bicycle access to Liberty High School.
- Future improvements to Hecktown Road could expand access to Northampton Community College, Bethlehem Area Vocational-Technical School, and Freedom High School.

**Considerations**

- There are many minor intersections and driveways along Easton Avenue. The design of the separated bike lanes should minimize conflict points and maximize the visibility of bicyclists. Where possible, driveways should be consolidated, narrowed or eliminated.
- LANta Route 220 operates along the corridor. Coordination with LANta is needed to ensure the bike lane design is compatible with the needs of transit riders.

**Recommendations**

**General**

7.1 **Signalized Intersections** – Provide ADA compliant pedestrian crossings at all signalized intersections.

7.2 **Future Redevelopment** – All future development along this corridor should orient building toward the street and any parking lots behind the building.

**Location-Specific**

7.3 **Neighborhood Greenway** – Provide a low-speed neighborhood greenway on Maple Street from Church Street to Washington Avenue.

7.4 **Separated Bike Lanes** – From Washington Avenue to Butztown Road (*Map A*), provide separated bike lanes on each side of the street. Parking protected bike lanes are preferred when legislative changes clarify the status of parking-protected bike lanes in Pennsylvania. The posted speed limit should be reduced to 25 mph in conjunction with the design changes.

7.5 **Landscaped Median Islands** – East of Lincoln Street, add landscaped median islands within center turn lane.

7.6 **Intersection of Easton Avenue & Stefko Boulevard** – The intersection (*Map B*) should be redesigned to reduce traffic exposure for bicycles and pedestrians. A modern roundabout should be considered in place of a traffic signal.

7.7 **Eliminate Channelized Right-Turn Lanes** – All channelized right-turn lanes should be eliminated, including those on side streets. Unnecessary right-turn lanes, such as the one at the Giant shopping center (*Map C*) should be eliminated.

7.8 **Future Roadway Widening** – East of Butztown Road (*Map D*) the roadway width is currently not sufficient to accommodate separated bike lanes. Future roadway improvement projects and development projects should account for future extensions of the separated bike lanes. Continue to provide traffic calming and improved pedestrian facilities.

7.9 **Parallel Trails** – There are existing trails that run parallel to Easton Avenue east of Butztown Road (Emerald Hills Greenway (*Map E*) and Bethlehem Township Municipal Park). These trails should be connected to each other and extended southwest to a connection point with Easton Avenue.
Recommendations Overview

Figure 5.23: It is recommended that separated bike lanes be installed on Easton Avenue between Washington Avenue and Butztown Road (Map A). Alternatives should be evaluated where parking would be impacted.

Figure 5.24: It is recommended that channelized right-turn lanes like this one at the Giant shopping center (Map C) be eliminated. Channelized right-turn lanes encourage higher traffic speeds at conflict points between motorists and cyclists.

Figure 5.25: East of Butztown Road (Map D) the roadway width is currently not sufficient to accommodate separated bike lanes. Future roadway improvement projects and development projects should account for future extensions of the separated bike lanes.

Figure 5.26: The existing Emerald Hills Greenway (Map E) trail runs parallel to Easton Avenue. It is recommended this trail be connected to the Bethlehem Township Trail Network connection via Middletown Road.
Northampton Street
(Greenwood Avenue to Larry Holmes Drive)

Corridor Characteristics

- **Length**: 3.1 miles
- **Speed Limit**: 35 mph
- **Curb-to-Curb Width**: 45–50 feet
- **AADT**: Ranges from 6,500 to 8,500
- **Land Use**: Town/Village Center

Benefits

- The route has high ridership potential because it connects densely populated areas in three municipalities.
- Provides access to major employment centers such as Easton Hospital, Northampton County Courthouse, and Downtown Easton.
- Connects with the Two Rivers Area Trailway via the Wilson Bike Path.

Considerations

- Where a sidewalk level separated bike lane is proposed, a five-foot wide bike lane should be provided with a two-foot wide buffer on either side. This would reduce the pedestrian through zone on the sidewalk to less than 10 feet.
- The proposed changes to the traffic circle in Centre Square should be incorporated as part of a comprehensive redesign that considers the needs of all roadway users. The changes should enhance streetscape and pedestrian safety.
- LANta Route 220 operates along the corridor. Coordination with LANta is needed to ensure the bike lane design is compatible with the needs of transit vehicles.
- To provide separated bike lanes on Northampton Street, parking would need to be eliminated on one or both sides of the street between 25th Street and 17th Street. Alternatively, Ferry Street could be converted into a low-speed neighborhood greenway. The bicycle route could shift back to Northampton Street at 17th Street or the neighborhood greenway could be extended further on Ferry Street with the implementation of a two-way conversion.

Recommendations

General

8.1 Protected Intersections – The standard intersection design should reflect best practices for protected intersections as outlined in the National Association of City Transportation Officials publication Don’t Give Up at the Intersection, May 2019. Clear sight distance must be provided at each intersection approach.

Location-Specific

8.2 Separated Bike Lanes – From Greenwood Avenue to 25th Street (Map A), eliminate the center left-turn lane and provide buffered bike lanes on each side of the street. The bike lanes may be upgraded to parking-separated bike lanes when legislative changes clarify the status of parking-protected bike lanes in Pennsylvania.

8.3 Reconfigure Intersections with 25th Street and Wood Avenue – Reconfigure the signalized intersections of Northampton Street with 25th Street (Map B) and Wood Avenue. If the existing signals are maintained then they should be redesigned as a protected intersection and all right-turn lanes should be removed. Alternatively, replace the signals with a compact modern roundabout.

8.4 Enhanced Trail Crossing – Where the Wilson Bike Path crosses Northampton Street, upgrade the crossing with a median refuge island, a raised crossing, and a rectangular rapid flashing beacon.

8.5 Separated Bike Lanes – From 25th Street to 15th Street, provide buffered or separated bike lanes on each side of the street.

8.6 Parking Separated Bike Lanes – From 15th Street to Larry Holmes Drive (Map C), expand the existing sidewalk into the street by narrowing the street to provide sidewalk level separated bike lanes on each side of the street. Street trees should be retained where possible and additional street trees should be added.

8.7 Centre Square – The traffic circle at Centre Square should be reconfigured to replace the outer travel lane with a separated bike lane. The intersection design and signal phasing should minimize the potential for right-hook crashes. It may be preferable to direct bicyclists to cross during the all-pedestrian phase. (Map D)
Recommendations Overview

Figure 5.27: The existing center left-turn lane west of 25th Street (Map A) should be eliminated to provide buffered or separated bike lanes.

Figure 5.28: The intersection of Northampton Street and 25th Street (Map B) has heavy traffic volumes, high traffic speeds, and channelized right turn lanes. It is recommended that this intersection be reconfigured as a protected intersection or compact modern roundabout.

Figure 5.29: Sidewalk level separated bike lanes can be provided from 15th Street to Larry Holmes Drive (Map C) without eliminating parking.
12th Street/13th Street (From Butler Street to Karl Stimer Arts Trail)

Corridor Characteristics
- **Length**: 0.8 miles
- **Speed Limit**: Not posted
- **Curb-to-Curb Width**: 35 feet
- **AADT**: 13th Street has an ADT of 13,000 vehicles per day. The estimated ADT on 12th Street is under 3,000 vehicles per day.
- **Land Use**: Town/Village Neighborhood

Benefits
- Provides a connection between Karl Stirner Arts Trail and the adjacent West Ward neighborhood.
- 13th Street and other parallel streets serve as the primary traffic thoroughfares in the surrounding area. Therefore, bicycles and pedestrians can be prioritized on 12th Street without disrupting the flow of traffic through the neighborhood.
- 12th Street also connects to other important community destinations such as Paxinosa Elementary School, Centennial Park, and Cottingham Stadium.

Considerations
- There is an existing residential driveway on Chidsey Street. If a full street closure is not possible a shared street may be considered.
- If the Karl Stirner Arts Trail is extended west of 13th Street an enhanced crosswalk should be provided.
- The Easton Area School District is considering converting one-block of 12th Street near Cottingham Stadium to one-way traffic. This change would require significant re-routing of bicycle traffic or the use of contraflow bike lanes. Coordination with the School District is needed. Generally speaking, the needs of a school (low traffic speeds and safety for vulnerable pedestrians) are compatible with the goals of the recommended improvements. If the street is reconfigured, a wide shared-use path or contraflow bike lane should be installed.

Recommendations

General

9.1 Neighborhood Greenway – 12th Street should be converted into a neighborhood greenway, also known as a bicycle boulevard, where people walking and biking are prioritized over motorized traffic. Neighborhood greenways feature low traffic speeds, reduced cut-through traffic, and streetscape improvements. Utilize custom street signs, directional signs, and pavement markings to establish and enhance the neighborhood greenway branding.

9.2 Streetscape Improvements – Install streetscape improvements such as street trees, improved street lighting, enhanced curbside plantings, and curb extensions at crossings. Curb extensions calm traffic, increase sight distance for pedestrians, and shorten pedestrian crossing distance.

9.3 Traffic Calming – The posted speed limit should be reduced to 15 mph. Speed reduction measures such as speed humps or neckdowns should be installed approximately every 300 to 400 feet to maintain a low-speed environment. If there are key emergency response routes where the movement of emergency vehicles is a specific concern then appropriate wheel cutouts may be provided to allow unimpeded passage by emergency vehicles.

Location-Specific

9.4 Sidepath on 13th Street – Between Chidsey Street and the Karl Stirner Arts Trail (Map A), reduce the width of 13th Street to 22 feet to provide a wide shared use path on the east side of the roadway in place of the existing sidewalk. Install additional lighting in the 13th Street underpass under Route 22.

9.5 Convert Chidsey Street to Shared Use Path – Prohibit motor vehicle use on Chidsey Street between 13th Street and Cherry Street (Map B). Convert Cherry Street to one-way southbound.

9.6 Intersection of 12th Street & Jackson Street – Install all-way stop control at the intersection of 12th Street & Jackson Street. (Map C)

9.7 Intersection of 12th Street & Wood Avenue – At the intersection of 12th Street & Wood Avenue (Map D), install pedestrian refuge islands and Combination Bike and Ped Crossing signage on Wood Avenue.

9.8 Cottingham Stadium – Retain two-way traffic on 12th Street near Cottingham Stadium and Paxinosa Elementary School (Map E). If a portion of the street must be converted to one-way traffic then a wide shared-use path or contraflow bike lane should be installed.

9.9 Intersection of 12th Street & Lehigh Street – Install all-way stop control at the intersection of 12th Street & Lehigh Street. (Map F)

9.10 Intersection of 12th Street & Butler Street – Install all-way stop control at the intersection of 12th Street & Butler Street. (Map G)
Recommendations Overview

Figure 5.30: Photo of Going Street Neighborhood Greenway from the National Association of City Transportation Officials Urban Bikeway Design Guide. It is recommended that 12th Street be converted into a neighborhood greenway.

Figure 5.31: Currently there is a narrow sidewalk on 13th Street at the Route 22 underpass (Map A). It is recommended that 13th Street be narrowed to provide space for a shared use path on the east side of the roadway and that additional lighting be installed under Route 22.

Figure 5.32: Chidsey Street (Map B) is a narrow, lightly used street. It is recommended that Chidsey Street be converted to a shared use path.

Figure 5.33: 12th Street connects to important community destinations such as Cottingham Stadium and Paxinosa Elementary School (Map E). If a portion of the street must be converted to one-way traffic, it is recommended that a wide shared-use path or contraflow bike lane be installed.
Route 512 (Buss Street to Main Street)

**Corridor Characteristics**
- **Length:** 4.0 miles
- **Speed Limit:** 25–40 mph
- **Curb-to-Curb Width:** Typically 26 feet in Bangor and 30 feet in Pen Argyl.
- **AADT:** 6,000–11,000 vehicles per day
- **Land Use:** Town/village neighborhood with rural sections

**Benefits**
- Improves bicycling connection between two Boroughs that are less than three miles apart but lack connectivity.
- Connects to Plainfield Township Trail, a 6.7 mile trail that connects the Slate Belt to Stockertown.
- Improves bicycling route to Weona Park in Pen Argyl.

**Considerations**
- There is an extended steep uphill section for westbound cyclists traveling through Bangor.
- The roadway characteristics in Washington Township/Plainfield Township between the two Boroughs vary widely, with changing roadway width and inconsistent curbs/shoulders. The posted speed in this section is 40 mph, there are several commercial driveways, and there are horizontal curves that limit sight distance.
- Due to right-of-way constraints along the corridor it is likely infeasible to provide a shared-use path or separated bike lane.
- The land uses at the western end of the corridor may result in higher volumes of heavy vehicle traffic between Pen Argyl Borough and the Plainfield Township Trail.
- The recommended improvements will improve conditions for confident cyclists but even with these improvements the usage of this corridor will likely be limited to highly confident bicyclists.
- The proposed on-road alignment would require the elimination of all on-street parking on Market Street in Bangor and Pennsylvania Avenue in Pen Argyl. As an alternative to the on-road bicycle route, a new bicycle route could be created through Bangor and Roseto to connect with the proposed Northern Tier Trail. The trail will provide an off-road connection to Pen Argyl.

**Recommendations**

**Location-Specific**

10.1 Shared-Use Path – Provide a sidepath along the south side of Route 512 between the Plainfield Township Trail and George Street in Pen Argyl. *(Map A)*

10.2 Pennsylvania Avenue Bike Lanes – On Pennsylvania Avenue in Pen Argyl Borough *(Map B)*, provide a bike lane in the westbound direction and shared lane markings in the eastbound direction.

10.3 Shared-Use Path – On East Main Street/Blue Valley Drive *(Map C)*, the preferred facility is a shared-use path parallel to the roadway. However, due to right-of-way constraints along the corridor it is likely infeasible to provide a shared-use path or separated bike lane.

10.4 Shoulder Improvements – If a shared-use path is not feasible *(Map D)*, bicycling conditions may be improved by providing a consistent shoulder with a preferred width of seven feet, reducing the speed limit to 30 mph, and eliminating channelized right-turn lanes. However, even with these improvements the usage of this corridor will likely be limited to highly confident bicyclists.

10.5 Market Street Bike Lanes – On Market Street in Bangor *(Map E)*, provide a bike lane in the westbound direction and shared lane markings in the eastbound direction.

10.6 Northern Tier Trail Trailhead – As an alternative to the proposed on-road alignment, investigate whether a connection could be provided to the proposed Northern Tier Trail near the intersection of Front Street & Bangor Junction Road *(Map F)*.

10.7 On-Street Connection to Northern Tier Trail – If a trail connection in Roseto is feasible, then directional signage should be added to Front Street in Roseto and N. Ninth Street in Bangor *(Map G)* to direct users to the trailhead. Traffic calming treatments may be implemented to control traffic speeds and volumes.
Recommendations Overview

Figure 5.34: Example of a sidepath. It is recommended that a sidepath be installed on the south side of Route 512 (Map A) to connect to the Plainfield Township Trail.

Figure 5.35: Example of paved shoulder. If a sidepath on the south side of Route 512 is infeasible (Map D), it is recommended that a consistent, 7 foot wide shoulder be provided.

Figure 5.36: View of Market Street in Bangor (Map E). It is recommended that a bike lane be provided in the westbound direction and shared lane markings in the eastbound direction.

BICYCLE NETWORK RECOMMENDATIONS
Catalytic Projects

A Catalytic Project is a project that has significant potential to spark interest and use of active transportation in the Lehigh Valley—not just for work trips but also for errands and social and recreational trips. A preliminary list of 11 candidate Catalytic Projects was developed and prioritized based on each project’s ability to:

• Address a known safety issue
• Improve pedestrian and bicycle network connectivity
• Facilitate access to transit
• Facilitate access to trails
• Produce a significant local and/or regional economic benefit
• Incorporate state of the art design
• Serve historically disadvantaged communities

Five Catalytic Projects were ultimately selected for field assessment—two in Lehigh County, two in Northampton County and one in both counties.
CATALYTIC PROJECT (1)

Delaware and Lehigh National Heritage Corridor – Lehigh Valley Catalyst

Project Overview
The Delaware and Lehigh National Heritage Corridor (D&L) is a 165-mile multi-use trail that traverses natural and historic sites across Eastern Pennsylvania. The D&L Trail is the spine of the trail network in Lehigh and Northampton Counties, but there are notable gaps in the trail between Allentown and Northampton.

In partnership with PennPraxis, the Delaware and Lehigh National Heritage Corridor, and the Wildlands Conservancy, LVPC has completed an analysis of this corridor and envisioned a one-of-a-kind active transportation corridor that will connect communities along the river to each other and connect users with the corridor’s unique natural environment and history. By closing existing gaps, using bridges to link parallel trails and creating several new trailheads, this project goes beyond a linear corridor to create a true transportation network.

- Length: 7 miles
- Speed Limit: N/A
- Curb-to-Curb Width: N/A
- AADT: N/A
- Land Use: Natural areas along Lehigh River with connections to adjacent urban and suburban neighborhoods.

