VOL 3

RETHINKING 322

Strategies for the proposed State College Area Connector in Penns-Brush Valley

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Developed by the Advanced Design Studio (LARCH 414) of the Penn State Department of Landscape Architecture, in collaboration with landscape architecture faculty members, the Centre County Historical Society and the Hamer Center for Community Design. This initiative has been further enriched through contributions from Penn State Sustainability and the Thomas D. Larson Pennsylvania Transportation Institute.

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With an Introduction by Paul Daniel Marriott, associate professor of landscape architecture and LARCH 414 studio instructor.

The information, concepts and illustrations in this document were developed by students in the Department of Landscape Architecture at Penn State during the spring semester of 2024 to offer strategies to consider for the State College Area Connector project under study by the Pennsylvania Department of Transportation and are not intended as engineering or safety advice.

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Image: Darlington Farm along U.S. Route 322- Aaron Solderich

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LARCH 414 | Class of Spring 2024

Penn State, Department of Landscape Architecture

PennState
College of Arts
and Architecture

Stuckeman School
Hamer Center for Community Design

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Image: Spring 2024 studio class exploring roundabout design, Brunswick, MD
Image: Paul Daniel Marriott

Introduction

Welcome to Volume 3 of "Rethinking 322, Strategies for the proposed State College Area Connector in Penns-Brush Valley." This guide, building on the findings of the prior two studio projects, begins a shift from the earlier conceptual ideas to Rethink 322 to more targeted responses addressing specific locations and concerns–helping the community rethink its concerns for watershed quality and public health, and offering an innovative roundabout option for traffic management in Boalsburg, Pennsylvania.

This publication was prepared as the final project for the thirteen students in the LARCH 414: Advanced Design Studio within the Penn State Stuckeman School's Department of Landscape Architecture, who spent the 2024 spring semester exploring strategies to rethink the proposed State College Area Connector (SCAC) project under study by the Pennsylvania Department of Transportation (PennDOT).

As with the first two volumes, each student was charged with identifying an interest area related to the proposed highway or the contextual setting of Penns-Brush Valley. Their focus areas were refined during the early weeks of the semester as they researched the SCAC project and met with local advocacy organizations, government agencies, elected officials, and individual stakeholders to gather different perspectives about the proposed highway. As always, the responses from area residents, advocacy organizations, and agencies were extraordinarily generous, and the sincere concerns they shared with the students - from improved highway safety to preserving rural heritage - are reflected in each student's strategy section in this document. Our project remains indebted to the community's vision for a safe, thoughtful and sustainable future for Penns-Brush Valley.

We remained steadfast in our commitment to not endorse any of the proposed corridors under consideration by PennDOT for the SCAC. We see our job to identify possibilities and opportunities regardless of the corridor selected and to help the local communities articulate a unified vision for what is desired for the proposed highway project and the future of Penns-Brush Valley.

From our start in 2022, the students identified the passion and affection for the rural character, historic sites and agricultural heritage of the valley as a common theme. They evaluated the SCAC within the 168-square-mile Penns-Brush Valley Rural Historic District that was determined eligible for the National Register of Historic Places in 2002. Within this context, specific concerns about climate change and growth inthe Centre Region, ecosystem integrity, and sustainable farming were studied.

As a result, the students determined that while PennDOT's actions could impact the legacy of the valley, so too could local land use policies and conservationprograms.

As the students explored their interests, they met twice weekly to share their research and community contacts with one another. In addition, in person and virtual visits to the studio augmented their explorations with insights from the Penn State Law, Penn State Sustainability, the Thomas D. Larson Pennsylvania Transportation Institute at Penn State, the Centre County Historical Society, Ian Lockwood, a livable transportation engineer with Toole Design, and PennDOT Region 2. In March, the students shared their initial ideas and sought community feedback at a meeting at the Centre County Historical Society

On April 4th and 5th, the students traveled to the award-winning Maryland Route 200/Intercounty Connector (ICC) project and visited the Context Sensitive Solutions (CSS) freeway to study the road's alignment, sound barrier design, integrated regional bike trail, and wildlife crossings. Next, they visited the Montgomery County Agriculture Reserve (MD) to learn about an innovative program to preserve farmland and sustainable farming. On the second day they explored the Mt. Vernon Memorial Parkway (National Park Service) in Virginia, the new Interstate 66 (VA) bike trail and the model traffic calming project for U.S. Route 50 in Middleburg, Virginia. Concluding the trip, they traveled to Brunswick, Maryland (population 8,000) to tour the state's most successful roundabout program–a joint effort by the city, a local developer, and the Maryland State Highway Administration that has improved traffic efficiency and safety in the growing rural community.

Many of these influences shaped the students' final presentations, presented at the College Township Offices on April 24th.

The result of each student's studio work is presented in the following strategy sections. We hope they will spark lively conversations for a new vision to Rethink 322.

–Paul Daniel Marriott, Studio Professor

Image: Paul Daniel Marriott

Paul Daniel Marriott, Ph.D.

Principal and Founder of Paul Daniel Marriott + Associates and Associate Professor of Landscape Architecture, Penn State

Dan is a licensed landscape architect and has consulted on transportation projects for the Federal Highway Administration and National Park Service. He is a past member of the Transportation Research Board's Standing Committee on Landscape and Environmental Design. He co-founded and chairs the Preserving the Historic Road International biennial conference, sponsored by the Federal Highway Administration (FHWA) and the American Association of State Highway and Transportation Officials (AASHTO). Dan is the author of "Saving Historic Roads, Design and Policy Guidelines" (Wiley) and "From Milestones to Mile-Markers, Understanding Historic Roads" (FHWA-National Scenic Byways Program). Dan also served on the External Review Committee for FHWA's Flexibility in Highway Design guide. He has been an expert reviewer for UNESCO World Heritage roads and developed context sensitive solutions, scenic byway and historic roads trainings, and corridor management plans for state transportation departments including, Arizona, Alaska, California, Colorado, Hawaii, Illinois, Indiana, New Jersey, New Mexico, New York, the Osage Nation, and the Massachusetts Department of Conservation and Recreation. In addition, he has consultedon transportation projects in Australia, Canada, Mexico, and the United Kingdom. Dan was honored with the Centre County Historical Society, 2023 Education and Advocacy Award for his work with Rethinking 322.