Recommendations
General
1.1 Trails on Each Side of Lehigh River – Provide parallel, complementary path systems on both sides of the river. Trails on both sides would provide 14 miles of trail conducive to walking, running, and bicycling. The trail on the west side of the river would be specifically designed to meet the needs of cyclists and multimodal commuters.

1.2 New Trailheads – Provide frequent trailheads and links to the surrounding sidewalk network on each side of the river.

1.3 Upgrade Existing Bridges – Provide wide, welcoming pathways for bicycles and pedestrians on the following bridges over the Lehigh River: Hamilton Street, Tilghman Street, Race Street, Lehigh Street, and Route 329. Provide direct access between each bridge and the adjacent trail.

Location-Specific
1.4 Retrofit the Coplay Trestle – The Coplay Trestle (Map C), located south of the Coplay-Northampton Bridge, should be retrofitted to serve as a new bicycle/pedestrian bridge across the river and link to the Ironton Rail Trail.

1.5 Hamilton Street Bridge - On the Hamilton Street Bridge, replace the narrow sidewalk on the north side of the bridge with a wide shared use path. The preferred minimum width is 14 feet. If a cantilevered side path is not feasible then one westbound travel lane should be eliminated. Conduct traffic and feasibility studies to determine next steps.
Recommendations Overview

Figure 5.37: The trail recommended for the west bank of the river (Map A) would include a 12-foot-wide bikeway separate from the 6-foot-wide running path. Graphic created by Penn Praxis for Delaware & Lehigh National Heritage Corridor: Lehigh Valley Catalyst Framework Plan Summary, April 18, 2019.

Figure 5.38: The trail recommended for the east bank of the river (Map B) would be a crushed stone trail ranging from 6 feet to 12 feet in width, as conditions allow. Graphic created by Penn Praxis for Delaware & Lehigh National Heritage Corridor: Lehigh Valley Catalyst Framework Plan Summary, April 18, 2019.
**Benefits**

- **Addresses Known Safety Issue**: There is currently a significant gap in the bicycling network. The only parallel option for bicyclists is to utilize parallel roads such as Dauphin Street or Fullerton Avenue with heavy traffic volumes.

- **Facilitates Access to Transit or Trail**: The D&L Trail is the spine of the local trail network known as THE LINK. The existing gaps have a major impact on trail connectivity in the center of the Lehigh Valley.

- **Significant Local and/or Regional Economic Benefit**: The D&L Trail is the backbone of the regional trail network. Strengthening the connections between the trail and surrounding communities would benefit trail users who are looking for amenities along their route. Enhancing access to shops, restaurants, and historic sites along the trail can attract more visitors to the trail and benefit the local economy.

- **Serves Disadvantaged Communities**: The neighborhoods along the Lehigh River in the City of Allentown have some of the highest poverty rates in Lehigh or Northampton counties.

<table>
<thead>
<tr>
<th>State of the Art Design:</th>
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</thead>
<tbody>
<tr>
<td>The trail plan incorporates a cutting edge approach to thinking about active transportation, placemaking, and immersing users in natural and cultural history.</td>
</tr>
<tr>
<td>The design is intended to spur additional historic preservation and revitalization in the communities along the trail.</td>
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</tbody>
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- **Potential for Emotional Engagement**: The project calls for a unique approach to placemaking that highlights history, culture, and the natural environment.

**Considerations**

- **State of the Art Design:** The Lehigh River with parallel canal and railroads historically served as critical transportation corridors that shaped development in the region and America’s 19th century industrial revolution.

- **Facilitates Access to Transit or Trail**: Route 22 can serve as a barrier for walking, biking, and rolling in the Lehigh Valley. The project would provide routes for walking or rolling under Route 22 on both sides of the river.

- **Significant Local and/or Regional Economic Benefit**: The D&L Trail’s connection with adjacent neighborhoods and adjoining trails on each side of the river should be maximized. The more frequently the trail connects with the sidewalk network and other multi-use trails, the more useful it will be from a transportation perspective.

- **Serves Disadvantaged Communities**: By preserving historic sites, creating new green infrastructure, and promoting community revitalization, the project will create a unique user experience that encourages more people to walk or bike as part of their daily routine.

- **State of the Art Design**
  - The trail plan incorporates a cutting edge approach to thinking about active transportation, placemaking, and immersing users in natural and cultural history.

- **Facilitates Access to Transit or Trail**
  - The D&L Trail is the spine of the local trail network known as THE LINK. The existing gaps have a major impact on trail connectivity in the center of the Lehigh Valley.

- **Significant Local and/or Regional Economic Benefit**
  - The D&L Trail is the backbone of the regional trail network. Strengthening the connections between the trail and surrounding communities would benefit trail users who are looking for amenities along their route. Enhancing access to shops, restaurants, and historic sites along the trail can attract more visitors to the trail and benefit the local economy.

- **Serves Disadvantaged Communities**
  - The neighborhoods along the Lehigh River in the City of Allentown have some of the highest poverty rates in Lehigh or Northampton counties.

  - The census tracts along the Lehigh River in the City of Allentown and Catasauqua have low rates of car ownership.

  - The City of Allentown has comparatively high rates of diabetes.
Funding and Implementation

Potential Funding Sources
- PA Department of Conservation & Natural Resources (DCNR) – Pennsylvania Recreational Trails Program
- PA Department of Conservation & Natural Resources (DCNR) – Keystone Recreation, Park and Conservation Fund
- PA Department of Conservation & Natural Resources (DCNR) – Environmental Stewardship Fund
- PA Department of Community & Economic Development (DCED) – Greenways, Trails, and Recreation Program
- PennDOT Multimodal Transportation Fund
- DCED Multimodal Transportation Fund
- Lehigh Valley Transportation Study–Transportation Improvement Program
- Private funds

Interim Measures
- Redevelopment projects along the waterfront should incorporate the project vision into the site.
- Continue work to close individual trail gaps along the corridor, especially on the east side of the river.
- Share the vision with the community to engage citizens in the process of developing new points of interest along the existing trail and future trail alignment.

Key Challenges
- The fourteen-mile loop of trail passes through seven different municipalities in two counties.
- The trail development process will require acquiring land not under municipal or partner ownership.
- The trail development process will require coordination with property owners and other stakeholders to facilitate construction and provide the best possible trail access.
- To promote the connectivity needed for long term success, the bridges across the river must provide wide, inviting paths that are easy to access and separated from adjacent traffic.

Figure 5.39: This rendering shows a vision for the Coplay Trestle and adjacent park at the intersection of the D&L Trail and the Ironon Rail-Trail. Graphic created by PennPraxis for Delaware & Lehigh National Heritage Corridor: Lehigh Valley Catalyst Framework Plan Summary, April 18, 2019

Figure 5.40: This rendering shows how the trail network can interact with the transit network along the redeveloping Allentown Waterfront. Graphic created by PennPraxis for Delaware & Lehigh National Heritage Corridor: Lehigh Valley Catalyst Framework Plan Summary, April 18, 2019
Project Overview

7th Street/MacArthur Road (S.R. 145) is a major transportation backbone of two communities: the City of Allentown and Whitehall Township. Over the past several decades the design of the roadway has evolved to meet increasing demands of automobile traffic along the corridor. However, the high speeds and heavy traffic volumes impede access by pedestrians, bicyclists, and transit riders.

In Allentown, 7th Street is a three-lane road, one-way southbound starting at Washington Street, running through a busy neighborhood business district between Tilghman Street and Gordon Street and then through the heart of downtown between Linden Street and Walnut Street. The surrounding blocks make up one of the densest residential neighborhoods in the Lehigh Valley. In Whitehall, MacArthur Road widens to a six lane arterial roadway and provides access to major employment and shopping destinations.

- **Length:** 3.1 miles
- **Speed Limit:** 35–40 mph
- **Curb-to-Curb Width:** 48 feet (Allentown)/80 feet (Whitehall)
- **AADT:** Ranges from 8,000 to 35,000
- **Land Use:** Urban Core/Suburban Corridor
- **Responsible Entities:** City of Allentown, Whitehall Township, PennDOT District 5-0

Recommendations

**MacArthur Road in Whitehall**

**General**

2.1 Fill in Sidewalk Gaps – Sidewalks should be provided on both sides of the road. A minimum clear width of five feet should be provided along with a minimum two foot buffer between the sidewalk and the roadway. Alternate treatments for separating the sidewalk from the roadway include bike lanes and physical barriers, such as protection plantings.

2.2 Provide Crosswalks – Ensure all signalized intersections are equipped with crosswalks on all four approaches.

2.3 Discourage High-Speed Turns – Identify intersections where right turns are made at high speeds. This may include channelized right-turn lanes, jug handles, and other intersections with a wide curb radius or acute angles. Redesign intersections as necessary to reduce high-speed conflicts between vehicles and pedestrians, e.g., by implementing raised crosswalks or adjusting the angle of the intersection to discourage high-speed turns.

2.4 Consolidate Driveways – Combine driveways and improve connectivity between adjacent properties so short trips can be made without traveling on MacArthur Road.

2.5 Pedestrian-Oriented Site Planning – Minimize building setback and provide direct, pedestrian connections from the sidewalk to the building.

2.6 Transit Signal Priority – Coordinate with LANtA to implement Transit Signal Priority (TSP) where appropriate.

2.7 Center Running Bus Lanes - Coordinate with LANtA to determine if center running bus lanes would be beneficial in conjunction with the planned High Frequency Bus service on the corridor.

**Location-Specific**

2.8 Enhanced Trail Crossing – Provide an enhanced crosswalk where the Jordan Creek Greenway crosses MacArthur Road. *(Map C)*

**7th Street in Allentown**

**General**

2.9 Two-Way Conversion – Convert 7th Street from one-way traffic to two-way traffic.

2.10 Curb Extensions – Install curb extensions to reduce crossing distance at intersections.

2.11 Eliminate Right Turns on Red – Prohibit right-turns on red at all intersections.

2.12 Reduce Curb Cuts – Reduce the number of driveways taking access to 7th Street.

2.13 Leading Pedestrian Intervals – Add leading pedestrian intervals to the traffic signals.
Recommendations Overview

Figure 5.41: There are significant gaps in the sidewalk network along MacArthur Road, such as this one near Whitehall Square (Map A). Where sidewalks do exist there is often no buffer between the pedestrian and high-speed traffic. It is recommended that continuous sidewalks with a minimum 2' buffer be provided on both sides of MacArthur Road.

Figure 5.42: Pedestrians are prohibited from crossing MacArthur Road at several traffic signals along the corridor, such as this one at Mickley Road (Map B). It is recommended that all signalized intersections be equipped with marked crosswalks on all four approaches.

Figure 5.43: 7th Street (Map D) is a three-lane road, one way southbound starting at Washington Street, running through a busy neighborhood business district between Tilghman and Gordon streets. It is recommended that 7th Street be converted to two-way along this section.
Benefits

- **Addresses Known Safety Issue:**
  - 7th Street has one of the highest rates of bicycle and pedestrian crashes in the City of Allentown.
  - The census tract that includes the Lehigh Valley Mall has a higher rate of bicycle and pedestrian crashes than other census tracts in surrounding suburban communities.

- **Facilitates Access to Transit or Trail:**
  - LANta plans to introduce high frequency bus service along 7th Street/MacArthur Road. Improving pedestrian safety and walkability would complement this plan, as transit users need a safe walking environment between the bus stop and their ultimate destination.

- **Significant Local and/or Regional Economic Benefit:**
  - Promotes multimodal transportation options along one of the most heavily traveled corridors in the region.

- **Serves Disadvantaged Communities:**
  - The census tracts surrounding 7th Street in the City of Allentown have some of the highest poverty rates in Lehigh or Northampton counties.
  - The census tracts surrounding 7th Street in the City of Allentown have some of the lowest rates of car ownership in Lehigh or Northampton counties.

Considerations

- **The area surrounding the 7th Street corridor in Allentown is already one of the most walkable neighborhoods in the Lehigh Valley because of the traditional urban form.** There are many homes and destinations in a compact area and most buildings are located along the sidewalk, not set back behind a parking lot. Redesigning 7th Street to prioritize the needs of pedestrians would eliminate a major barrier for the people who live, work, and walk to school in the neighborhood.

- **The average traffic signal spacing along MacArthur Road between Mickley Road and Schadt Avenue is approximately 950 feet. Pedestrians are prohibited from crossing MacArthur Road at several traffic signals along the corridor.**

- **The Jordan Creek Greenway was recently improved on the west side of MacArthur Road. However, to connect with the existing trail on the east side of MacArthur Road pedestrians and bicyclists must walk approximately 200 feet north to the nearest signal, and then walk approximately 500 feet south to reconnect with the trail.**

- **If a two-way traffic pattern is implemented on 7th Street, it may be beneficial to implement a similar change on 6th Street or 8th Street.**

- **As properties are redeveloped, buildings should be placed closer to the roadway to minimize the distance pedestrians must walk across a parking lot.**

- **As properties along MacArthur Road are redeveloped, Whitehall Township can enhance opportunities for active transportation by reducing parking requirements and promoting mixed-use development.**
Funding and Implementation

Potential Funding Sources

- Transportation Alternatives Set Aside
- Multimodal Transportation Fund
- Lehigh Valley Transportation Study–Transportation Improvement Program

Interim Measures

- The installation of an enhanced crossing for the Jordan Creek Greenway can be prioritized as a stand-alone project. The trail has already been improved on either side of MacArthur Road.
- As properties along MacArthur Road in Whitehall are redeveloped many of the recommendations along MacArthur Road can be implemented. Sidewalks should be installed or improved along the property frontage, driveways should be consolidated with adjacent properties, and the number of channelized right-turn lanes should be reduced. The setback for new buildings should be minimized.

Key Challenges

- For many years the design of Seventh Street has accommodated high volumes of regional traffic passing through Center City Allentown, so efforts to slow traffic in the neighborhood may be temporarily disruptive. However, the completion of the American Parkway Bridge and redesign of the Fullerton Avenue Interchange of Route 22 each provide alternative paths for regional traffic with similar travel time.
- There are many individual property owners along the MacArthur Road corridor, and many existing buildings may not be modified for years, or even decades. Therefore, any changes to site layout or land use will likely occur over a long period of time.

Figure 5.44: Rendering by PennPraxis of what MacArthur Road could like if transformed to include separated bikeways, center-running transit lanes, and pedestrian-oriented streetscape design.
Let's Connect Easton

Project Overview

The City of Easton is home to 26,000 people, and thousands of people from surrounding communities travel to Easton regularly for work and recreation. There are major regional trails on either side of the City, but they are disconnected from the neighborhoods where people live and work. The communities around Easton are linked by the Two Rivers Trailway, but Easton's Karl Stirner Arts Trail is currently disconnected from this network. The D&L Trail, which is the spine of THE LINK regional trail network, runs along the south side of the Lehigh River within sight of Easton’s walkable downtown, but no bicycle facilities exist to provide a connection.

Connecting these major trails to the core of the City would connect Easton to Allentown, Bristol and other cities further afield, and make Easton a major destination for regional bicyclists of all abilities. The newly connected trail network would also create new low-stress bike commuting routes connecting Easton with the surrounding communities.

- Gap Length (Two Rivers Trailway): 1 mile
- Gap Length (Downtown Easton to D&L Trail): 1,200 feet
- Land Use: Town/Village Center
- Responsible Entities: City of Easton

Recommendations

Two Rivers Trailway:

Location-Specific

3.1 New Trail Along Bushkill Creek – Construct a new trail along the south side of the Bushkill Creek (Map A) that connects Hackett Park to the 13th Street trailhead of the Karl Stirner Arts Trail.

3.2 Enhanced Crosswalk on 13th Street – Install a new high-visibility crosswalk across 13th Street to connect the new trail with the existing trailhead (Map B). Install a rectangular rapid flashing beacon at the crosswalk location.

Downtown Easton to D&L Trail

Location-Specific

3.3 Sitgreaves Street Connection – Sitgreaves Street (Map C) should be converted into a two-way low speed street with shared lane markings from Northampton Street to Larry Holmes Drive to welcome bicyclists into the heart of downtown.

3.4 Enhanced Crosswalk – Provide an enhanced crosswalk at the intersection of Larry Holmes Drive & Sitgreaves Street.

3.5 Construct New Bridge Over Lehigh River – Construct a 340-foot-long pedestrian and bicycle bridge across the Lehigh River, starting at the red-brick pump station in Scott Park on Larry Holmes Drive and connecting to the D&L Trail on the south side of the river. (Map D) If a dedicated bridge cannot be built, a possible alternative is to install a cantilevered sidepath on the Third Street bridge; however, this could only be done in conjunction with major highway improvements.
Recommendations Overview

Figure 5.46: The Karl Stirner Arts Trail currently terminates at this trailhead on 13th Street (Map B). It is recommended that a new high-visibility crosswalk be installed across 13th Street to connect the proposed new trail with the existing trailhead.

Figure 5.47: Sitgreaves Street (Map C) should be converted into a two-way low speed street with shared lane makings to lead bicyclists into the heart of downtown.
Benefits

- **Addresses Known Safety Issue**
  - Both South Third Street and Larry Holmes Drive have a high rate of crashes involving bicyclists and pedestrians.
  - There is a horizontal curve on S. Delaware Drive (Route 611) that limits sight distance on a narrow section of the roadway.

- **Facilitates Access to Transit or Trail**
  - Downtown Easton is a major tourist destination located near the midpoint of the D&L Trail. An easy to navigate bicycling connection between the trail and the town would make Easton a highlight destination for both local and long distance trail riders.
  - People who live and work in Easton would gain direct access to the regional trail network via both the D&L Trail and the Two Rivers Area Trailway.
  - The Karl Stirner Arts Trail, which is already a popular destination, would be linked with the regional trail network.

- **Significant Local and/or Regional Economic Benefit**
  - The D&L Trail is the backbone of the regional trail network. Strengthening the connections between the trail and surrounding communities would benefit trail users who are looking for amenities along their route. Enhancing access to shops, restaurants, and historic sites along the trail can attract more visitors to the trail and benefit the local economy.

- **Serves Disadvantaged Communities**
  - Easton’s West Ward has one of the highest poverty rates of any neighborhood in Northampton County.
  - Households in Downtown Easton and the West Ward have some of the lowest rates of car ownership in the Lehigh Valley.

- **State of the Art Design**
  - Linking the new trail with the existing Karl Stirner Arts Trail with an enhanced crossing adjacent to the newly redeveloped Simon Silk Mill will create a notable gateway along 13th Street.

- **Potential for Emotional Engagement**
  - An improved bicycle and pedestrian crossing over the Lehigh River will provide a unique view of the Lehigh and Delaware rivers.
  - City residents will be able to access the natural beauty of Delaware Canal State Park with an easy 10-minute bike ride.

Considerations

- Removing right-turn lanes at two signalized intersections on either side of the Third Street Bridge will impact traffic operations. PennDOT will likely request a traffic analysis.

- As Delaware Drive (Route 611) passes under the railroad trestle there is not adequate space to provide a trail along the roadway. The elevation of the adjacent D&L trail must be raised to provide adequate width for a trail along the side of the road. The resulting trail grades and trail width should be consistent with American Association of State Highway and Transportation Officials trail design standards.

- If Alternative 1 for connecting Downtown Easton to the D&L Trail is not feasible then Alternative 2 should be pursued.
Funding and Implementation

Potential Funding Sources
- Transportation Alternatives Set Aside
- Multimodal Transportation Fund
- Lehigh Valley Transportation Study—Transportation Improvement Program

Interim Measures
- Connect the Karl Stimer Arts Trail to Hackett Park by modifying the shoulder of Bushkill Drive to provide a two-way bike lane separated from the roadway by a barrier.

Key Challenges
- The City does not currently control the land needed for the new trail along the south side of the Bushkill Creek west of 13th Street. Further negotiations with the property owner are needed.

Figure 5.49: Example of enhanced crosswalk with rectangular rapid flashing beacon, as proposed for the 13th Street trailhead. Graphic from Federal Highway Administration publication Small Town and Rural Multimodal Networks.

Figure 5.50: The Hawthorne Bridge in Portland has a wide shared-use path for bicycles and pedestrians.
Project Overview

Every day thousands of people walk, roll, drive and ride transit along Broad Street in Bethlehem. There are five LANta bus routes with numerous stops along the corridor. During the school year crossing guards stand at key intersections to help children cross safely on their way to school.

Broad Street is a place where people go to shop, dine, socialize, and work. Downtown Bethlehem is a major employment hub, and there are secondary business districts on Broad Street east and west of downtown. There are multiple retirement communities located within a few blocks of the corridor, where many residents can walk to meet their regular shopping needs.

Broad Street is one of the true multimodal transportation corridors in the Lehigh Valley. However, the width of the roadway and other design elements encourage high motor vehicle speeds that create a stressful and potentially dangerous environment for people walking, rolling, and bicycling outside of the core downtown area.

- **Length:** 3.2 miles
- **Speed Limit:** 25–35 mph
- **Curb-to-Curb Width:** Typically 56 to 60 feet with a few 40 foot wide sections
- **AADT:** Ranges from 9,000 to 12,000
- **Land Use:** Town/Village Center
- **Responsible Entities:** City of Bethlehem

Recommendations

General

4.1 Reduce Lane Width – To calm traffic speeds and shorten the pedestrian crossing distance, reduce the typical lane width to a standard 11 feet. The speed limit should be reduced to 25 mph for the full corridor.

4.2 Separated Bike Lanes – Install separated bike lanes on each side of the street. Parking separated bike lanes are preferred when legislative changes clarify the status of their use in Pennsylvania. Alternative forms of separation should be utilized on the bridges over Route 378 and the Monocacy Creek.

4.3 Reduce Conflicts at Intersections – Intersections should be designed to minimize bicycle exposure to traffic, keep vehicle turning speeds low, and provide clear sight distance. Major intersections should follow all best practices for protected intersections. At minor intersections, design features such as raised crossings, bump-outs, and compact corners should be used to keep turning speeds low and ensure a clear approach sightline is provided.

4.4 Accessible Pedestrian Islands – Intersections should include accessible pedestrian islands that meet the needs of people using personal mobility devices and reduce the pedestrian crossing distance.

4.5 Streetscape Improvements – Provide streetscape enhancements such as new street trees and pedestrian scale street lighting.

4.6 Eliminate Turning Lanes – Most turning lanes on the corridor are unnecessary and should be eliminated to minimize pedestrian crossing distance. It may be appropriate to retain a left-turn lane at a few key intersections.

4.7 Reduce Curb Cuts – Reduce the number of driveways that provide access from Broad Street. Where possible provide access from side streets instead.

Location-Specific

4.8 Integrate Bike Lanes into Downtown Streetscape – The installation of separated bike lanes from Main Street to Center Street (Map C) should be incorporated into a cohesive streetscape enhancement project that maintains the distinctive streetscape elements of Historic Downtown Bethlehem. Sidewalk-level separated bike lanes should be utilized.
Recommendations Overview

Figure 5.51: The wide travel lanes on Broad Street encourage speeding and increase the crossing distance for pedestrians. West of Eighth Avenue (Map A) there is a stretch of West Broad Street where the nearest signalized crossings are more than 4,500 feet apart. It is recommended that the travel lanes be narrowed to 11 feet and the speed limit reduced to 25 mph along the entire corridor.

Figure 5.52: The installation of separated bike lanes from Main Street to Center Street should be incorporated into a cohesive streetscape enhancement project that maintains the distinctive streetscape elements of Historic Downtown Bethlehem (Map B).

Figure 5.53: The long crossing distance, vehicle speeds, and traffic volumes make it difficult to cross Broad Street at unsignalized locations (Map C). To help address this situation, it is recommended that intersections include accessible pedestrian islands.
Benefits

- **Addresses Known Safety Issue**: Several census tracts along the corridor have high rates of bicycle and pedestrian crashes.
  - Reducing vehicle speeds has a major impact on pedestrian safety. When a motorist strikes a pedestrian at 40 mph, the likelihood of a pedestrian fatality or severe injury is 73 percent. When a motorist is traveling at 20 mph, the likelihood of a pedestrian fatality or severe injury is reduced to 13 percent.

- **Facilitates Access to Transit or Trail**: There are five LANta bus routes on Broad Street. Due to the traffic volumes and speeds, crossing the street to access bus stops can be challenging, particularly for people with disabilities.
  - LANta’s Bethlehem Transportation Center is located near the center of the corridor.
  - LANta plans to introduce high frequency bus service along West Broad Street. Improving pedestrian safety and walkability would complement this plan, as transit users need a safe walking environment between the bus stop and their ultimate destination.

- **Significant Local and/or Regional Economic Benefit**: The walkability of Bethlehem attracts visitors from across the region. Enhancing walkability on Broad Street builds upon the strengths of downtown Bethlehem and invites visitors to extend their visit to the surrounding neighborhood business districts.
  - Combined with LANta’s high frequency bus service plan, these improvements would enhance multimodal transportation options for residents traveling to their place of employment.

- **Serves Disadvantaged Communities**: The census tracts along the corridor have above average poverty rates and below average rates of car ownership.

- **State of the Art Design**: There are currently no separated bike lanes in the Lehigh Valley. Separated bike lanes have the potential to increase cycling rates by appealing to a broad range of people and in doing so contribute to increases in bicycling volumes and rates.
  - Protected intersections have been implemented in cities across North America in recent years. This project would create protected intersections that serve as an inspiration for other communities in the Lehigh Valley.

- **Potential for Emotional Engagement**: The project would dramatically improve the walking and biking experience on one of the most visible corridors in the City of Bethlehem, signaling to everyone that Bethlehem is a place where people walk, bike, and roll to their destinations.
  - Broad Street is lined with potential destinations from one end of the corridor to the other, including parks, churches, restaurants, and the YMCA. Therefore, the recommended improvements are likely to be well-used as soon as they are built.

Considerations

- **The downtown blocks between Main Street and Center Street have existing median islands, curb extensions, and other traffic calming treatments that would need to be modified. Existing street trees should be retained.**

- **Memorial Fire Station is located on Broad Street between 4th Avenue and 5th Avenue. The street design on this block will require significant input from the fire department to make sure that emergency operations are not disrupted. For example, the separated bike lane may be designed using alternative materials in this area.**

- **To provide separated bike lanes on Broad Street, parking would need to be eliminated on the Broad Street Bridge over the Monocacy Creek. It may be possible to gain additional parking spaces in the same vicinity by restriping the block of Main Street north of Broad Street. Alternatively, it may be possible to significantly widen the sidewalks and provide sidewalk level separated bike lanes while maintaining parking on one side. Further assessment is needed to determine if this configuration is feasible.**
Funding and Implementation

Potential Funding Sources
- Transportation Alternatives Set Aside
- Multimodal Transportation Fund
- Lehigh Valley Transportation Study–Transportation Improvement Program

Interim Measures
- A phased approach should be considered to facilitate the funding of the project.
- The center of the corridor, from Main Street to Center Street, will be most complex and will likely have the highest cost because it requires the reconfiguration of the existing streetscape elements.
- The section west of Main Street may be an appropriate first phase to demonstrate how the project can enhance the streetscape of secondary business districts, reduce the crossing distance, and encourage cycling to downtown destinations.

Key Challenges
- Historic Downtown Bethlehem has a distinctive and well-maintained streetscape. The installation of separated bike lanes from Main Street to Center Street would need to be incorporated into a well-designed streetscape upgrade to ensure a cohesive design that maintains and enhances the key streetscape elements.
- As with any transportation project adjacent to a business district, the construction phasing should be well planned to minimize the impact on the nearby businesses.

Figure 5.54: This illustration shows how a street can be reconfigured to better accommodate people walking, biking, and taking transit. The island separating the bike lane from the travel lane also shortens the crossing distance for pedestrians and provides space for an high frequency bus stop. National Association of City Transportation Officials Urban Street Design Guide.
Project Overview

The Catasauqua Area Trail & Transit Initiative is a multi-municipal project that spans the Borough of Catasauqua, Lehigh County and the Borough of North Catasauqua and Allen Township, Northampton County. The Boroughs of Catasauqua and North Catasauqua are located in close proximity to two major regional trails: the D&L Trail and the Nor-Bath Trail. However, due to local constraints the trails are difficult to access from within the communities. Allen Township is a growing employment destination, but lacks bicycle and pedestrian connectivity to Catasauqua and North Catasauqua.

This project envisions a strong multimodal connection between the three communities and the surrounding trail network. Residents should be able to access schools, jobs, and recreational destinations without having to get in a car.

- **Length:** 4.5 miles
- **Land Use:** Town/Village Neighborhood
- **Responsible Entities:** Catasauqua Borough, North Catasauqua Borough and Allen Township

Recommendations

Location-Specific

5.1 New Trail along Catasauqua Creek – Construct a new trail across the Willow Brook property that connects Breinigs Lane in North Catasauqua Borough (Map A) to the trail in Wayne A. Grube Memorial Park. The trail should connect to the existing trail at the intersection of Willowbrook Road & W. Bullshead Road.

5.2 Connect Trail to Catasauqua High School – Provide an enhanced trail crossing on Bullshead Road (Map B) to connect the trail to Catasauqua High School. A trail should be constructed on the north side of Bullshead Road to connect with the existing trail crossing on Willowbrook Road.

5.3 Connect Trail to FedEx Ground Facility – Construct a trail spur that extends from the new trail across the Willow Brook property to provide direct trail access to the FedEx Ground facility (Map C). The trail should align with the signalized intersection of Willow Brook Road & Radar Drive.

5.4 Improve Access to D&L Trailhead – The North Catasauqua Trailhead of the D&L Trail is located behind the North Catasauqua Public Works Building on Front Street (Map D). To improve pedestrian and bicycle access, construct a shared-use path on the west side of Main Street between Green Street and Penn Street. Install high-visibility crosswalks with advance warning signs at the intersection of Main Street & Green Street and the intersection of Main Street & Penn Street.

5.5 New Trail In Catasauqua – Construct a new trail between N. 10th Street and N. 14th Street in Catasauqua (Map E). The eastern end of the trail should include an enhanced trail crossing to connect to the Francis H. Sheckler Elementary School.

5.6 Connect Trails with Neighborhood Greenways – Preliminary on-street routing is shown on the project map. A collaborative process with municipal leaders is needed to refine the route and determine where traffic calming may be appropriate.

5.7 Upgrade Path Between Front Street and Second Street – The existing path between Second Street and Front Street north of Wood Street in Catasauqua (Map F) should be upgraded to a 12-foot wide shared use path.

5.8 Extend Street Grid to Iron Works Site – The Iron Works redevelopment site (Map G) should be integrated into the existing street grid and provide a direct connection to the D&L Trail via a pedestrian bridge over the canal.
Recommendations Overview

Figure 5.55: The new trail along the Catasauqua Creek should connect to the existing trail access at the intersection of Willowbrook Road & W. Bullshead Road near Catasauqua High School (Map B).

Figure 5.56: Enhance access to the North Catasauqua Trailhead of the D&L Trail with new crosswalks, signage, and a new side-path on the west side of Main Street (Map D).

Figure 5.57: The existing path between Second Street and Front Street (Map F) is well-located near existing businesses and the planned Iron Works redevelopment. The existing path should be upgraded to a 12-foot wide shared-use path.

Figure 5.58: The Iron Works redevelopment (Map G) site should be integrated into the existing street grid and provide a direct connection to the D&L Trail.
**Benefits**

- **Addresses Known Safety Issue**
  - Conflicts with traffic can discourage people from walking or biking in their community. A connected biking and walking network that links trails, neighborhoods, and major new developments will provide residents with multimodal choices with minimal traffic conflicts.

- **Facilitates Access to Transit or Trail**
  - There are trailheads for the D&L Trail in both Catasauqua and North Catasauqua. However, access to the trailheads may not be intuitive to residents. The project is intended to better integrate the trailheads into the surrounding communities.
  
  - In Allen Township, Wayne A. Grube Memorial Park provides a direct connection to the Nor-Bath Trail. Extending a high-quality trail connection into the adjacent boroughs would provide direct access to the park and the Nor-Bath Trail.
  
  - The area is served by LANta Route 103, which travels along Fourth Street/Main Street in North Catasauqua. Strengthening bicycle and pedestrian connectivity from Main Street to the surrounding neighborhoods will benefit residents who walk or roll to the bus.

- **Significant Local and/or Regional Economic Benefit**
  - The D&L Trail is the backbone of the regional trail network. Strengthening the connections between the trail and surrounding communities benefits trail users who are looking for amenities along their route. Enhancing access to shops, restaurants, and historic sites along the trail can attract more visitors to the trail and benefit the local economy.

- **Serves Disadvantaged Communities**
  - The neighborhood around Front Street in Catasauqua has a lower rate of car ownership and higher rate of poverty than the surrounding communities.

- **State of the Art Design**
  - There are two major developments planned in the study area: the proposed Iron Works project in Catasauqua and the proposed Willow Brook development in Northampton Borough, North Catasauqua Borough, and Allen Township. This plan calls for integrating bicycle and pedestrian mobility as a central feature of the planned developments. This vision shows that the municipalities are committed to maintaining a healthy community and prioritizing residents’ quality of life.

- **Potential for Emotional Engagement**
  - The northern section of the proposed trail would enhance public access to the Catasauqua Creek.
  
  - On the Willow Brook property there is potential for a scenic picnic area between the creek and a small former quarry on the site.

**Considerations**

- **There is steep terrain on either side of the creek in Catasauqua that may inhibit bicycling to destinations such as the Catasauqua Middle School and Suburban North Family YMCA.**

- **The North Catasauqua trailhead for the D&L Trail is behind the North Catasauqua Public Works building. Trail users must pass around the building and through the parking lot. Signage and pavement markings should be added to improve visibility of the trailhead and balance the needs of trail users and Borough staff.**
**Funding and Implementation**

**Potential Funding Sources**
- Transportation Alternatives Set Aside
- Multimodal Transportation Fund
- Lehigh Valley Transportation Study–Transportation Improvement Program

**Interim Measures**
- As the Iron Works and Willow Brook land development projects move forward the pedestrian connections within the properties and the future connections to the surrounding network can be fully constructed.