Glossary

AASHTO–American Association of State Highway and Transportation Officials, a national state-led organization that conducts research and presents guidance on highway design. AASHTO guidance offers a range of acceptable solutions for different aspects of highway design and has been adopted by FHWA for federal highway projects. A state may adopt the full range or a more limited range as a state standard for highway design.
ADT–average daily traffic, a calculation of the average number of vehicles on a particular segment of roadway measured in whole days.
Alignment–the movement of a roadway through the landscape, its curves, straight sections, and hills.
Arterial–a roadway providing the principal high-volume and high-speed linkages within a community and between communities.
Avenue–a broad urban thoroughfare, usually tree-lined.
Berm–an artificial hill or mound created for screening or to enhance a design landscape.
Boulevard–a broad urban thoroughfare, usually tree-lined and with a broad median.
Clear zone–the recommended area alongside a roadway clear of all potential hazards (something an automobile might strike) such as trees, rocks, utility poles, and the like. The recommended width of a clear zone varies based on the functional classification of the road.
Collector–a roadway providing service between arterials and local roads.
CSS–Context Sensitive Solutions, also known as Context Sensitive Design, is an approach to highway design that considers community structure, local landscapes, and environmental settings as an integral part of highway planning and design.
Cut and Fill–the removal (cut) or placement (fill) of soil in construction. Ideally highway construction projects are designed so that cut and fill are "balanced;" i.e., the amount of soil removed in a hillside "cut" equals the amount required to "fill" the ravine at the base of the hill.
Designed landscape–a landscape, or the alteration or modification of the natural landscape, that has been created specifically to provide a desired experience (usually aesthetic) to the user or a community. Designed landscapes are generally created by a landscape architect, planner, architect, or other design professional.
Design speed–the maximum safe speed at which a vehicle can be expected to operate on a roadway. The speed for which a roadway is designed–this may not be the posted speed.
DOT–department of transportation
Errant vehicle–a vehicle leaving the roadway in a reckless or uncontrolled manner.
Expectancy–a theory, based on a motorist's "knowledge stores" of driving experiences, that suggests predictable driver responses to familiar situations and settings. Routine experiences, such as sufficient merging space at the end of a freeway ramp, become unconsciously established in the driver's mind–thus creating conflict should the "expectancy" not be met.
FHWA–Federal Highway Administration
Galvanized steel–a zinc coating applied to steel to prevent rusting. Galvanized steel has a flat chalky-gray appearance.
Guardrail–a barrier, usually of a post-and-beam construction located alongside a roadway, in medians, and in front of hazards to prevent an errant vehicle from striking an obstacle or encountering a dangerous slope or drop-off.
Horizontal alignment–the movement of a roadway to the left or right; its curves.
Integrity–the current quality of a feature or element when compared to its original quality.
Jersey barrier–an angled concrete barrier designed to guide an errant vehicle back to the roadway and guard against hazards.
Limited access–a concept whereby the entrances and exits of a roadway are restricted to certain locations–generally to allow for higher speed traffic movement due to the absence of cross streets and intersections.
Local road–a roadway serving adjacent residences and businesses–generally of low-volume traffic
Median–a central space, often planted, dividing opposite moving travel lanes.
MPO–Metropolitan Planning Organization, a federally-mandated and federally-funded transportation policy-making organization to ensure regional cooperation in transportation planning.
MUTCD–Manual of Uniform Traffic Control Devices, the FHWA guidance for regulatory signs.
National Register of Historic Places–a national listing of sites meeting the U.S. Secretary of the Interior's standards, maintained by the National Park Service.
NEPA–National Environmental Policy Act of 1969, a federal review program to ensure federally-funded projects assess potential impacts to the environment. NEPA is dependent on federal funding. When there is no federal funding, PennDOT follows Section 2002 of the Administrative Code of 1929, which defines the powers and duties held by PennDOT. Act 120 of P.L. 356 amended Section 2002 in 1970 to add requirements to address environmental impacts from transportation projects.
Parkway–a roadway contiguous with or linking park spaces. In its truest definition, a parkway provides access to recreational, scenic, or leisure spaces.
PennDOT–Pennsylvania Department of Transportation
Post and cable guardrail–a guardrail constructed of regularly spaced posts connected by a flexible (usually steel) cable.
Posted speed–the speed at which a roadway is signed. This is usually, though not always, lower than the design speed.
Realignment–the repositioning of a segment of a roadway.
Reinforced concrete–concrete with a steel reinforcing framework. Reinforcing enables the concrete to perform in structural situations. Concrete by its nature resists high compressive loads (the heavy weight of a truck, for example). Steel reinforcing resists high-tensile loads (the pull to the left or right one would encounter on a bridge, for example).
Right-of-way–the land area dedicated to or associated with a roadway that is owned or managed by the road management entity–including the roadway, shoulder, and affiliated landscape.
Road diet–the removal or narrowing of lanes to make a road safer or more efficient.
Shoulder–a stabilized level area adjacent and parallel to the roadway that provides a recovery space for an errant vehicle or a safe space for a disabled vehicle.
Sight distance–the length of roadway ahead that is visible to the motorist.
Standards–the legally adopted policies and practices directing the design and construction of a road in a state or municipality.
Street–an urban thoroughfare, usually defined by buildings.
Superelevation–the banking or sloping of a road curve to enable vehicles to maintain a speed consistent with the overall speed of the roadway. The banked ends of racing tracks represent an exaggerated superelevation.
Taking–in legal terms, the direct acquisition of property, or the implementation of policies or actions that significantly impact a property.
Tort liability–a situation in which an injury or harm has occurred, due to a breach of a preexisting duty or obligation, resulting in potential exposure to an individual or organization for damages.
Traffic calming–a strategy to slow vehicle speed through the use of physical changes in the road's alignment, including speed humps, speed tables, roundabouts, and chicanes (a shift in the horizontal alignment). For example, a speed table was installed in front of the HUB on Penn State's University Park Campus to improve pedestrian safety.
Vertical alignment–the movement of a roadway up and down; its hills.
Volume–the number of vehicles a roadway carries.
Watershed–an area of land drained by a particular body or bodies of water. An individual body of water often belongs to a hierarchy of watersheds–a tributary river off the Susquehanna River has its own watershed of creeks but is also a part of the larger Susquehanna River watershed and the even larger Chesapeake Bay watershed.
W-Beam–a common type of guardrail/barrier recognized by its curved "W" face.

Image: Mary Sorensen

LARCH 414 studio class during final presentations at the College Township Municipal Building.
From left to right: Sarah Scutti, Yuqing Peng, Eliza Li, Clareigh Ellis, Elijah Pfeiffer, Ella Strzempek, Hayley Mahoney, Paige Swope-Ginley, Adam Braughler, Morgan Smith, Jake Hutton, Cas Ryan, David Khenkin, and Paul Daniel Marriott

Approach to Ernie's Rotary. Windham, ME.
Image: Elijah Pfeiffer

Rethinking Boalsburg

Elijah Pfeiffer | LARCH 414 | Spring 2024

Strategy

U.S. Route 322 requires a strategy that comphrehensively addresses safety based on accident histories. Employing roundabouts will be explored in this section as a strategy to improve safety and efficiency on the corridor. Their use could effectively reduce speed when changing from a high-speed segment to a low-speed segment, and improve safety with connecting roads. A pair of roundabouts at the Boalsburg Interchange introduces a viable option to improve the number of vehicular connections while also accommodating other users, such as bicyclists, pedestrians, recreational users, and wildlife.

Rendering of U.S.322 over Spring Creek. Boalsburg, PA.
Image: Jacob Hutton, Midjourney AI

Boalsburg Today

Existing Junction

As of today, the meeting point of U.S. Highway 322, Boal Avenue (South Atherton Street), and Pennsylvania Route 45 serves not only as a junction, but as a transition between highway and rural road. To the west lies the Mount Nittany Expressway, a four-lane divided, limited-access highway with a 55 mph speed limit. To the east is the General Porter Highway, a two-lane segment being studied by PennDOT for the State College Area Connector project.

Between the western and eastern sections, a series of ramps connect Boal Avenue and PA 45 to their respective sections of U.S. 322. With ADT vehicle counts between 15,000 and 17,000 (Gis.Penndot.Pa.Gov), this junction requires rethinking for safety.

As noted in Ryan Stackiewicz's research in Rethinking 322 vol. 2 (Rethinking Safety, pp. 28-37), there are significant safety concerns for this junction on U.S. 322 based on an analysis of PennDOT's statistics. The current junction could benefit from a more effective transition between the expressway and rural road. Specifically, traffic traveling eastbound
on 322 is required to merge into a single lane while encountering oncoming traffic, and then reduce speed for the undivided segment. This transition involves merges, turns, and speed changes in quick succession, which can create a challenging experience for drivers. Addressing these issues could enhance safety and ease of use, improving overall traffic flow and driver responses.

Additionally, the connection between Business 322 (Boal Avenue) and 322 is designed with long, gently curving ramps, which can give the impression that the highway meets interstate standards. However, when transitioning onto Boal Avenue, these same gentle ramps can lead to highway traffic entering the Boalsburg neighborhoods at higher speeds than intended. Enhancing this connection could improve safety and ensure that traffic speeds are more appropriately managed as vehicles enter residential areas.

Figure 1.0 - Boalsburg Junction Today, Boalsburg, PA. Image: Google Earth

Figure 1.1 - Eastbound 322 where highway meets 2-way.
Image: Google Earth

Figure 1.2 - Merging onto 322 from Boal Avenue.
Image: Google Earth

Crash Zones

As a result of the research conducted in previous semesters, we as a studio class were able to identify three crash zones located at the previously described locations. The clusters of crashes (sourced from PennDOT crash data) are located at the eastbound merge point, the undivided oncoming traffic meet, and the Boal Avenue ramp merge. Two of these three crash zones involve the possibility of undivided oncoming traffic coming into conflict with each other. This combined with the large amount of semi-truck traffic creates a potentially high probability of dangerous driving situations.

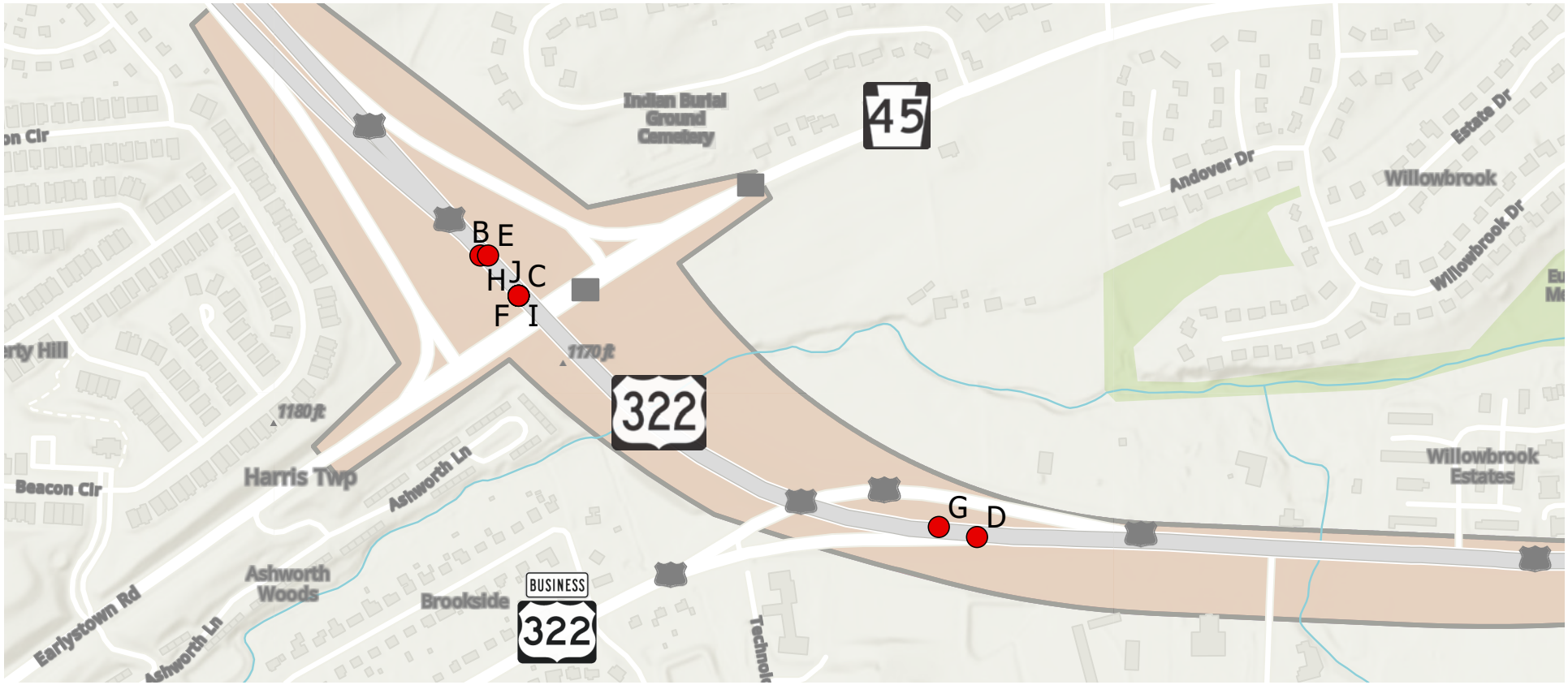

Figure 2.0 - Combined Crash Statistics at Boalsburg Interchange, 2020-2022. Boalsburg, PA.

Source: Ryan Stackiewicz.

New Boalsburg Interchange

Overview

The Boalsburg roundabout concept is a proposal to dramatically rethink the function and safety of the current intersections within the regional and environmental context of Penns-Brush Valley. The design is based on models of successful higher-speed and higher-volume roundabouts in the United States.