**Key Challenges**
- The project spans three adjacent communities in two counties.
- Key elements of the project are proposed on private property, so the timeline for full build-out is linked to the future development plans.

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**Figure 5.59:** The conceptual plan for the Iron Works project in Catasauqua, from the Iron Works Master Plan prepared by Spillman Farmer Architects. The conceptual plan shows several ways that pedestrian connectivity can be built into a land development plan: the development connects to the existing street grid in multiple locations, there is a mix of land uses, the parking is located behind the buildings, and there is a direct connection to the D&L Trail.

**Figure 5.60:** Clear wayfinding signage is needed where on-street connections are used to connect to trails. These examples are from the D&L National Heritage Corridor design toolkit.
The Visionary Bicycle Network is comprised of Visionary Connections, the Priority Bicycle Network (Catalytic Projects and Priority Bicycle Commuting Corridors), and Existing and Previously Proposed Regional Trails. Visionary Connections were identified from previously planned trails and candidate Bicycle Commuting Corridors and Catalytic Projects not selected for field assessment, along with newly proposed on-road and off-road bicycle routes, critical for establishing regional connections. Factors considered in developing the Visionary Connections included existing major trails, proposed and conceptual trails, feedback, regional commuting patterns, and demographic and employment data. For example, data indicated a significant number of commuting trips between the City of Bethlehem and Hanover Township led to the inclusion of Schoenersville Road as a Visionary Connection. Please note that a feasibility assessment of each Visionary Connection was not conducted as part of this plan.

A map of the Visionary Bicycle Network is provided on the next page (Figure 5.61). Note that local trails that connect or will connect to the Visionary Bicycle Network in the future are not displayed on the map.
WALK/ROLL LV

BICYCLE NETWORK RECOMMENDATIONS

ALLENTOWN

BETHLEHEM

EASTON
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<td>Liberty Bell Trolley Rail Trail, Coopersburg Borough</td>
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<td>Industrial park; Upper Macungie Township</td>
<td>PBCC-Hamilton Blvd; Upper Macungie Township</td>
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<td>3</td>
<td>Lower Macungie Greenway Trail (in Salisbury Twp); Lower Macungie Township, Salisbury Township</td>
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<td>Community park, Saucon Rail Trail, college; Upper Saucon Township</td>
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<td>PBCC-Hamilton Blvd; Lower Macungie Township</td>
<td>PBCC-Hamilton St, large urban park; City of Allentown</td>
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<td>Shopping center, office buildings; South Whitehall Township</td>
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<td>Visionary Connection--N 27th/N 28th Streets, large urban park; City of Allentown</td>
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<td>Visionary Connection--N 4th St, Jordan Creek Greenway-D&amp;L Trail Connector, downtown; City of Allentown</td>
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<td>Commercial area, elementary school; City of Allentown</td>
<td>PBCC-Hamilton St; City of Allentown</td>
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<td>Residential area; City of Allentown</td>
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<td>Visionary connection--Union Boulevard; City of Allentown</td>
<td>Jordan Creek Greenway Trail/D&amp;L Trail Connector, Visionary Connector--Linden and Turner Streets (Turner), downtown; City of Allentown</td>
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<td>Visionary Connection--Elizabeth Ave and Eaton Ave; City of Bethlehem</td>
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<td>D&amp;L Trail, September 11th National Memorial Trail, park; Hanover Township</td>
<td>PBCC-Hanover Avenue and Hamilton Street Bridge; City of Allentown</td>
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<td>PBCC-William Penn Hwy/Easton Avenue, school; City of Bethlehem</td>
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<td>Visionary Connection--Catasauqua Borough, Weaversville Road, Schoenersville Road; City of Bethlehem, Hanover Township</td>
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<td>South Bethlehem Greenway; City of Bethlehem</td>
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<td>downtown (north side), college; City of Bethlehem</td>
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<td>Trexler Nature Preserve, community college; North Whitehall Township</td>
<td>Ironton Rail; North Whitehall Township</td>
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<td>Jordan Creek Greenway Trail; Whitehall Township, South Whitehall Township</td>
<td>Ironton Rail; Whitehall Township</td>
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<td>Catalytic-Catasauqua Area Trails, school; Catasauqua Borough</td>
<td>Visionary Connection--Elizabeth Avenue and Eaton Avenue, park; City of Bethlehem</td>
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<td>Industrial park; Bethlehem Township</td>
<td>Monocacy Way; City of Bethlehem</td>
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<td>Park (south segment) and shopping center (north segment); Bethlehem Township</td>
<td>Visionary Connection--Palmer-Bethlehem Township Bikeway to Louise Moore Park; Palmer Township</td>
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<td>PBCC-William Penn Hwy/Easton Avenue; Bethlehem Township</td>
<td>Community park Bethlehem Township</td>
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<td>25</td>
<td>Louise Moore Park, Lower Nazareth Township</td>
<td>St. Luke's University Health Network--Anderson Campus, Palmer-Bethlehem Township Bikeway; Bethlehem Township</td>
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<td>Visionary Connection--Louise Moore Park to Palmer-Bethlehem Bikeway</td>
<td>PBCC-Northampton Street; Palmer Township</td>
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<td>Wilson Borough Bike Path/Palmer-Bethlehem Township Bikeway, S 25th Street commercial area; Wilson Borough, Palmer Township</td>
<td>Visionary Connection--S 25th St to Philadelphia Rd, D&amp;L Trail/PA Highlands Trail; Wilson Borough, Palmer Township</td>
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<td>Visionary Connection--Wilson Bike Path to D&amp;L Trail, school; Wilson Borough</td>
<td>Catalytic-Let's Connect Easton; City of Easton</td>
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<td>PBCC-Northampton St; Wilson Borough</td>
<td>Catalytic-Let's Connect Easton; City of Easton</td>
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<td>Visionary Connection--Tatamy Road/Bath Pike (Route 248) from Nazareth to Bath; Palmer Township</td>
<td>Palmer Township Bike Path, September 11th National Memorial Trail, park; Palmer Township, Lower Nazareth Township</td>
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<td>Visionary Connection--Northwood Ave &amp; Van Buren Rd; Palmer Township</td>
<td>Palmer Township Bike Path, September 11th National Memorial Trail, Forks Township Trail Network; Palmer Township, Forks Township</td>
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<td>Nor-Bath Trail, park, downtown; Bath Borough</td>
<td>Tatamy Rail Trail, industrial; Tatamy Borough</td>
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<td>33</td>
<td>Northern Tier Trail, Martins-Jacoby Watershed Network Trail; Washington Township</td>
<td>PBCC-Pen Argyl to Bangor, Northern Tier Trail; Bangor Borough</td>
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CHAPTER 6
Policy and Program Recommendations
Policy and Program Recommendations

This chapter outlines policy and program recommendations to support the vision and goals established in Walk/Roll LV. It is expected that the LVPC will take the lead on implementing these recommendations.

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<thead>
<tr>
<th>Recommendation</th>
<th>Plan Goals Addressed</th>
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<tbody>
<tr>
<td><strong>Include strategies to support active transportation and walkable, bikeable, transit-oriented development in regional plans.</strong> The FutureLV Comprehensive Plan/Long-Range Transportation Plan update prioritizes walkable, bikeable, transit-oriented, infill development.</td>
<td>Convenience and Connectivity</td>
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<tr>
<td><strong>Create a dedicated fund for pedestrian and bicycle projects.</strong> For example, the Puget Sound Regional Council dedicates 10 percent of its funding from both the Surface Transportation Block Grant Program and Congestion Mitigation and Air Quality Improvement Program to walking and bicycling projects. A portion of the funds included in this fund might be reserved specifically for further development and implementation of Catalytic Projects and Priority Bicycle Commuting Corridor recommendations.</td>
<td>Convenience and Connectivity</td>
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<td><strong>Continue LVPC staff support for local planning for active transportation and walkable, bikeable, transit-oriented development.</strong> Example projects are the Catasauqua Front Street Study and Bath Multimodal Safety + Parking Analysis.</td>
<td>Convenience and Connectivity</td>
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<td><strong>Pursue funding to support local planning for active transportation and walkable, bikeable, transit-oriented development.</strong> Potential strategies include establishing a grant program to fund local planning projects that support active transportation and/or walkable, bikeable, transit-oriented development. Examples: Metropolitan Washington Council of Governments Transportation and Land use Connections Program, Atlanta Regional Commission Livable Centers Initiative.</td>
<td>Convenience and Connectivity, Seamless Multimodal Integration</td>
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| **Support Complete Streets and Context-Sensitive Bicycle and Pedestrian Supportive Design.** Recommended strategies include:  
  - Adopt regional Complete Streets and bicycle and pedestrian connectivity policies requiring projects that receive funding to include bicycle and pedestrian features that are appropriate for the location and type of roadway.  
  - Develop a regional Complete Streets and context-appropriate bicycle and pedestrian and public transit-supportive design guide and model ordinance for urban, suburban and rural areas for development and redevelopment opportunities. Considerations should include connected street networks, mixed uses, added density, transit- and trail-oriented development, walkable/bikeable warehouse districts, among others. Provide visualizations/renderings to illustrate concepts.  
  - Support development of municipal-level Complete Streets policies by providing training, technical assistance and other resources.  
  - Develop a model municipal ordinance to encourage developers to include long-term bike parking in new development projects. | Convenience and Connectivity, Seamless Multimodal Integration |
| **Support a Safe System/Vision Zero approach to traffic safety.** Recommended strategies include:  
  - Conduct a training (or series of trainings) for municipal government staff on Safe System/Vision Zero using the LVPC Traffic Safety Plan and the Pennsylvania Strategic Highway Safety Plan.  
  - Support development of municipal-level Vision Zero policies and action plans by providing training, technical assistance and other resources.  
  - Continue to fund a public education and outreach campaign focused on the safety impacts of motor vehicle speeds and/or other critical issues impacting pedestrian and bicycle safety, such as impairment, distraction, failure to yield, non-compliance with traffic controls, and other risky pedestrian, bicyclist, and motor vehicle driver behaviors. The Coalition for Appropriate Transportation has already done some work in this area related to motor vehicle speeds and crosswalk yielding. The City of Bethlehem Bureau of Health, on behalf of all Northampton County residents, and the Buckle Up PA Highway Safety Network, on behalf of all Lehigh County residents, also provide public education.  
  - Provide technical assistance to municipalities regarding enforcement techniques that reduce risky travel behaviors, such as high-visibility enforcement of laws pertaining to impairment, cell phone use, crosswalk yielding, and compliance with traffic controls. | Safety and Accessibility |
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<tbody>
<tr>
<td><strong>Provide training and technical assistance to support walkability/bikeability, pedestrian and bicycle safety.</strong> Potential topics include:</td>
<td></td>
</tr>
<tr>
<td>• Land use regulation to support walking, bicycling and public transit.</td>
<td>Convenience and Connectivity</td>
</tr>
<tr>
<td>• Development review to support pedestrian and bicycle access.</td>
<td>Seamless Multimodal Integration</td>
</tr>
<tr>
<td>• Designing for pedestrian and bicycle safety.</td>
<td>Safety and Accessibility</td>
</tr>
<tr>
<td>• The updated American Association of State Highway and Transportation Officials (AASHTO) Bike Guide</td>
<td></td>
</tr>
<tr>
<td>• Innovative pedestrian and bicycle design treatments (e.g., separated bike lanes, bicycle boulevards, bicycle priority lanes, shared streets, pedestrian hybrid beacons, rectangular rapid flashing beacons)</td>
<td></td>
</tr>
<tr>
<td>• Americans with Disabilities Act guidelines and strategies for creating accessible street designs.</td>
<td></td>
</tr>
<tr>
<td>• Strategies to reduce crashes involving alcohol or drug impaired drivers, pedestrians, or bicyclists.</td>
<td></td>
</tr>
<tr>
<td>Training could be provided by hired consultants with expertise in each area or by in-house experts at LVPC or local governments or non-profits in the region. A training program through the Pennsylvania Department of Transportation Local Technical Assistance Program should be considered. Funding for training and technical assistance could come from a range of federal sources, including the Transportation Alternatives and Highway Safety Improvement, and Congestion Mitigation and Air Quality programs. Click here for a more complete list.</td>
<td></td>
</tr>
<tr>
<td><strong>Facilitate regional coordination on active transportation issues.</strong> Recommended steps include:</td>
<td>Convenience and Connectivity</td>
</tr>
<tr>
<td>• Set a regional target for pedestrian and bicycle mode share.</td>
<td>Seamless Multimodal Integration</td>
</tr>
<tr>
<td>• Assign an active transportation coordinator to increase emphasis on active transportation projects at the LVPC and serve as the liaison with municipalities on active transportation issues. Example: Hampton Roads Planning District Commission.</td>
<td>Safety and Accessibility</td>
</tr>
<tr>
<td>• Continue to engage the Multimodal Working Group in discussions about best practices and innovative ideas related to walking, bicycling, access to public transit and walkable/bikeable/transit-oriented development.</td>
<td></td>
</tr>
<tr>
<td>• Continue to support THE LINK to promote and grow the Lehigh Valley trail network and collaborate with partners for off-road trail facilities, including commuting corridors, and interconnections with on-road bicycle and pedestrian facilities.</td>
<td></td>
</tr>
<tr>
<td>• Monitor and regularly report progress toward regional active transportation performance targets, such as through publication of a biannual report card on active transportation. Example: Seattle.</td>
<td></td>
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<tr>
<td>• Develop a regional bicycle and pedestrian wayfinding plan.</td>
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<tr>
<td><strong>Coordinate review of functional classifications and provide input to PennDOT on changes necessary to improve pedestrian and bicyclist safety or implement bicycle network recommendations in this plan.</strong> MPOs have an opportunity to review functional classifications on PennDOT roads every 2-4 years. PennDOT is currently updating its Smart Transportation Guidebook and related street design standards. It is recommended that the LVPC review functional classifications after the updated documents come out and before the next round of functional classification updates.</td>
<td>Safety and Accessibility</td>
</tr>
<tr>
<td><strong>Coordinate review of speed limits and provide input to PennDOT on changes necessary to improve pedestrian and bicyclist safety.</strong> PennDOT generally bases speed limits on the 85th Percentile speed, i.e., the speed at or below which 85 percent of motor vehicles are observed to travel. However, PennDOT has begun using the Federal Highway Administration’s USLIMITS2 tool to set speed limits, which takes land use context into account. The LVPC should recommend that PennDOT use USLIMITS2 for speed limit designations in the Lehigh Valley.</td>
<td>Safety and Accessibility</td>
</tr>
<tr>
<td>Recommendation</td>
<td>Plan Goals Addressed</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td><strong>Continue exploring the potential for regional bikeshare/scootershare.</strong> Next steps include:</td>
<td><strong>Emerging Technologies</strong></td>
</tr>
<tr>
<td>• Conduct a regional bikeshare/scootershare feasibility study to analyze areas of potential demand, gather stakeholder input on bikeshare/scootershare technologies and station/hub locations and conducting financial analyses for a future program.</td>
<td></td>
</tr>
<tr>
<td>• As a function of the Multimodal Working Group, begin coordination on bikeshare/scootershare issues throughout the Lehigh Valley. Regional bikeshare/scootershare systems often require ongoing coordination on issues such as procurement, marketing/communications and system expansion.</td>
<td></td>
</tr>
<tr>
<td>• Reach out to potential vendors (in the case of a privately-operated system) and/or funding partners to gauge interest in a Lehigh Valley bikeshare/scootershare system.</td>
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</tr>
<tr>
<td>• Evaluate options for incorporating any existing local systems into regional bikeshare/scootershare initiatives.</td>
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</tr>
<tr>
<td><strong>Leverage the potential benefits of autonomous vehicles for walking, bicycling and public transit while avoiding potential downsides for these modes.</strong> Potential autonomous vehicle benefits include improved safety and more dedicated roadway space for walking, bicycling and public transportation. Potential autonomous vehicle downsides include increased vehicle miles traveled and sprawl development.</td>
<td><strong>Emerging Technologies</strong></td>
</tr>
<tr>
<td><strong>Incorporate equity into all aspects of regional transportation planning, project selection and implementation.</strong> Recommended strategies include:</td>
<td><strong>Equity</strong></td>
</tr>
<tr>
<td>• Allow time and resources (budget) for authentic, inclusive and effective public outreach and engagement for all LVPC projects, particularly public outreach and engagement to disadvantaged communities.</td>
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<tr>
<td>• Engage (pay) local non-profits with an active presence in disadvantaged communities to assist with public outreach and engagement in those communities.</td>
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<tr>
<td>• When establishing existing conditions, supplement public input with analysis of demographic, crash, mode/trip choice and health data focused on disadvantaged communities.</td>
<td></td>
</tr>
<tr>
<td>• To gain a better understanding of historical inequities, calculate the share of ped/bike infrastructure funding that has been directed to historically disadvantaged communities over the past 10 years and compare to funding for historically advantaged communities.</td>
<td></td>
</tr>
<tr>
<td>• Develop project selection criteria that prioritize funding for walking and bicycling projects in disadvantaged communities.</td>
<td></td>
</tr>
<tr>
<td>• Evaluate each LVPC planning process based on equity. Assess both the outcome of the process and the process itself and collect the necessary data to facilitate such evaluation.</td>
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</tr>
<tr>
<td><strong>Help develop a culture that supports and encourages walking and bicycling.</strong> Recommended strategies include:</td>
<td><strong>Culture</strong></td>
</tr>
<tr>
<td>• Support public education and outreach initiatives aimed at giving Lehigh Valley residents the information, skills and practical experience they need to take advantage of alternatives to driving a private car. Examples include individualized assistance with multimodal trip planning, training on the use of bus racks, and escorts for first-time bicycle commuters.</td>
<td></td>
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<tr>
<td>• Support an Open Streets event, such as the Walk/Roll LV Bethlehem event in June 2019.</td>
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<tr>
<td>• Support pop-up demonstration projects to build support for innovative pedestrian and bicycle facilities.</td>
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<tr>
<td>• Support Safe Routes to School programs.</td>
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<tr>
<td>• Support International Walk to School Day (October) and National Bike to School Day (May).</td>
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</tr>
<tr>
<td>• Expand support for National Bike to Work Week (May).</td>
<td></td>
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<tr>
<td>• Expand support for adult and child bicycle safety classes.</td>
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<tr>
<td>• Establish a regional transportation demand management (TDM) program aimed at reducing single occupancy vehicle travel and encouraging sustainable modes. Example: Arlington Transportation Partners.</td>
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<tr>
<td>• Feature active transportation prominently on the LVPC website.</td>
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<tr>
<td>• Support/advocate for increased funding of the Transportation Alternatives Set-Aside Program and Multimodal Transportation Fund Program.</td>
<td></td>
</tr>
<tr>
<td><strong>Collect better data on walking and bicycling.</strong> Potential strategies include:</td>
<td><strong>Convenience and Connectivity</strong></td>
</tr>
<tr>
<td>• Conduct a regional survey to better understand travel behaviors, e.g., ped/bike mode shares for trip types other than commuting (covered by the American Community Survey) and market segments most likely to be converted to walking and bicycling.</td>
<td></td>
</tr>
<tr>
<td>• Establish a regional pedestrian and bicycle count program to gain a better understanding of pedestrian and bicycle flows, estimate ped/bike demand and justify/evaluate future investments in active transportation. Example: Delaware Valley Regional Planning Commission.</td>
<td></td>
</tr>
</tbody>
</table>
CHAPTER 7