This site requires a unique design. At right is the proposed redesign for the Boalsburg Interchange. This design solution gives the region an opportunity to rethink this highway utilizing roundabout strategies that have been successfully employed in other states. It can respond to the needs of local communities as well as the needs of the nation through recent infrastructure and design movements.

Incorporating the wealth of research gathered over the previous two years, this design increases the safety of all users in and around the site. Proper consideration for local communities and user groups can result in more equitable transportation options and usable public spaces. Restoration of Spring Creek from a box culvert to a freely flowing stream will improve local ecosystems critical to Centre County. A better transition from from Mt. Nittany Expressway to two-lane U.S. Route 322, and a two-way street (Boal Avenue) to a highway (U.S. Route 322) can act as a template for better transitions that would not only serve travelers but benefit all communities in contact with the highway. The new Boalsburg Interchange can provide more to Pennsylvania than just a means of travel.

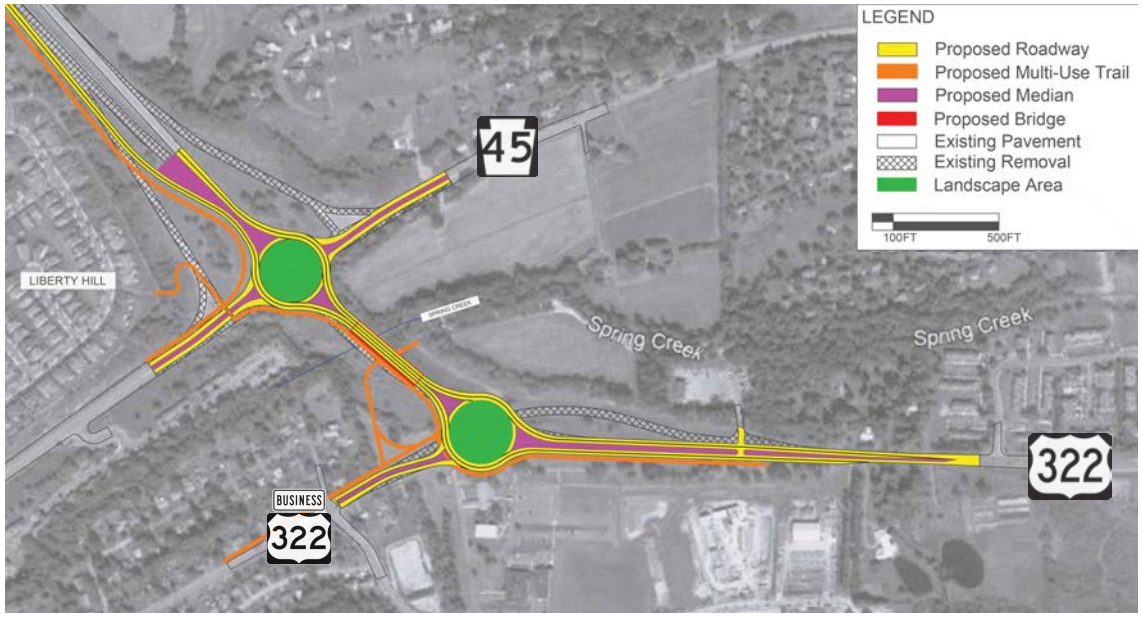

Figure 3.0 - New Boalsburg Interchange Rendering. Boalsburg, PA. Image: Elijah Pfeiffer

Figure 4.0 - New Boalsburg Interchange Rendering. Boalsburg, PA.

Image: Jacob Hutton and Elijah Pfeiffer

Spring Creek Crossing

A major feature of this proposal is the new Spring Creek bridge crossing. This multi-use bridge will replace the existing box culvert through which the creek currently flows with an elegant structure spanning the waterway and accommodating multiple users. It will restore the function and beauty of Spring Creek in the Boalsburg area.

- The bridge restores and elevates the importance of Spring Creek and its important role in local history.
- Multi-use traffic (such as bike and pedestrian) can safely transit under and across the bridge without threats from vehicular traffic.
- The length and height of the bridge are designed to allow for a wildlife corridor to better accommodate storm and flooding concerns increasing with climate change.

The Spring Creek Crossing can be a multi-use asset to the community, enhancing traffic flow, public space, and local ecosystems while symbolically recognizing the importance of the region.

Figure 5.0 - Section of Spring Creek Crossing. Boalsburg, PA. Image: Eijah Pfeiffer

Figure 5.1 - Perspective of 322 Bridge over Spring Creek from Multi-Use Trail. Image: Eijah Pfeiffer

Roundabouts

Most unique to this design approach for the new Boalsburg Interchange are the dual roundabouts. This pair of roundabouts is designed to maintain the same number of connections between U.S. 322, PA 45, and Business 322 while still accommodating the multi-use features of the Spring Creek Crossing. These connections are improved through the increased efficiency and safety inherent to roundabout designs, particularly for ones of the size presented in this concept.

Brunswick, Maryland

During the semester, the class visited several model roundabout projects, including a series of roundabouts in Brunswick, Maryland. The four new roundabouts manage traffic between U.S. Route 340 (a limited-access freeway) and a new residential and commercial area for the small rural city. The new development is accessed by the four roundabouts along Maryland Route 17–eliminating traffic signals and left turns. The city also required wide setbacks from the road for new development with dense plantings and farm fences to help maintain their rural character. Safety and efficiency were both improved as a result of the project.

Figure 6.0 - Roundabout, ME. Image: Elijah Pfeiffer

Figure 6.1 - Roundabout, ME. Image: Elijah Pfeiffer

Figure 6.2 - Class Photo in Brunswick, MD. Image: Dan Marriott

Ernie's Rotary

An excellent example of a higher-volume, higher-speed roundabout is in Windham, Maine. With its access to major U.S. routes and the U.S. Interstate system, is can be a useful example for rural interchanges, such as in Boalsburg. This large, rural-style roundabout sits at the junction of two major U.S. highways, similar to U.S. Route 322. One road connects the tourist-dense Lakes Region directly to Maine's largest city (Figure 6.0) while the other serves as an alternate route for I-95, linking to Maine's southern beaches (Figure 6.1).

As a resident of Maine, I have regularly used this roundabout. As a result of this class, I undertook a deeper review of its function and design. The roundabout (called a rotary in New England) is one of the few junctions in the area that flows smoothly during the tourist-dense summer seasons. This demonstrates that a roundabout can effectively handle U.S. highway-level traffic, even during periods of high tourist traffic.

The key to handling such traffic lies in the size of this specific rotary. With a diameter exceeding 300 feet, semi-trucks can easily navigate the radius. Moreover, its large size allows for higher speeds and longer sightlines, enhancing safety by allowing entering traffic to observe vehicles within the rotary for an extended period when compared to smaller roundabouts.

Figure 7.0 - Satelite View of Ernie's Rotary. Image: Google Earth

Figure 7.1 - A Semi Passing the Exit to Portland, ME. Image: Elijah Pfeiffer

Circular Safety

Supporting this, publications from the FHWA show that crash injuries in intersections with roundabouts were 51% fewer than their traditional junction counterparts, with total accidents down by 31% (Rodegerdts). Additionally, studies from 2002 to 2022 found that serious injuries reported from intersections replaced with roundabouts decreased by 24%, while non-serious injuries were reduced by more than 50% ("Roundabouts." PennDOT).

Furthermore, PennDOT has proposed roundabouts at other major state highway junctions–such as at the intersection of PA 41 and PA 841–and further along PA 41 near the town of Chatham in Chester County (Figure 8.0). Both of these plans were proposed in 2021, indicating that PennDOT. not only embraces roundabouts but has actively advocated for them for some time.

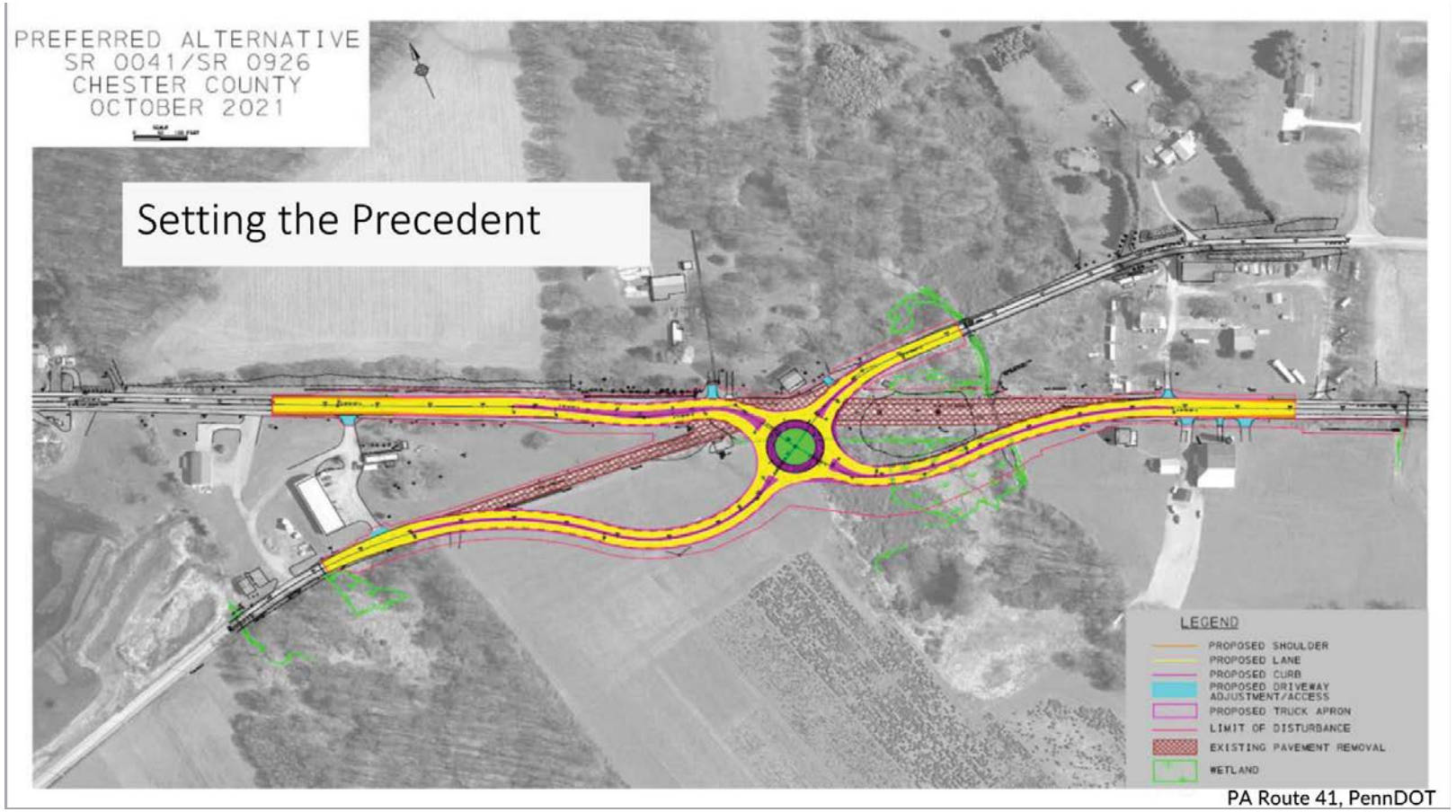

Figure 8.0 - Proposed Roundabout at PA 41 / PA 926. Chester County, PA.

Image: PennDOT

Approaches

With roundabouts established, achieving proper speed is crucial when approaching and entering the roundabout. Speed-control measures can effectively slow traffic entering the site. Figure 9.0 depicts a section of a typical interstate-standard highway published by PennDOT, illustrating the Nittany Expressway directly before the roundabout.

By gradually narrowing the highway into a configuration more akin to Figure 9.1, drivers will naturally reduce speed instinctively when approaching the roundabout, thereby preventing abrupt braking and minimizing the use of semi-truck jake brakes.