Implementation and Evaluation
Implementation

This chapter presents key steps for implementing Walk/Roll LV recommendations, including pedestrian network improvements, bicycle network improvements and catalytic projects. It also includes sections on assessing traffic impacts, identifying implementation opportunities, the PennDOT Connects program and funding. The chapter concludes with restating the Plan Vision and Goals and a discussion of potential performance measures for assessing progress towards their achievement.

Key Implementation Steps

Because the LVPC does not construct bicycle and pedestrian infrastructure directly, Walk/Roll LV will succeed only if local agencies and other regional partners act to improve active transportation across the Lehigh Valley. This section outlines key steps Lehigh Valley municipalities and the LVPC can take to implement the recommendations contained in Walk/Roll LV. It is also recommended that municipalities incorporate the plan recommendations into appropriate planning documents or regulations, such as a comprehensive plan; parks, recreation and open space plan; or official map.

Note that any entity with primary implementation responsibility will have many partners. An example is municipalities that will work with local leaders, businesses and groups as well as regional partners and state agencies to plan and implement improvements.

Key Implementation Steps for Pedestrian Network Improvements

Chapter 4 identified 30 Priority Pedestrian Areas throughout the Lehigh Valley, classifying them by type and providing generalized recommendations for improving pedestrian access, safety and comfort. As noted in Chapter 4, the generalized Priority Pedestrian Area recommendations can be applied to other locations with similar characteristics. Table 7.1 includes recommended implementation steps for Priority Pedestrian Areas and notes the entity (or entities) with primary responsibility for implementing them.

<table>
<thead>
<tr>
<th>Recommended Implementation Step</th>
<th>Primary Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Determine Priority Pedestrian Area boundaries.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Evaluate existing conditions within Priority Pedestrian Area boundaries.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Develop planning-level recommendations for specific locations. Refer to Chapter 4 for context-appropriate pedestrian improvement strategies. Refer to Appendix A: Design Toolkit for guidance on facility selection and design.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Review and refine recommendations based on public input, constraints, coordination with adjacent jurisdictions, and other considerations. See Assessing Traffic Impacts (following page) for guidance on assessing potential traffic impacts.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Identify implementation opportunities and develop a funding strategy. See Identifying Implementation Opportunities and Funding below for further detail.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Prioritize pedestrian projects in Priority Pedestrian Areas for funding.</td>
<td>LVTS</td>
</tr>
<tr>
<td>Provide technical assistance for project development.</td>
<td>LVPC</td>
</tr>
</tbody>
</table>

Key Implementation Steps for Bicycle Network Improvements

Chapter 5 identified a Priority Bicycle Network consisting of ten Priority Bicycle Commuting Corridors and five Catalytic Projects. Chapter 5 also introduced the Visionary Bicycle Network, a generalized, conceptual framework for creating a bicycle network that connects communities, provides access to key destinations, and serves a
broad range of trip purposes. Table 7.2 includes recommended implementation steps for the Priority Bicycle Network and Visionary Network and notes the entity (or entities) with primary responsibility for implementing them.

Table 7.2: Recommended Implementation Steps for Priority Bicycle Commuting Corridors and the Visionary Network and Primary Responsibility for Implementation

<table>
<thead>
<tr>
<th>Recommended Implementation Step</th>
<th>Primary Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Priority Bicycle Network</strong></td>
<td></td>
</tr>
<tr>
<td>Establish a dedicated funding mechanism to support further development of the Priority Bicycle Network. See Funding below for additional detail.</td>
<td>LVTS</td>
</tr>
<tr>
<td>Reach out to municipalities where Catalytic Projects and Priority Bicycle Commuting Corridors have been identified to provide technical assistance for project development and advice on funding opportunities and next steps.</td>
<td>LVPC</td>
</tr>
<tr>
<td>Review and refine the recommendations based on public input, constraints, coordination with adjacent jurisdictions, and other considerations. Refer to Appendix A: Design Toolkit for guidance on facility selection and design. See Assessing Traffic Impacts for guidance on assessing potential traffic impacts.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Prioritize Catalytic Projects and Priority Bicycle Commuting Corridors for funding.</td>
<td>LVTS</td>
</tr>
<tr>
<td><strong>Visionary Bicycle Network</strong></td>
<td></td>
</tr>
<tr>
<td>Prioritize corridors for evaluation based on the goals established in Walk/Roll LV, additional public input and other relevant criteria.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Confirm alignment and evaluate existing conditions.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Develop planning-level facility and intersection recommendations. Refer to Appendix A: Design Toolkit for guidance on facility selection and design.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Review and refine recommendations based on public input, constraints and other considerations. See Assessing Traffic Impacts for guidance on assessing potential traffic impacts.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Identify implementation opportunities and develop a funding strategy.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Prioritize bicycle projects on the Visionary Network for funding.</td>
<td>LVTS</td>
</tr>
<tr>
<td>Provide technical assistance for project development.</td>
<td>LVPC</td>
</tr>
</tbody>
</table>

Assessing Traffic Impacts

There may be a concern that reallocating roadway space and reconfiguring intersections to better accommodate pedestrians and bicyclists will have negative impacts on motor vehicle travel. This concern may be amplified by the conventional motor vehicle level of service approach to traffic analysis, which prioritizes longer motor vehicle trips at higher speeds over other community values, and travel demand models that often overestimate future motor vehicle travel while underestimating the potential for mode shift. While these tools can be useful in understanding the impacts to motor vehicles, they should not be the sole deciding factor in transportation planning. The conventional motor vehicle level of service and travel demand model approaches tend to yield wider and faster roadways, which have adverse impacts on pedestrian and bicyclist travel.

Often, strategically planned pedestrian and bicycle projects can be implemented with few negative impacts on motor vehicle capacity or travel times. In fact, pedestrian and bicycle projects often improve motor vehicle flow. For example, a 2017 study by the Minnesota Department of Transportation found that bike lanes reduced queuing behind bicyclists and resulted in more predictable motor vehicle movements.\(^1\)

\(^1\) [http://dot.state.mn.us/research/reports/2017/201723.pdf#page=89&zoom=100,0,549](http://dot.state.mn.us/research/reports/2017/201723.pdf#page=89&zoom=100,0,549)
Identifying Implementation Opportunities

The Transportation Improvement Program, roadway resurfacing and development review processes provide implementation opportunities for pedestrian and bicycle projects. Table 7.3 includes recommendations for identifying these implementation opportunities and notes the entity (or entities) with primary responsibility for implementing them.

Table 7.3: Recommendations to identify Implementation Opportunities and Primary Responsibility for Implementation

<table>
<thead>
<tr>
<th>Recommendation</th>
<th>Primary Responsibility</th>
</tr>
</thead>
<tbody>
<tr>
<td>Biennially review the Transportation Improvement Program to determine if there are projects currently in the pipeline that could be modified to better accommodate pedestrian and bicycle transportation.</td>
<td>LVPC</td>
</tr>
<tr>
<td>Annually review the PennDOT roadway resurfacing schedule to identify overlaps with Priority Pedestrian Areas, Bicycle Commuting Corridors, Visionary Bicycle Network, Catalytic Projects and proposed pedestrian and bicycle projects. Communicate with relevant municipalities regarding the potential to coordinate pedestrian and bicycle improvements with roadway resurfacing.</td>
<td>LVPC</td>
</tr>
<tr>
<td>Pursue Walk/Roll LV recommendations and other planned pedestrian and bicycle projects through the PennDOT Connects process. See below</td>
<td>LVPC</td>
</tr>
<tr>
<td>Annually review the municipal resurfacing schedule to identify overlaps with proposed pedestrian and bicycle projects. Communicate with relevant departments regarding the potential to coordinate pedestrian and bicycle improvements with roadway resurfacing.</td>
<td>Municipalities</td>
</tr>
<tr>
<td>Require pedestrian and bicycle projects with new development</td>
<td>Municipalities</td>
</tr>
</tbody>
</table>

PennDOT Connects

PennDOT Connects is a new approach to project planning and development, announced by PennDOT in early 2017, which expands the Department’s requirements for engaging local and planning partners. It requires collaboration with stakeholders before project scopes are developed. PennDOT Connects aims to ensure that “community collaboration happens early, and that each project is considered in a holistic way for opportunities to improve safety, mobility, access and environmental outcomes for all modes and local contexts. Collaboration occurring earlier in the process is intended to help meet current and projected needs and can reduce costly changes later in the project development process.”

The initiative is specifically meant to increase discussion about bicycle and pedestrian accommodation (as well as safety, public transit access, stormwater management, utility issues, local and regional plans and studies, freight-generating land uses and other important issues). This new initiative is an opportunity for more bicycling and walking projects to be developed, especially in communities that have strong local plans in place. Under PennDOT Connects, community transportation needs will be assessed based on local comprehensive plans and other local planning studies, such as bicycle, pedestrian and trail plans. Local governments should be able to show that bicycle and pedestrian features are a documented element of the community vision. Once the community need is established, cost should not be a reason to exclude pedestrian and bicycle components in a project.

Stakeholder Engagement

Stakeholder engagement is critical aspect of most significant transportation projects. As a result, it is important to dedicate sufficient time and resources to the stakeholder engagement process. Time is needed to obtain regular input from the full spectrum of stakeholders, explain the rationale for the project, fully respond to concerns, and build trust and support. Resources are needed to cover the additional expenses that a lengthier process entails and to develop multiple design concepts for stakeholder input.

Resources are also needed for innovative engagement techniques. For example, a temporary pilot is an excellent way to simulate the potential impacts of a separated bike lane project, collect input, increase awareness, and build support. Also, photo-realistic graphics or animations are a great way to help stakeholders visualize proposed designs and can help build support and excitement. However, both of these strategies require additional time and funding to develop.
Interim Implementation

An interim approach to constructing pedestrian and bicycle projects may be appropriate if there is a need to implement them quickly (e.g., due to an identified safety concern) or funding is insufficient to pursue costlier approaches right away. Interim approaches typically involve less expensive materials that can be installed quickly. Interim approaches differ from temporary approaches [See Temporary Pilot Projects text box] in that they are intended to last a few years rather than a few days or weeks. Examples of lower cost materials that might be used for interim construction include:

- Flex posts—Can be used for curb extensions, chicanes, neckdowns, medians, and other traffic calming measures. Can also be used as a measure to separate a bike lane from the adjacent street.
- Pre-manufactured curbs—Can be used for curb extensions, chicanes, neckdowns, medians, and to provide separation between a street and an adjacent bike lane.
- Rubber speed cushions—Can be used in place of asphalt speed cushions or humps.
- Signage—Can be used to provide speed limit information and to warn people they are entering a low speed zone.
- Paint or thermoplastic—Can be used for pedestrian crossings, bike lanes, narrower motor vehicle travel lanes, and pavement markings.

When selecting materials for interim construction, consider how well they will hold up under local traffic and weather conditions. For example, thermoplastic is generally more durable than paint and may be more suitable in locations with high motor vehicle traffic. This will be the community’s first look at the new design before it becomes permanent. If it fails because of poor material choices, community momentum behind the project may be undermined.

Temporary Pilot Projects

If there is concern about a pedestrian and bicycle project, consider implementing it on a temporary or pilot basis before constructing it permanently. This approach is a way to test out how a concept works and build support while demonstrating benefits. Pilot projects may be in place for a few hours or a few weeks. For pilot projects to be effective, the temporary measures should:

- Simulate the ultimate proposed design as closely possible.
- Be accompanied by education, outreach, and enforcement as necessary.
- Be installed for long enough to enable public officials and community members to become familiar with the changes.
- Collect metrics of acceptance/performance of the zone.

Temporary pilot projects are sometimes referred to as “tactical urbanism.” For ideas about how to implement tactical urbanism, see: Tactical Urbanism: Short Term Action, Long Term Change.
Table 7.4 presents some common sources of funding for active transportation projects. When pursuing funding, smaller projects can often be grouped in with larger, more complex projects that may require a mix of funding sources.

<table>
<thead>
<tr>
<th>Program Name</th>
<th>Funding Source</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>General Funds, Annual Budget</td>
<td>Local</td>
<td>Bicycle, pedestrian and trail projects can be funded through a local jurisdiction’s general fund.</td>
</tr>
<tr>
<td>Bond Programs</td>
<td>Local</td>
<td>Cities sometimes sell bonds to investors to fund transportation projects, including pedestrian and bicycle improvements.</td>
</tr>
<tr>
<td>Adopt-a-Path Programs</td>
<td>Local</td>
<td>Maintenance of bicycle paths and trails can be funded by private community groups and non-profits through an Adopt-a-Path program. This is often done in exchange for public recognition, such as signs along the path saying, “Maintained by (name).”</td>
</tr>
<tr>
<td>Neighborhood Improvement Districts (PIDs) / Tax Increment Financing</td>
<td>Local</td>
<td>Bicycle and pedestrian improvements can often be included as part of larger business improvement and retail district beautification efforts. Similar to benefit assessments, BIDs collect levies on businesses to fund area-wide improvements that benefit businesses and improve access for customers.</td>
</tr>
<tr>
<td>Private and Nonprofit Partnerships</td>
<td>Local</td>
<td>Many communities have developed innovative partnerships that bring in funding from private or nonprofit organizations to create bicycle, pedestrian and trail projects. The Delaware and Lehigh National Heritage Corridor is an example of this in the Lehigh Valley.</td>
</tr>
<tr>
<td>Better Utilizing Investments to Leverage Development (BUILD)</td>
<td>U.S. Department of Transportation</td>
<td>The BUILD program provides $1.5 billion in discretionary funds for transportation projects. Preference goes to projects in rural areas, and projects are evaluated based on safety, economic competitiveness, quality of life, environmental protection, state of good repair, innovation and opportunity for additional non-federal revenue.</td>
</tr>
<tr>
<td>Transportation Alternatives Set-Aside</td>
<td>LVTS and Pennsylvania Department of Transportation</td>
<td>The Transportation Alternatives Set-Aside (TASA) Program provides funding for programs and projects defined as transportation alternatives, including on- and off-road pedestrian and bicycle facilities, pedestrian and bicyclist education programs, transit access, environmental mitigation, recreational trails, and Safe Routes to School. TASA funding can be used as match funding for the PennDOT Multimodal Transportation Fund, Community Conservation Program, and other grant programs. In addition, TASA funding secured at the local MPO-level can elevate an application for state-level Transportation Alternatives funding and vice versa.</td>
</tr>
<tr>
<td>Highway Safety Improvement Program</td>
<td>LVTS and Pennsylvania Department of Transportation</td>
<td>Each year, PennDOT receives approximately $97 million in federal funding for its Highway Safety Improvement Program (HSIP). The Department distributes $45.5 million of this funding to its planning regions based on fatalities, major injuries and reportable crashes. Each planning organization receives $500,000 to allow for larger projects in the smaller planning organizations. The remaining $35 million is awarded annually to implement low- to moderate-cost systemic infrastructure safety improvements. The overall purpose of this program is to achieve a significant reduction in traffic fatalities and serious injuries on state roads through the implementation of medium-cost infrastructure-related highway safety improvements. Pedestrian and bicyclist concerns can be addressed through this program.</td>
</tr>
<tr>
<td>Congestion Mitigation and Air Quality Program</td>
<td>PA Transportation Management Associations</td>
<td>The Congestion Mitigation and Air Quality Program provides funding for projects and programs in air quality nonattainment and maintenance areas for ozone, carbon monoxide, and particulate matter that reduce transportation-related emissions. Eligible projects include planning, design, and construction of pedestrian and bicycle facilities and outreach to encourage pedestrian and bicycle transportation.</td>
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</tbody>
</table>
**Evaluation**

**Evaluating Projects**

Evaluation is critical for understanding whether a pedestrian or bicycle project is achieving the vision and goals established for it and whether any adjustments are needed to improve performance. Also, positive results from an evaluation process can help make the case for pedestrian and bicycle projects elsewhere.