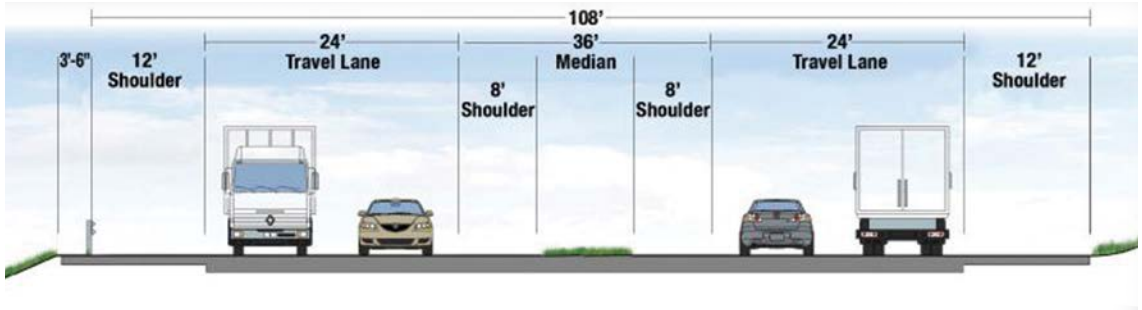

Figure 9.0 - PennDOT Section as Guide for U.S. 322 Expansion. Image: PennDOT

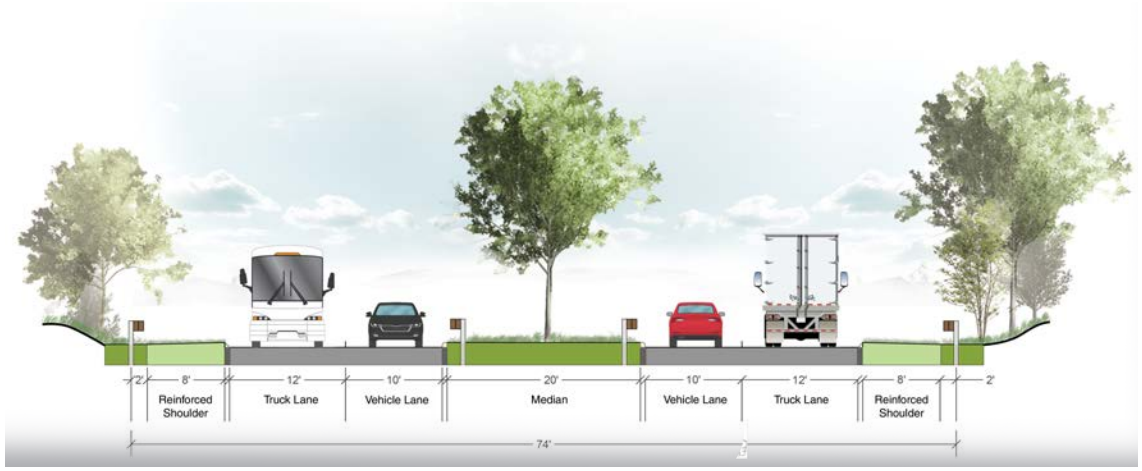

Figure 9.1 - Approach Section for the new Boalsburg Interchange. Image: Elijah Pfeiffer

Right-Of-Way

After learning of the various concerns regarding eminent domain surrounding the broader U.S. Route 322 expansion, this roundabout concept presents a desirable model. The entire proposed Boalsburg Interchange lies within the existing state-owned right-of-way. This design solution could be implemented today without the need for eminent domain or the taking of any private land.

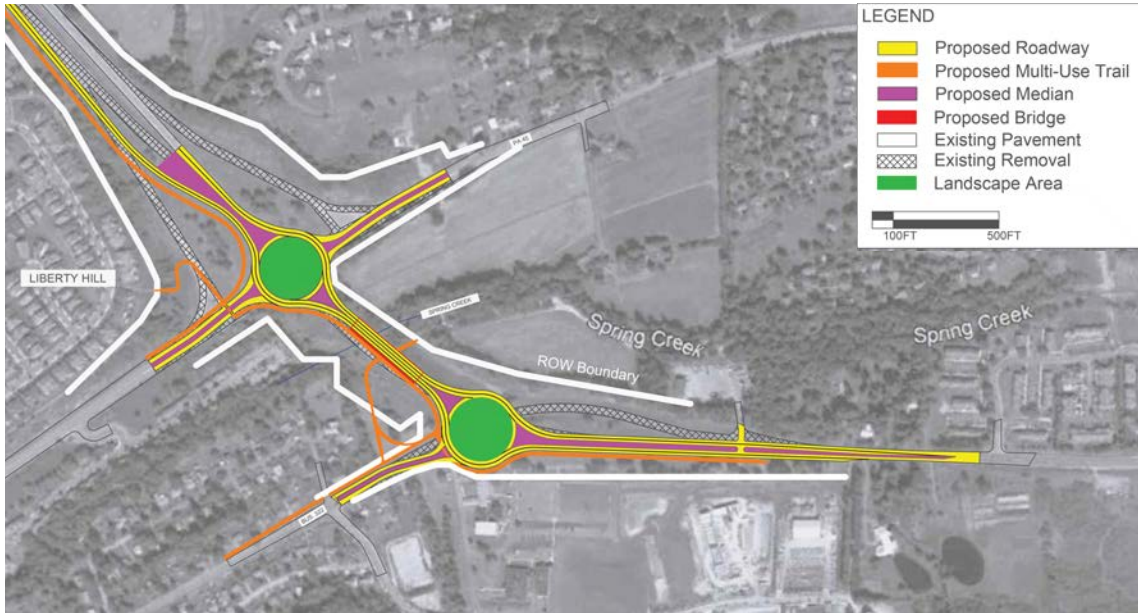

Figure 10.0 - Right-Of-Way Outlined on Proposed Design. Image: Elijah Pfeiffer

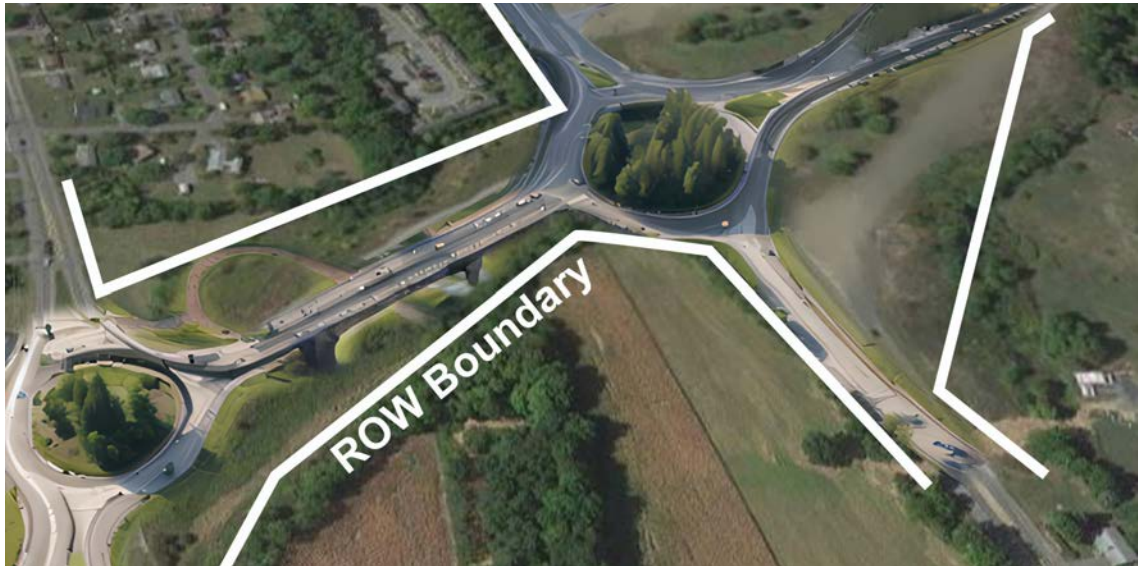

Figure 10.1 - New Boalsburg Interchange Rendering with R.O.W. Image: Jacob Hutton and Elijah Pfeiffer

Closing

"There is no power for change greater than a community discovering what it cares about."

- Margaret J. Wheatley

One of Many Possibilities

The outlined design solutions represent one approach to addressing an urgent problem facing our local community. It is the collective effort of every student, community member, volunteer, leader, representative, engineer, and expert consulted over these past two years that has made this publication - and design solution - possible.

The safety concerns raised by community members underscore an urgent need for change not only for Boalsburg, but for U.S. Route 322 as a whole. It is through these concepts that new design possibilities can be explored.

Overall, the new Boalsburg Interchange can be much more than just a piece of infrastructure. It can serve as a catalyst for equitable access (local vs. through traffic, car vs. truck, bike/ped vs. motor vehicles), ecological restoration, community health, and safety, as well as a reflection of the region's rich heritage. This proposal will be a gateway entrance to both Penns Valley and the State College region.

Figure 11.0 - School Bus Exiting Ernie's Rotary. Image: Elijah Pfeiffer

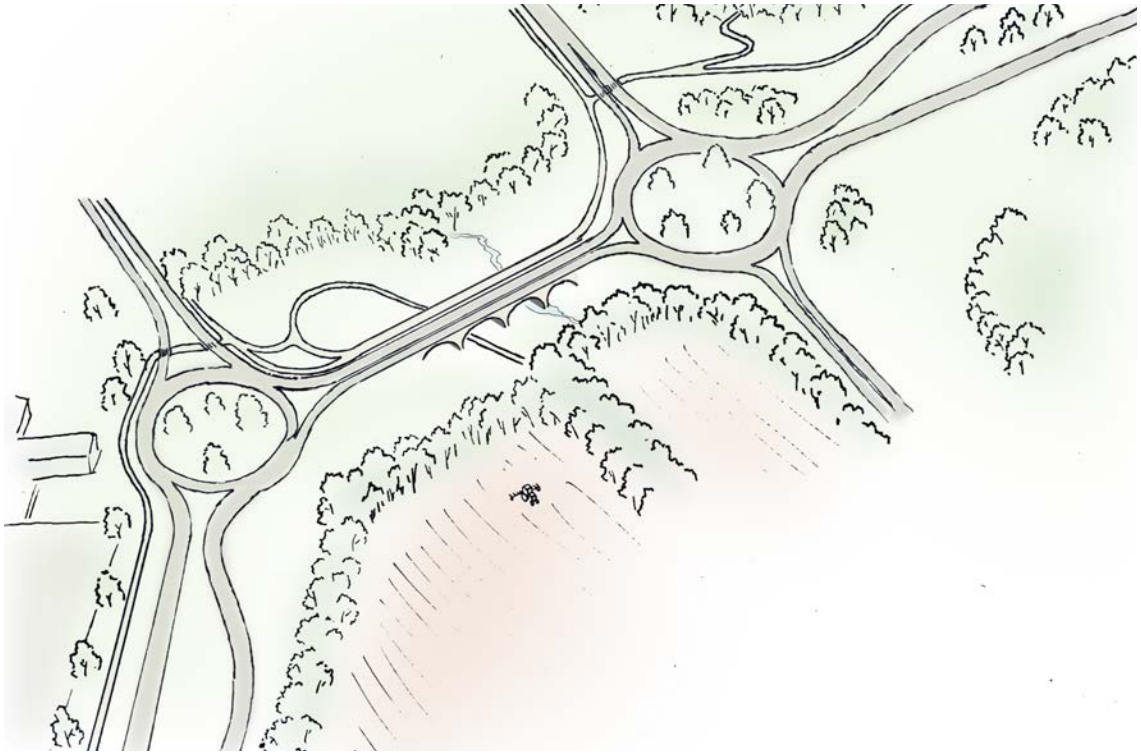

Figure 11.1 - Sketch & Rendering of the New Boalsburg Interchange. Image: Elijah Pfeiffer

Biography

Elijah Paul Pfeiffer
Fourth-Year Landscape Architecture Student

Elijah grew up in Wisconsin before moving to Pennsylvania and eventually settling in Maine. His lifelong passions include transportation, photography, and graphic design. Elijah is an active member of Alpha Rho Chi (APX), the professional co-ed fraternity for architecture and the allied arts, the Monorail Club, and the Landscape Architecture Student Society (LASS). He is deeply interested in transportation systems, humanitarian and social causes, and ecological design principles.

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Image: Artful Runoff Mitigation
Image: Jacob Hutton, Midjourney AI

Stormwater & Bioretention

Adam Braughler | LARCH 414 | Spring 2024

Strategy

Improved stormwater retention practices will be critical for Rethinking U.S. Route 322. Proper stormwater management is necessary for clean waterways and healthier ecosystems. Poor stormwater retention can lead to the increased presence of pollution in waterways, leading to a decline in public health. While Pennsylvania implements stormwater policies, it is important to examine effective strategies employed by other states that may offer creative solutions well suited to Penns-Brush Valley. There are many opportunities for PennDOT to improve stormwater and bioretention along the proposed 322 highway corridor.

Image: Stormwater Solution Rendering Image: Jacob Hutton, Midjourney AI

Rethinking Stormwater Management

Background

The proposed expansion of U.S. Route 322 presents Pennsylvania with an opportunity to reconsider how stormwater retention is designed and implemented. Currently, rainwater collects toxic chemicals and metals from the highway, which often end up in small retention ponds without adequate filtration before being discharged into streams and waterways. This runoff poses significant health risks to wildlife, plant life, and human populations alike.

Problem Statement

The proposal for a new expressway connection along Pennsylvania's U.S. Route 322 offers an opportunity to redefine stormwater-retention practices. Currently, managing most highway runoff involves engineered solutions, such as building ditches alongside highways, where water either remains or flows out into streams with minimal filtration. This causes water quality issues. However, envisioning an aesthetically pleasing and ecologically beneficial solution is possible. Landscape architects can play a pivotal role in developing a solution that meets both aesthetic and ecological criteria.

Image: AI Cover Image

Image: Jacob Hutton, Midjourney AI

Stormwater Management

"A functioning storm water infrastructure is critical to support the movement of goods, people, and services on State highways."

- PennDOT, Appendix B4 Highway Occupancy Permit Storm Water Facility Guidebook, Pg 1

Intro to Stormwater

Maintenance of stormwater facilities is essential to ensure their expected lifespan and to safeguard the public from hazards associated with poorly performing stormwater systems. A well-maintained stormwater infrastructure is crucial for facilitating the movement of goods, people, and services on state highways. PennDOT categorizes stormwater facilities into five categories (Figure 1.0). Its objective is for all new developments to retain stormwater runoff from site development on its property.