The selected evaluation approach should be based on project goals. For example, if a project goal is to increase bicycling, then bicycle counts should be collected before and after the project is implemented to determine its impact. Likewise, if the goal of a project is to improve safety, then data related to safety, such as crashes and motor vehicle speeds, should be collected before and after.

**Evaluating Progress Toward Plan Implementation**

Table 7.5 includes potential performance measures to assess progress toward achieving the vision and goals established for Walk/Roll LV. Some are measures required by the U.S. Department of Transportation and incorporated into the transportation planning and funding process. Others are specific to this plan. The Lehigh Valley Transportation Study, Lehigh Valley Planning Commission, Pennsylvania Department of Transportation and the Multimodal Working Group should work together to evaluate and select the performance measures and collect any needed data to evaluate the success of Walk/Roll LV implementation moving forward. These performance measures should be balanced with the other metrics, including safety and even freight, to support and achieve an “all-mode equal” transportation system.
Table 7.5: Potential Performance Measures

<table>
<thead>
<tr>
<th>Goal</th>
<th>Potential Performance Measure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reduce crashes and improve personal security for people who walk, roll, bicycle or use public transit. Eliminate barriers for people with disabilities.</td>
<td>Average number of non-motorized fatalities and non-motorized serious injuries per year (Required by PennDOT)</td>
</tr>
<tr>
<td></td>
<td>Average number of non-motorized fatalities and non-motorized serious injuries per 100,000 residents per year</td>
</tr>
<tr>
<td>Make it easier for people of all ages and abilities to get where they want to go by walking, rolling, bicycling and using public transit</td>
<td>Percentage of walking and bicycling travel to work</td>
</tr>
<tr>
<td></td>
<td>Total linear miles of shared use path</td>
</tr>
<tr>
<td></td>
<td>Total linear miles of separated bike lane</td>
</tr>
<tr>
<td></td>
<td>Total linear miles of sidewalk</td>
</tr>
<tr>
<td></td>
<td>Percent of facility mileage recommended in plan completed</td>
</tr>
<tr>
<td>Provide seamless integration between trails, sidewalks, roads and public transit.</td>
<td>Percent of public transit stops adjacent to sidewalk</td>
</tr>
<tr>
<td></td>
<td>Percent of public transit stops on arterial roadways adjacent to bikeways (i.e., bike lanes or side paths)</td>
</tr>
<tr>
<td>Foster regional coordination to improve pedestrian and bicycle conditions and develop a connected regional bicycle network.</td>
<td>Number of activities organized per year by the LVPC that address conditions for walking, rolling and bicycling or developing a regional bicycle network and include representatives from at least 10 regional stakeholders, including municipalities, LANta and others</td>
</tr>
<tr>
<td>Make walking, rolling, bicycling and public transit use key elements of regional recreation and transportation.</td>
<td>Number of people using the D&amp;L Trail per year</td>
</tr>
<tr>
<td></td>
<td>Number of Lehigh Valley schools registered for Walk to School Day events on walkbiketoschool.org per year</td>
</tr>
<tr>
<td>Provide equal access to high-quality, low-stress walking, rolling, bicycling and public transit networks for everyone in the Lehigh Valley.</td>
<td>Percentage of pedestrian and bicycle killed and seriously injured crashes occurring in Census Block Groups with high poverty rates, i.e., in the top 25% for percent of households in poverty</td>
</tr>
<tr>
<td>Leverage emerging technologies to increase the safety, comfort and convenience of walking, rolling, bicycling and public transit use.</td>
<td>Percentage of non-single occupant vehicle travel to work (Required by PennDOT for the Delaware Regional Planning Commission and Southwestern Pennsylvania Commission)</td>
</tr>
<tr>
<td></td>
<td>Average daily vehicle miles traveled per capita</td>
</tr>
</tbody>
</table>

2 Note: These measures also relate to the “all ages and abilities” goal above.
Conclusion

The vision for Walk/Roll LV is to make the Lehigh Valley a place where a growing number of people of all ages and abilities choose walking, rolling, bicycling and public transit as a safe and convenient daily option for commuting, enjoyment, exercise or mobility.

Walk/Roll LV creates an implementable strategy to accomplish this vision, organized around the following key goals.

- Reduce crashes and improve personal security for people who walk, roll, bicycle or use public transit. Eliminate barriers for people with disabilities.
- Make it easier for people of all ages and abilities to get where they want to go by walking, rolling, bicycling and using public transit.
- Provide seamless integration between trails, sidewalks, roads and public transit.
- Foster regional coordination to improve pedestrian and bicycle conditions and develop a connected regional bicycle network.
- Make walking, rolling, bicycling and public transit use key elements of regional recreation and transportation.
- Provide equal access to high-quality, low-stress walking, rolling, bicycling and public transit networks for everyone in the Lehigh Valley.
- Leverage emerging technologies to increase the safety, comfort, and convenience of walking, rolling, bicycling and public transit use.

Walk/Roll LV outlines an ambitious vision, targeted goals, and specific pedestrian and bicycle-related projects, policies, and initiatives. Working together and toward this shared vision, LVPC and its regional partners will make walking, rolling, bicycling and public transit a safe and convenient daily option for people of all ages and abilities.

Key plan outcomes are summarized below. To move these forward, it will be critical for the municipalities to review, analyze and prioritize the recommendations.

Priority Bicycling Network

The plan’s centerpiece is a 73-mile Priority Bicycle Network consisting of 10 Bicycle Commuting Corridor projects and 5 Catalytic Projects. These projects will provide a critical framework for bicycle commuting in the Lehigh Valley. They will be prioritized for implementation, recognizing that some may take longer to develop due to their complexity.

Visionary Bicycle Network

The plan also includes a 612-mile Visionary Bicycle Network. The Visionary Bicycle Network represents a vision for improving the connectivity of the bicycle network for both commuting and recreational purposes. Some elements of the Visionary Bicycle Network have already been constructed or are in the planning stages.

Pedestrian Network Recommendations

Pedestrian network recommendations are focused on 30 Priority Pedestrian Areas. The municipalities where the Priority Pedestrian Areas are located will determine Priority Pedestrian Area boundaries and develop location-specific recommendations. LVTS will then identify opportunities to prioritize these recommendations for funding.

Policy and Program Recommendations

This plan also includes a set of policy and program initiatives aimed at supporting the vision and goals outlined above. LVPC will take a lead role in implementing these initiatives in collaboration with municipal governments and other stakeholders.
Appendix A: Design Toolkit

The Design Toolkit provides guidance for improving safety, comfort and access for people who are walking, rolling and bicycling. Specifically, the Toolkit includes guidance on the design of:

- Pedestrian and bicycle facilities, including sidewalks, shared-use paths, separated bike lanes, and buffered bike lanes
- Intersections and crossings
- Bridges
- Bus stops
- Bicycle parking

It also includes guidance for bicycle facility and crosswalk improvement selection.

The Toolkit is intended for high-level planning and engineering and is not intended to be exhaustive. Designs should comply with the Proposed Public Rights-of-way Accessibility Guidelines (Proposed PROWAG) if in a public right-of-way or Advance Notice of Proposed Rulemaking (AN-PRM) on Accessibility Guideline if in a private right-of-way. The following resources should also be consulted:

- Pennsylvania Traffic Control Detailed Drawings, Policies and Design Manuals
- FHWA Separated Bike Lane Planning and Design Guide, 2015
- FHWA Achieving Multimodal Networks: Applying Design Flexibility and Reducing Conflicts, 2016

Facilities

Trails and Sidepaths

Trails and sidepaths are shared-use facilities that accommodate two-way travel for walking, rolling, bicycling and other active modes such as jogging and skating. A sidepath is a shared use facility that is located inside or adjacent to the roadway right-of-way. A trail is a shared-use facility that is in an independent right-of-way, except where it interacts with streets to make neighborhood connections.

Guidance

- The minimum width of a shared use path is 10 feet. More width (11-14 feet) is needed in locations where volumes exceed 300 total users during peak hour.
- Crushed stone and other unpaved surfaces may not be appropriate for trails with grades steeper than 3 percent due to drainage/erosion issues and bicycle handling concerns.
- A graded shoulder area of 3-5 feet should be included on both sides of the path.
- There should be a minimum 2-foot clearance between the path and vertical objects such as poles, signs and landscaping.
- At intersections, sidepath design should follow separated bike lane design guidance.

Considerations

- An urban shared use path with a variety of users, frequent conflicts and constraints may be designed for lower speeds than a rural path that includes few conflicts and is used primarily by recreational bicyclists.
- At driveways, consider using color and other design details to alert drivers that trail users will be coming from both directions.
- Attractive and comfortable design includes:
  » Intuitive and safe intersection crossings.
  » Adequate widths to enable side-by-side travel and passing.
  » Separation between pedestrians and bicyclists in areas with higher levels of use.
Bicycle Facilities

Separated Bike Lanes

Separated bike lanes (also known as protected bicycle lanes or cycle tracks) combine the user experience of a sidepath with the on-street infrastructure of a conventional bicycle lane. Separated bike lanes may be either one-way or two-way and are physically separated from motor vehicle traffic and distinct from the sidewalk (although they may be at sidewalk level). Separated bike lanes provide separation from motor vehicles both horizontally, by providing a separate space for bicycling along the street and vertically, by including physical objects and/or a change in elevation from the street surface.

Guidance

- Separated bike lanes should generally be installed on any road with one or more of the following characteristics:
  - Total traffic lanes: 3 lanes or greater
  - Posted speed limit: 30 mph or higher
  - Average Daily Traffic: 6,000 vehicles or greater
  - Streets that are designated as truck or bus routes
- For one-way separated bike lanes, the preferred width is 6.5 feet wide. Wider lanes are preferred if bicyclist volumes exceed 150 at peak hour. In constrained corridors, separated bike lanes should be sufficiently wide to enable passing maneuvers between bicyclists and other users where possible.
- For two-way separated bike lanes, the preferred width is 11 feet. Again, wider lanes are preferred if bicyclist volumes exceed 150 at peak hour. In constrained corridors, two-way separated bike lanes should be a minimum of 8 feet.
• A minimum shy distance of 1 foot should be provided between vertical objects in the sidewalk or street buffer and the bicycle lane.

• Intersections with separated bike lanes should be designed to ensure slow-speed turning movements for motor vehicles (10 mph or less) to improve yielding.

• At intersections, well-designed protected intersections (Figure A.1) are preferred over designs that require people riding bikes to mix with motor vehicle traffic. Protected intersections clearly define pedestrian and bicyclist operating spaces within the intersection and minimize potential conflicts between users.

Considerations
• Separated bike lanes can provide different levels of separation (Figure A.2):
  » Separated bike lanes with flexible delineator posts (“flexposts”) offer the least separation from traffic and are appropriate as an interim solution, depending on the land use context. Flexible delineator posts can be visually obtrusive in single-family neighborhoods.
  » Separated bike lanes that are raised above the roadway surface and include a wider buffer provide the greatest level of separation from traffic, but often require road reconstruction.
  » Separated bike lanes that are protected from traffic by a row of on-street parking offer a high degree of separation.
  » Separated bike lanes can be integrated with a variety of public transit stop designs. They are compatible with mid-block, near-side and far-side public transit stop locations. Where feasible, separated bike lanes should be routed between the public transit stop and the curb to eliminate conflicts between buses and bicyclists.
  » On two-way streets, one-way separated bike lanes on each side of the street are typically preferred over a two-way separated bike lane or sidepath on one side of the street. This configuration provides intuitive and direct connections with the surrounding transportation network, including simpler transitions to existing bike lanes and shared travel lanes. It is also the most consistent with driver expectation since bicyclist operation is in the same direction as motor vehicle operation.
  » It may be beneficial to locate a two-way separated bike lane on one side of the street to better connect to the bicycle network or provide access to destinations such as businesses, schools, public transit centers, employment centers, parks and neighborhoods.

(See section on Bridge Design for considerations of separated bike lanes on bridges.)
Figure A.1: Options for separating the bike lane from the motor vehicle traffic.

1. corner island
2. forward bicycle queuing area
3. motorist yield zone
4. pedestrian crossing island

5. pedestrian crossing of the separated bike lane
6. pedestrian curb ramp
7. bicycle crossing of travel lanes
8. pedestrian crossing of travel lanes

Figure A.2: Protected intersection

- Raised Island
- Flexible Delineator Posts
- Rigid Bollards
- Parking Stops
- Planters
- Concrete Barriers
- Parking
**Bicycle Boulevards**

Bicycle boulevards are streets designed to prioritize bicycle travel by including physical traffic calming measures that encourage low motor vehicle speeds and volumes and by providing safety enhancements at intersections, particularly when crossing higher speed and volume roads.

**Guidance**

- The design should produce low motor vehicle speeds and volumes. Operating speeds should be 20 mph or less and Average Daily Traffic Volumes should be 1,000 or less (3,000 maximum).
  - Horizontal traffic calming measures such as chicanes and traffic circles can be used to achieve the desired speeds. (See Horizontal and Vertical Deflection below for more.)
  - Traffic management devices such as diverters or semi-diverters can be used to achieve the desired volumes, while still enabling local access to the street.
- The design should minimize the need for people riding bikes to stop at crossings with local streets.
- The design should provide safe and convenient crossings at major roads.

**Considerations**

- Bike boulevards can provide critical connections to neighborhoods, schools, parks, business districts, major bicycle corridors, major public transit corridors, employment centers and other key destinations.
- Grid pattern street networks are typically better suited for bike boulevards because parallel streets provide multiple alternative routing options for motor vehicles and they are simple and intuitive for people riding bikes to follow because they minimize turns.
- On suburban streets that form loose grids and have multiple dead-end streets (cul-de-sacs), neighborhood streets combined with short segments of shared use paths to connect dead-end streets or pass through parks can make bicycle boulevards more viable over longer distances.
Buffered and Conventional Bike lanes

Conventional bike lanes are roadway travel lanes that are designated for preferential use by people riding bikes. They are one-way facilities that typically carry bicycle traffic in the same direction as adjacent motor vehicle traffic. Buffered bike lanes are designed with a striped space separating the bicycle lane from adjacent motor vehicle travel lane and/or parking lane to increase the comfort of people bicycling.

Guidance

- Buffered bike lanes should generally be considered on any road with one or more of the following characteristics:
  - Total traffic lanes: 3 lanes or fewer.
  - Posted speed limit: 30 mph or lower.
  - Average Daily Traffic: 9,000 vehicles or fewer.
  - Parking turnover: infrequent.
- Conventional bike lane widths should meet the following criteria:
  - Adjacent to parking: 6 - 7 ft desirable, 5 ft minimum
  - Adjacent to a curb or curb with gutter: 5 - 7 ft desirable, 4 ft minimum
- Buffered bike lanes widths should meet the following criteria:
  - Bike lane: 5 ft minimum, 6 ft desirable.
  - Buffer: 3 ft minimum adjacent to parallel parking, 2 ft minimum adjacent to diagonal parking.
- Where there is 7 feet of roadway width available for a bicycle lane, a buffered bicycle lane should be installed instead of a conventional bicycle lane.

Considerations

- Increasing the lateral separation between bicyclists and motor vehicles provides a more comfortable environment for people riding bikes.
- On streets designated for one-way operation, it is sometimes desirable to allow bicyclists to operate in two ways by marking a counterflow bike lane on the appropriate side separated by a yellow center line marking.
- Where space is available, the provision of a wider bicycle lane or the addition of a buffer is preferable to encourage people riding bikes to operate in the center of the bicycle lane.
- In cases where a buffer is added, it is usually placed between the bike lane and the motor vehicle travel lane. However, a buffer may be installed on both sides of the bike lane or only on the parking lane side. In locations with high parking turnover, consideration should be given to placing a buffer between the bike lane and the parking lane.
- Where it is feasible to provide buffers totaling 6 feet or more in width, consideration should be given to installing separated bike lanes as an alternative approach.

Figure A.3: Example of a buffered bike lane.
**Shared lane markings**

Bicycles may be operated on all roadways except where prohibited by statute or regulation. Thus, shared lanes exist in all contexts: on urban streets, on suburban streets and roads and on rural roads and highways. On lower speed streets, shared lane markings (or “sharrows”) can be used to indicate to motorists and people riding bikes where bicyclists should position themselves in the roadway. They can also be used to emphasize bicyclist priority on bicycle boulevards or increase awareness that bicyclists may operate within shared lanes on streets with separated bike lanes or sidepaths.

**Guidance**

- Do not use on roads with speed limits above 35 mph or within bicycle lanes or shoulders.
- If lane is less than 14 feet wide, place marking in the center of the lane.
- If lane is more than 14 feet wide and there is no parking lane, place marking a minimum of 4 feet from the face of curb, gutter seam or edge of the traveled way.

More distance is needed where there are potential hazards, such as inlets or gutters, or where there is are physical objects, such as guardrails or walls, immediately adjacent to the travel lane.

- If lane is more than 14 feet wide and a parking lane is present, place markings 13-14 feet from the face of curb or edge of traveled way.

**Considerations**

- Bicyclists who fit the Interested but Concerned profile will prefer not to operate in shared lanes unless traffic volumes are below 3,000 vehicles/day and operating speeds are below 30 mph. Above those thresholds these bicyclists will prefer separation from traffic, with a preference for physical separation where volumes exceed 6,000 vehicles/day or motor vehicle speeds exceed 30 mph.
- Research finds that shared lane markings can help reduce wrong-way riding and sidewalk riding, but their impact on bicyclist lane positioning and motorist behavior on streets with higher operating speeds and volumes is modest to negligible.
Bicycle Facility Selection Process

Bicycle facility selection depends primarily on roadway traffic speeds and volumes. Some people are willing to bike in mixed traffic but most will not consider bicycling a viable transportation option unless they can make their entire trip along a “low-stress” route that is safe, comfortable and convenient. For more on bicyclist user types, see page 37 in Chapter 3: Gaps and Needs.

The diagram below outlines the recommended selection process for bicycle facilities in the Lehigh Valley. The process includes identifying a desired corridor and facility type but offers a back-up plan if the desired corridor and facility combination are infeasible. This process is intended primarily for locations where Walk/Roll LV does not specify a preferred bicycle facility type but may also be applied to Walk/Roll LV facility recommendations if further analysis reveals them to be infeasible.

Figure A.4: Bicycle Facility Selection Process
Bicycle Facility Selection

Figure A.5 provides a framework for selecting bicycle facilities in urban, suburban and rural small town contexts to produce a low-stress bicycling experience that attracts riders of all ages and abilities. Note that as speeds and traffic volumes increase, additional separation from motor vehicle traffic is needed to achieve low-stress bicycling conditions.

Notes
- Chart assumes operating speeds are similar to posted speeds. If they differ, use operating speed rather than posted speed.
- See Section 4.4 of the FHWA Bikeway Selection Guide for examples of alternatives if the preferred bikeway type is not feasible.

Figure A.6 provides a framework for selecting shoulder widths on rural roads. Shoulders are appropriate for confident, recreational riders in a rural context; however, additional separation is needed for routes that are intended to serve a broader spectrum of riders.

Notes
- This chart assumes the project involves reconstruction or retrofit in constrained conditions. For new construction, follow recommended shoulder widths in the AASHTO Green Book.
- A separated shared use pathway is a suitable alternative to providing paved shoulders and provides greater separation which increases safety and comfort for pedestrians and bicyclists.
- Chart assumes operating speeds are similar to posted speeds.
- If they differ, use operating speed rather than posted speed. If the percentage of heavy vehicles is greater than 10 percent, consider providing a wider shoulder or a separated pathway.
Sidewalks

Sidewalks are critical for pedestrian safety, comfort and accessibility. They provide people who are walking and rolling with a space to travel within the public right-of-way that is separated from motor vehicles. They are also used for social interaction, lingering and people-watching. In addition to these activities, the space between the property line and street can accommodate street trees and other plantings, stormwater infrastructure, street lights and bicycle racks.

Sidewalk space typically consists of three zones: the Frontage Zone, the Pedestrian Zone and the Amenity Zone.

Pedestrian Zone

The Pedestrian Zone is the walkable area within the streetscape. It should be continuous, clear of obstacles and provide an unobstructed passageway for people who are walking and rolling to access street crossings and adjacent amenities.

Guidance

• For the Pedestrian Zone to function, it must be kept clear of any obstacles and be wide enough to comfortably accommodate expected pedestrian volumes including people using mobility assistance devices, pushing strollers or pulling carts.

• To maintain the social quality of the street, the width of the Pedestrian Zone should accommodate pedestrians passing singly, in pairs or in small groups as anticipated by density and adjacent land use.

• At driveway crossings, continue the Pedestrian Zone material, width, grade and cross-slope across the driveway.

• Provide curb ramps at intersections and crossings. ADA-compliant curb ramps are required by law for newly constructed or altered streets, roads and sidewalks.

Frontage Zone

The Frontage Zone is the area between the Pedestrian Zone and building face. It provides a buffer between people who are walking and rolling in the Pedestrian Zone and opening doors, architectural elements and building signage. This zone may also provide space for sidewalk cafés, store entrances, window shopping or landscaping.

Considerations

• Where buildings are located against the back of the sidewalk and constrained situations do not provide width for the Frontage Zone, the effective width of the Pedestrian Zone is reduced by 2 feet, as people who are walking and rolling will shy away from the building edge.

Amenity Zone

The Amenity Zone is where public amenities and utilities are located, including street signs, light poles, benches, bike racks and landscaping. Sometimes private retail seating is located in this zone as well.

Guidance

• The Amenity Zone should be wide enough to accommodate two curb ramps at the corner, each aligned with its own marked crosswalk. If such space is not available, it may be possible to install a curb extension to accommodate the ramps. Otherwise, only one curb ramp can be installed. This ramp is typically oriented at a diagonal to the crosswalks, since it needs to serve both; however, this orientation is not ideal, particularly for people with mobility disabilities, since it directs pedestrians into the center of the intersection rather than into the crosswalk.

• The width of the Amenity Zone should be considered when selecting trees and vegetation, so that plantings do not damage the sidewalk as they mature.

Figure A.7: Example of continuing the pedestrian zone material, width and cross-slope across a driveway.
- Utilities, street trees and other sidewalk furnishings should be set back from the curb face a minimum of 18 inches but should not obstruct the Pedestrian Zone.
- Green infrastructure elements should be designed to make use of stormwater runoff from the sidewalk and the street. Permeable paving may be considered.
- Vertical objects in the Amenity Zone must be strategically placed to preserve sight lines, avoid damage from vehicles on the street and allow access to and from parked cars and public transit stops.
- The Amenity Zone should be designed to accommodate winter snow storage and prevent snow from obstructing the Pedestrian Zone.
Intersections and Crossings

Crosswalks

Crosswalks continue the path of the sidewalk across an intersection, designating where people walking and rolling may cross. Legal crosswalks exist at all locations where sidewalks intersect the roadway, regardless of whether pavement markings are present. Providing a marked crosswalk communicates to drivers that people walking and rolling may be present and helps guide pedestrians to locations where they should cross the street.

Guidance

- Crosswalk locations should be well-lit, so that drivers can easily see crossing pedestrians in low light conditions.
- Crosswalk markings should be placed on all legs of signalized intersections, in school zones and across streets with more than minimal levels of traffic.
- Marked crosswalks should be at least 10 feet wide or the width of the approaching sidewalk if it is greater. In areas of heavy pedestrian volumes, crosswalks can be up to 25 feet wide.
- High-visibility crosswalk markings are preferred over standard crosswalk markings, particularly in locations with higher motor vehicle volumes and speeds, higher numbers of pedestrians or visibility/driver awareness concerns (Figure A.8).
- Marked crosswalks should generally cross perpendicular to streets to minimize pedestrian crossing distance and exposure to traffic.
- ADA-compliant curb ramps should direct pedestrians into the crosswalk. The bottom of the ramp should lie within the area of the crosswalk (flares do not need to fall within the crosswalk).
- Raised crossings can calm traffic and increase the pedestrian visibility (Figure A.9).

Standard crosswalk marking

High visibility crosswalk marking

Figure A.8: Examples of standard and high visibility crosswalk markings.

Figure A.9: Example of a raised intersection.

1 This rule does not apply if a “No Pedestrian Crossing” sign (R9-3) is posted at the intersection.
Selecting Crosswalk Countermeasures

Table A.1 and Table A.2 below provide guidance on selecting countermeasures to improve pedestrian safety at pedestrian crossing locations. Table A.1 suggests countermeasures that should be considered based on motor vehicle volumes, roadway speeds and the number of motor vehicle travel lanes. Table A.2 provides additional guidance based on the safety problems that are observed at a crossing location, e.g., through analysis of the site’s crash history or a pedestrian safety audit.

Table A.1: Applicability of Pedestrian Crash Countermeasures by Roadway Feature

<table>
<thead>
<tr>
<th>Roadway Configuration</th>
<th>Posted Speed Limit and AADT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Vehicle AADT &lt;9,000</td>
</tr>
<tr>
<td></td>
<td>≤30 mph</td>
</tr>
<tr>
<td>2 lanes (1 lane in each direction)</td>
<td>1</td>
</tr>
<tr>
<td>3 lanes with raised median (1 lane in each direction)</td>
<td>1</td>
</tr>
<tr>
<td>3 lanes w/o raised median (1 lane in each direction with a two-way left-turn lane)</td>
<td>1</td>
</tr>
<tr>
<td>4+ lanes with raised median (2 or more lanes in each direction)</td>
<td>1</td>
</tr>
<tr>
<td>4+ lanes w/o raised median (2 or more lanes in each direction)</td>
<td>1</td>
</tr>
</tbody>
</table>

Given the set of conditions in a cell,

- **Signifies that the countermeasure should always be considered, but not mandated or required, based upon engineering judgment at a marked uncontrolled crossing location.**
- **Signifies that crosswalk visibility enhancements should always occur in conjunction with other identified countermeasures.**

The absence of a number signifies that the countermeasure is generally not an appropriate treatment, but exceptions may be considered following engineering judgment.

**PHBs and RRFBs should not both be installed at the same crossing location. Also, PHB’s are not currently approved for use in Pennsylvania. (Source: FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations).**
Table A.2: Safety Issues Addressed by Each Countermeasure

*These countermeasures make up the Safe Transportation for Every Pedestrian countermeasure “crosswalk visibility enhancements.” Multiple countermeasures may be implemented at a location as part of crosswalk visibility enhancements. (Source: FHWA Guide for Improving Pedestrian Safety at Uncontrolled Crossing Locations).

<table>
<thead>
<tr>
<th>Pedestrian Crash Countermeasure for Uncontrolled Crossings</th>
<th>Safety Issue Addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conflicts at crossing locations</td>
</tr>
<tr>
<td>Crosswalk visibility enhancement</td>
<td>✅</td>
</tr>
<tr>
<td>High-visibility crosswalk markings*</td>
<td>✅</td>
</tr>
<tr>
<td>Parking restriction on crosswalk approach*</td>
<td>✅</td>
</tr>
<tr>
<td>Improved nighttime lighting*</td>
<td>✅</td>
</tr>
<tr>
<td>Advance Yield Here To (Stop Here For) Pedestrians sign and yield (stop) line*</td>
<td>✅</td>
</tr>
<tr>
<td>In-Street Pedestrian Crossing sign*</td>
<td>✅</td>
</tr>
<tr>
<td>Curb extension*</td>
<td>✅</td>
</tr>
<tr>
<td>Raised crosswalk</td>
<td>✅</td>
</tr>
<tr>
<td>Pedestrian refuge island</td>
<td>✅</td>
</tr>
<tr>
<td>Pedestrian Hybrid Beacon</td>
<td>✅</td>
</tr>
<tr>
<td>Road Diet</td>
<td>✅</td>
</tr>
<tr>
<td>Rectangular Rapid-Flash ing Beacon</td>
<td>✅</td>
</tr>
</tbody>
</table>
Intersection Geometry

The design of intersections has a significant impact on pedestrian and bicyclist comfort, safety and mobility. Absent a grade separation, this is where pedestrians, bicyclists and motor vehicle drivers inevitably cross paths. The design of intersections should consider how pedestrians, bicyclists and other users navigate the approach, departure and crossing of the intersection.

Guidance

- Intersection designs should result in an actual curb radius that is between 10 to 25-feet. The default curb radius for two intersecting residential streets should be 10 to 15-feet. For all other street classifications, including streets that intersect with residential streets, corner design should strive for an actual curb radius that is no more than 15-feet. (Figure A.10)

- On low volume (less than 4,000 vehicles per day), two-lane streets, corner design should assume that a large vehicle will use the entire width of the departing and receiving travel lanes, including the oncoming traffic lane.

- Geometric design features should complement traffic control devices to promote compliance as well as improve safety and comfort where users are expected to yield the right of way.

- Where eliminating of conflicts is not possible or practical, the design should limit the amount of time and space where pedestrians and bicyclists are exposed to moving traffic.

- If conflict points cannot be eliminated, intersection design should minimize the speed differential between users at the points where travel movements intersect.

- Crossing islands are effective at reducing crashes at uncontrolled locations on busy multi-lane roadways where gaps are difficult to find, particularly for slower pedestrians, such as pedestrians with disabilities, older pedestrians and children.

Figure A.10: Curb Radius
Minimizing Bicyclist Exposure at Intersections

It is particularly important to ensure bicycle facility design maintains separation through intersections, given the prevalence of crashes involving people riding bikes at these locations. As demonstrated in the diagram below, with increased separation, the number of conflict points between bicyclists and motorists is reduced, thereby enhancing safety.

Figure A.11: Comparison of Bicyclist Exposure at Intersections. (Source: MassDOT Separated Bike Lane Planning & Design Guide.)
**Signals**

**Pedestrian Signals**

Pedestrian signals are used to manage pedestrian crossings, typically in conjunction with motor vehicles and bicycles. They include four intervals:

- A walk interval, signified by the WALK indication, alerts pedestrians to begin crossing the street.
- A pedestrian change interval, signified by a flashing UPRAISED HAND indication symbolizing “don’t walk,” alerts pedestrians approaching the crosswalk that they should not begin crossing the street.
- A buffer interval, signified by a steady UPRAISED HAND, that lasts for at least 3 seconds before conflicting vehicles get the green.
- A don’t walk interval, signified by a steady UPRAISED HAND, that lasts while conflicting traffic has the green.

**Guidance**

- Pedestrian signals should be provided at all signalized intersections for all crosswalks.
- Pedestrian signals should allocate enough time for pedestrians of all abilities to safely cross the roadway, if they begin crossing before the start of the pedestrian clearance time, which includes the pedestrian change interval and the buffer interval. See the Manual of Uniform Traffic Control Devices for specific guidance.
- Pedestrian signals should include a countdown display that is provided with the DON’T WALK indication.
- In areas with high pedestrian activity, a pedestrians push button may not be appropriate. Pedestrians should get a pedestrian cycle every signal phase without having to push a pedestrian push button.
- Pedestrian signals should be timed to minimize pedestrian wait times. Requiring people who are walking or rolling to wait for extended periods can encourage crossing against the signal, creating a safety concern. The 2016 Highway Capacity Manual states that pedestrians have an increased likelihood of risk-taking behavior (e.g., crossing against the light) after waiting longer than 30 seconds at signalized intersections.

**Accessible Pedestrian Signals**

An accessible pedestrian signals (APS) and pedestrian push button is an integrated device that communicates crossing information to pedestrians with visual and/or hearing disabilities using audible tones and vibrotactile surfaces. The pedestrian pushbutton has a locator tone for detecting the device and a tactile arrow to indicate which pedestrian street crossing is served by the device.

**Guidance**

- Accessible pedestrian signals and pushbuttons should be provided when new pedestrian signals are installed, the signal controller and software are altered or the signal head is replaced.

**Bicycle Detection**

Bicycle detection is very important for bicycle access and safety at intersections. Absent bicycle detection, bicyclists must either dismount to use a pedestrian pushbutton, wait for a vehicle moving in the same direction, or cross against the signal.

**Guidance**

- Traffic signals, active warning devices, or pedestrian hybrid beacons should passively detect bicycles.
- If detection is used at an intersection or an intersection approach where bicyclists are expected, it should be designed to sense bicycles whether they are mixed with vehicle traffic or in their own lane.
- Various technologies are available for passively detecting bicycles, including inductive loops, microwave, video, and magnetometers. If inductive loops are used, they must be calibrated to detect bicycles and quadruple loops are preferred. If video detection is used, it is important that the detection zone be well-lit.
- To provide a backup to passive detection devices, a bicycle pushbutton may be used to allow a bicyclist to manually activate the warning device or signal. As bicycle pushbuttons require bicyclists to stop near them, they should not be used as primary detectors on roadways where bicyclists are operating away from edge of the roadway.
Bicycle Signals
A bicyclist traveling in a shared lane is controlled by the vehicular signal head. Where it is necessary or desirable to control bicyclists separately from motorists, a bicyclist may be controlled by a pedestrian signal head, a traffic signal head designated for bicycle use or a bicycle signal face.

Guidance
• Along a corridor, it is recommended that traffic signal indications for bicyclists be as consistent and as uniform as possible.
• In situations where motorists and bicyclists are on the same parallel approach, the design should minimize potential confusion related to similar traffic signal displays for motorists and bicyclists.
• A vehicular traffic signal face may be designated exclusively for bicyclists by mounting an adjacent BICYCLE SIGNAL sign.
• PennDOT has received interim approval for use of bicycle signal faces, which are signal heads with a bicycle symbol on the lens.

Leading Pedestrian Intervals
The leading pedestrian interval (LPI) is used to allow pedestrians to enter the intersection prior to vehicular traffic. Between 3 to 7 seconds of additional walk time is added to the start of the pedestrian phase, while vehicular traffic remains in the red phase. With this additional time, pedestrians can establish their position in the crosswalk before turning traffic is released.

Guidance
• LPIs should be used at intersections with high volumes of pedestrians and conflicting turning vehicles and at locations with large populations of children and seniors, who tend to walk more slowly.
• The LPI should be at least three seconds to allow pedestrians to cross at least one lane of traffic and establish their position in the crossing ahead of turning traffic.
• A lagging protected left arrow for vehicles should be provided to accommodate the LPI.
• Accessible pedestrian signals should be installed with LPIs to notify pedestrians with vision disabilities of the LPI’s presence. Otherwise, people with vision disabilities, who often rely on traffic noise to determine when to cross, may wait until after the LPI is over to begin crossing, a time when motorists are less likely to yield to them.
Right Turn on Red Restrictions
Permissive “right-turn on red” was introduced in the 1970s as a fuel savings measure; however, the change resulted in a 57 percent increase in right-turn pedestrian crashes.2 Right turn on red poses risks for pedestrians, because motorists making a right turn on red are typically focused on looking for traffic on their left and consequently may be unaware of pedestrians crossing on their right. Restricting turn on red is a way to address this risk.

Guidance
• Right turn on red restrictions can be implemented by adding a NO TURN ON RED sign or using more effective measures, such as dynamic NO RIGHT TURN ON RED signs, adding a red ball to the NO TURN ON RED sign or providing a red turn arrow in addition to the sign.
• Pair right turn on red restrictions with LPIs to reduce right turn on green conflicts when there are concurrent vehicular and pedestrian signals.
• It may be appropriate to implement right turn on red restrictions at all signalized intersections in areas with high pedestrian volumes, such as downtowns or main streets.

2 Zador, P., Moshman, J. “Adoption of right turn on red: Effects on crashes at signalized intersections.” Available online at https://www.sciencedirect.com/science/article/abs/pii/0001457582900331
Mid-block Crossing Treatments

Mid-block crossings are crosswalks located outside of the functional area of any adjacent roadway intersection. Midblock crossings are used in locations with significant pedestrian or bicycle movement or long distances between intersections.

Guidance

- It is preferable for crossings to be as close to 90 degrees as possible to minimize the crossing distance and improve sight lines. Retrofitting skewed shared-use path crossings can reduce the roadway exposure for path users.
- Crossing islands should be a minimum of 6-feet wide to meet ADA standards and accommodate the typical width of a bicycle.
- Crossing islands should be aligned directly with marked crosswalks and provide an accessible route of travel.
- Where mid-block or intersection crosswalks are installed at uncontrolled locations (i.e., where no traffic signals or stop signs exist), crossing islands should be considered as a supplement to the crosswalk and should be designed with a slight stagger forcing pedestrians to face oncoming traffic before progressing through the second phase of the crossing.
- Islands are appropriate at signalized crossings and may improve safety for vehicles by dividing traffic streams.
- If there is enough width, center crossing islands and curb extensions can be used together to create a highly visible pedestrian crossing and effective traffic calming.

Considerations

- Crossing islands allow pedestrians to focus on one direction of traffic at a time by enabling them to stop partway across the street and wait for an adequate gap in traffic before crossing the second half of the street.
- Crossing islands are effective at reducing crashes at uncontrolled locations on busy multi-lane roadways where gaps are difficult to find, particularly for slower pedestrians, such as pedestrians with disabilities, older pedestrians and children.

Figure A.14: Example of a mid-block crossing with median crossing island.
Bridges

Bridges provide critical connections within and between communities, so it is important that they accommodate people walking, rolling and bicycling. A bridge without walking and bicycling access can result in a lengthy detour that discourages pedestrian and bicycle trips or requires people walking, rolling and bicycling to operate in conditions that are unsafe.

Guidance

• The design should provide safe, comfortable access for people walking, rolling and bicycling.

• The design should provide adequate width for current and anticipated pedestrian and bicycle volumes and should meet or exceed the minimum widths for sidewalks, bike lanes, paved shoulders, separated bike lanes and shared use paths, where those facilities are incorporated in the design.

• The design of pedestrian and bicycle facilities should include shy space, since pedestrians and bicyclists will not travel immediately against a railing, barrier or other continuous vertical element. Shy distance of at least 2 feet is recommended.

• Railing height on bridges should be between 42” and 48” depending on the site location. Bridge approaches and span should not exceed 5 percent slope to accommodate people with disabilities.

• At transitions from on-grade facilities to bridges, the elevation of the approaching surface should closely match the elevation of the bridge surface to provide a smooth transition between the bikeway and bridge structure.

• On all bridge decks, care should be taken to use bicycle-compatible expansion joints and to ensure that decking materials (including expansion joint cover plates and grates) are not slippery when wet.

• For bridges that afford scenic views, consideration should be given to providing periodic locations where people walking, rolling and bicycling can stop for a respite or to enjoy the view from the bridge.

Considerations

• Bridges may provide needed connectivity within a community, but opportunities to rebuild them are infrequent. Therefore, when such opportunities arise, the new design should account for all anticipated future uses and connectivity needs. Note that waterways, railroads and highways may provide a desirable corridor for future shared use paths.

• While an accessible route will be required to access a bridge, stairs may provide a more direct and shorter route and should be considered to complement the accessible route. Stairs can accommodate bicycles by providing a bicycle channel, which is a ramp or channel incorporated into the steps to accommodate the bike wheels and ease walking up or down the steps.
In established road corridors, the feasibility of adding or expanding a pedestrian or bicycle facility may require reallocating roadway space. Strategies for accomplishing this include removing or narrowing travel lanes.

**Road Diets**

Road diets involve removing travel lanes from a roadway and utilizing the space for other purposes and travel modes. They can provide space for pedestrian and bicycle facilities and reduce exposure to motor vehicle traffic for crossing pedestrians. Other benefits include improved safety and improved roadway operations.

The most common Road Diet reconfiguration involves converting an undivided four-lane roadway to a three-lane undivided roadway made of two through lanes and a center two-way left turn lane. Studies show that this type of road diet can reduce crashes for all roadway users by 19 to 47 percent.³

**Considerations**

- Four-lane undivided streets with traffic volumes of less than 15,000 vehicles/day are good candidates for four-lane to three-lane conversions.
- The space gained for a center turn lane is often supplemented with painted, textured or raised center islands that improve pedestrian crossings, can incorporate landscape elements and reduce travel speeds.

**Lane diets**

Existing travel or parking lanes may be narrowed to better manage motor vehicle speed and/or provide space for bicycle facilities. The AASHTO Green Book provides flexibility to use travel lanes as narrow as 10 feet wide, depending on operating speeds, volumes, traffic mix, horizontal curvature, use of on-street parking and street context.

**Considerations**

- Motor vehicle travel lanes as narrow as 10 feet are allowed in low-speed environments (45 mph or less) according to the AASHTO Green book.
- Lane widths of 10 feet are appropriate in urban areas and have a positive impact on a street’s safety without impacting traffic operations.

Horizontal and Vertical Deflection

Horizontal Deflection
Horizontal deflection treatments require motorists to slow down to adjust to a visually narrower roadway or navigate a shifting or curving travel lane.

Guidance and Considerations
- Where motor vehicle volumes are higher than 2,000 average daily traffic (ADT), sufficient space for people riding bicycles to bypass the horizontal deflection elements should be provided.
- To improve bicyclist safety, mini-circles and approach streets should have clear sight-lines and should be clearly signed and marked to guide navigation around the circle.
- Curb extensions can be constructed to narrow a roadway to one travel lane to create a one-lane pinch-point which requires approaching motorists to yield. This treatment may be most appropriate on streets with more than 18 ft of clear operating width, streets with low parking demand or streets with parking on one side.
- Chicanes are a series of curb extensions, pinch-points, parking bays or landscaping features alternating from one side of the road to the other to establish a serpentine alignment. The design of chicanes on neighborhood streets can have a traffic calming effect and help achieve lower target speeds, which can be between 15 and 25 mph.
- Mini-traffic circles (also referred to as mini-circles) may be used to slow vehicle approach speeds to intersections with uncontrolled or yield-controlled approaches.

Vertical Deflection
Vertical deflections, or vertical speed control measures, are wide, slight pavement elevations that result in slower driving speeds. The primary geometric characteristics of vertical deflections are the height, length, width and ramp slope of the measure.

Guidance and Considerations
- Speed humps can be placed periodically along a route (every 200 to 400 ft) to reinforce speed control.
- Raised intersections elevate the entire intersection to sidewalk level.
- Well-designed vertical deflections allow vehicles and people riding bikes to proceed over the device at the intended speed with minimal discomfort.
- With vertical deflection, factors to consider include priority and delay of emergency response vehicles, truck or public transit use of the street, street type and effectiveness of slowing vehicles versus bicyclist comfort level.

Figure A.17: Example of horizontal deflection (chicane) and vertical deflection (speed hump).
Multimodal Connections

Bus stops

It is rare that a rider’s origin and destination will be directly served by public transit. Most people have some distance of travel between their residence or other destination and the bus stop to access public transit. Ensuring that these paths are safe requires a collaborative approach between LANta and local municipalities.

Guidance

- Understanding the actual paths people take when accessing the bus stop or their final destination is critical. The placement of the stop in relation to the origin or destination plays a large role in determining this. Stops that are not placed near the intersection may result in people crossing the street mid-block because this is viewed as the shortest path. Factors such as a long wait times for pedestrian walk signals may also contribute to this type of behavior. Operational considerations for public transit vehicle routing may not always allow for optimal placement of a stop. In these situations efforts should be made to remove barriers to safe crossings or access to the bus stop or destination.

Source: AASHTO Ch. 7
Where the stop is located will also dictate how people access the stop or destination. On-street stops will likely not be located convenient for everyone’s destination. Similarly, it doesn’t make sense to route a public transit vehicle off major corridors to serve every destination at the door. Typically, off-street stops only occur at major generators. Considerations about pedestrian infrastructure, activity and public transit operations need to be weighed when attempting to identify good locations.

Private developments provide unique challenges. In the case of private developments, it is important that public transit access, including the location and design of transit stops, be considered as part of the development review process.

NACTO’s guidelines recommend a minimum of 10 feet of clearance between the rear of the bus and the crosswalk at a far-side stop. With a near-side stop, a minimum of 10 feet of clearance between the front of the bus and the crosswalk is recommended.

Considerations

- People are generally willing to walk up to ¼ mile to a stop for conventional bus service and up to ½ mile for bus rapid transit service.
- Far-side stops are stops located after an intersection in the direction of travel and are preferred because they reduce conflicts between right-turning vehicles and stopped buses, eliminate sight distance deficiencies on approaches to an intersection and encourage pedestrian crossing at the rear of the bus.
- Near-side stops are stops located before an intersection in the direction of travel. They are acceptable when a far-side stop is deemed unsafe or impractical. They may also be used when a stop serves multiple routes that go in different directions after the downstream intersection.
- Floating bus stops are bus stops where the boarding platform is separated from the sidewalk by a bike facility. The bike facility is brought behind the bus stop to eliminate any potential conflict points between buses pulling into the stop and cyclists in the bike lane.

- If routing behind is not feasible, the separated bike lane design should include treatments such as signage and pavement markings to alert bicyclists to stop for buses and pedestrians accessing public transit stops.
- Typically, floating bus stops should not be installed on higher speed roads where the average travel speed is 35 miles per hour or greater.
- The floating bus stop functions similarly to a bus bulb in that it allows the bus to stop in the travel lane. This design saves travel time for the bus by eliminating the need for the bus driver to merge in and out of traffic. The floating bus stop also provides a waiting area for passengers and can relieve sidewalk congestion.

Bicycle parking

Bicycle parking is critical for creating a multimodal transportation system that encourages and enables bicycle trips. If people don’t have a place to securely store a bicycle at home, they are unlikely to keep their own bicycle. If people don’t have places to securely store a bicycle where they want or need to go outside the home (jobs, schools, grocery stores, restaurants, parks, etc.), they are unlikely to use a bicycle for these trips.

There are three primary types of bicycle parking: short-term, medium term, and long-term.

- Short-term bicycle parking is intended for cases where a bicycle needs to be stored for a short period of time, such as when going to the grocery store or meeting a friend at a restaurant, and the need for theft/vandalism deterrence and weather protection is low.
- Medium-term bicycle parking is intended for cases where a bicycle needs to be stored for a few hours, such as at schools and workplaces, and/or the need for theft/vandalism deterrence and weather protection is moderate.
- Long-term bicycle parking is intended for cases where a bicycle may need to be stored for more than a few hours or overnight, such as at an apartment building or dormitory, and/or the need for theft/vandalism and weather protection is high.
Guidance

In general, bicycle parking accommodations should:

- Be provided anywhere someone might need secure bicycle storage, including multifamily housing developments, dormitories, transit stations, schools, places of work, retail establishments, parks and recreation facilities, and other publicly accessible destinations.
- Be provided in sufficient quantity to satisfy existing demand as well as future demand based on community bicycle mode share goals.
- Be easily and quickly accessed from the street and/or trails and sidepaths.
- Include features that promote personal security and deter bicycle theft, such as good lighting, security cameras, or a location that can be easily watched and/or that has lots of pedestrian foot traffic.
- Support the bicycle at two points above its center of gravity.
- Be intuitive for first-time users.
- Accommodate high security U-shaped bike locks.
- Accommodate bicycles and bicycle attachments in a variety of shapes and sizes.
- Not contain protruding elements or sharp edges.
- Not bend wheels or damage other bicycle parts.
- Not require the user to lift the bicycle off the ground.

Short-term bicycle parking accommodations should:

- Be within 50 feet of building entrances, preferably within 25 feet.
- Be placed in locations with high levels of pedestrian traffic and visible to passers-by and people entering buildings to promote usage and enhance security.
- Allow reasonable clearance for opening of passenger-side doors of parked cars.
- Not impede movement by pedestrians, including those with visual impairments and users of walkers and wheelchairs.
- Not impede routine maintenance activities.
- Not block pedestrian access to buildings, bus boarding or freight loading.

Medium-term bicycle parking accommodations should:

- Meet the criteria above for short-term bicycle parking.
- Provide shelter from rain and snow by being located in a parking garage or under an overhang, or by having their own integrated cover.
- Provide a higher level of security than short-term bicycle parking, potentially through video surveillance cameras.

Long-term bicycle parking accommodations should:

- Generally be at ground level. When ground-level bicycle parking is not feasible, ramps or elevators that can accommodate a bicycle should be provided. In the case of bicycle parking provided in parking garages, bicyclists should have direct access to bicycle parking accommodations, so that they do not need to take their bicycles up stairs or through building lobbies.
- Include entrances or doorways that are wide enough for a person to walk through alongside their bicycle, which may come in a variety of shapes and sizes and include child carriers, panniers, and other attachments.
Considerations

• Short and medium-term bicycle parking accommodations are generally provided through bicycle racks located outside. The “inverted U” bike rack is generally preferred. Another common design is the “post and ring” or “hitch” rack. “Schoolyard” or “comb” racks and “wave” racks are not recommended, including at schools.

• Long-term bicycle parking is generally provided through:
  » Bicycle rooms - Rooms in residential, employment or public transit buildings designed for safely parking.
  » Bicycle cages - Controlled-access, enclosed fenced areas that contain bicycle racks. They may be part of a basement, garage or other room, or may be a stand-alone, outdoor, covered structure.
  » Bicycle lockers - Self-contained units that store an individual bicycle and related accessories and provide a high level of security.
  » Bicycle stations - Specially-designed buildings or structures for bicycle parking. They may be staffed or unstaffed and may provide additional end-of-trip services, such as repair stations, bike shops, vending machines, lockers or showers.

• A cluster of bicycle racks located in the parking lane (also known as an on-street “bicycle corral”) is an efficient way to provide short-term bicycle parking when sidewalk space is limited, particularly at intersections where replacing parked cars with parked bicycles may improve visibility between pedestrians and drivers.