Category 1	Open or enclosed surface storm water facilities draining or conveying drainage under a proposed driveway or local road.
Category 2	Open surface storm water facilities draining more than a proposed driveway or local road, whether connected to a highway storm water facility or not.
Category 3	Enclosed surface storm water facilities draining more than a proposed driveway or local road and physically or hydraulically connected to an existing or new highway storm water facility.
Category 4	New or modified enclosed surface storm water facilities draining the highway and/or adjacent properties.
Category 5	Enclosed surface storm water facilities not connected to a highway storm water facility.

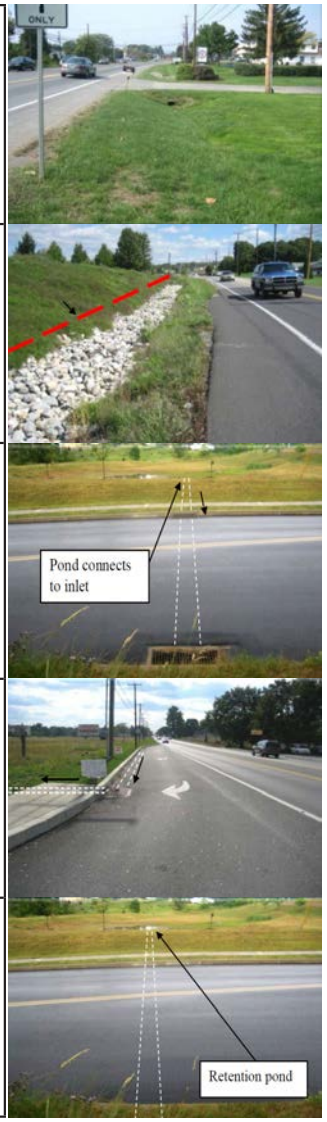

Figure 1.0 - Stormwater Categories. Images: PennDOT HOP Stormwater Facility Guidebook

Effects of Poor Stormwater Management

"When stormwater management is done well, streams, rivers, and lakes are cleaner; flood risks are reduced; costs due to flood damage decrease; and community quality of life increases."

- University of Nebraska, Lincoln Extension

Health and Stormwater

Stormwater management is crucial in rural, suburban, and urban development. Runoff increases when impermeable surfaces such as new buildings, roads, and parking lots are added to a landscape, increasing erosion or flooding, during high intensity storms and heightening negative effects on public health (Figure 2.0).

The goals of stormwater management encompass protecting the environment, safeguarding people and property from flood risks, alleviating strain on public stormwater drainage systems, and fostering healthier and more sustainable ecosystems.

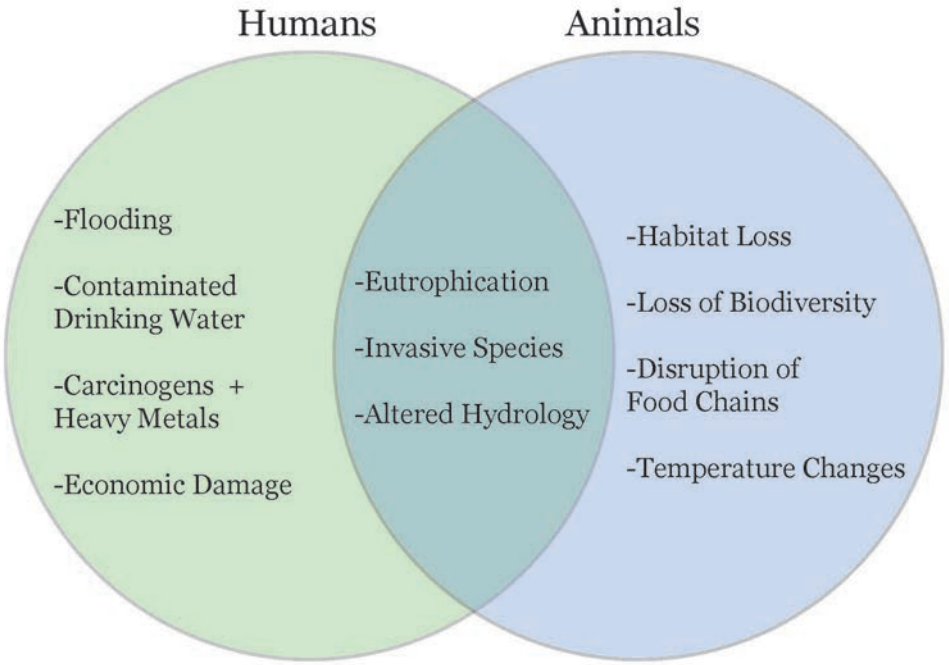

Figure 2.0 - Health Venn Diagram.

Stormwater and Spring Creek

Where Water Ends Up

"With increased amounts of impervious surfaces, larger quantities of rainwater reach the streams quickly causing flash flooding, stream bank scouring, and sedimentation of streambeds. Because of stream damage, litter, and pollution, stormwater has become a major concern in Pennsylvania impairing 4,170 miles of streams and accounting for one-third of the problems facing our waterways."

-Penn State Extension

One important consideration for stormwater management along Route 322 is the impact to local and regional watersheds from the corridor's roads and bridges. From Spring Creek, which plays a crucial role in the environmental health of the Centre Region, to the Chesapeake Bay, stormwater management is essential to sustainable roadway and community design. (Figure 3.0).

The Chesapeake Bay faces increased pollution each year. According to the Maryland Department of the Environment, the main contributor to this pollution is nutrient runoff (fertilizer, car exhaust, and stormwater runoff). Although Spring Creek is just one stream, more than half of Pennsylvania's streams and rivers eventually flow into the Chesapeake Bay.

Figure 3.0 - Flow of Water From U.S. Route 322 in Centre County. Image: RiverRunner.com

Bridge Drainage

Best Practices to Manage Bridge Runoff

Figure 4.0 illustrates bridge drainage practices used by PennDOT. This specific example is located at the intersection of Sellers Lane and I-99. Rainwater enters the drain inlet in the center of the bridge via a PVC pipe and directly flows onto flat ground below. With no filtration system in place, this allows pollutants and chemicals from highway traffic to enter local streams and eventually reach the Chesapeake Bay.

In Figure 4.1, we observe the overpass stormwater system at the intersection of Maryland 200 Highway and Briggs Chaney Road in Fairland, Maryland. Here, water is diverted away from the center of the bridge. After entering the drain inlet and passing through PVC piping, it is directed into a bed of river rock. The river rock serves to filter and cool the polluted stormwater. Subsequently, the water flows through a swale, further filtering it before it reaches the local stream system.

Figure 4.0 - PennDOT Bridge. Image: Google Earth Pro

Figure 4.1 - Maryland DOT Bridge. Image: Google Earth Pro

Comparing other DOTs

Maryland

The following pages will cite examples of stormwater facilities and features from other state's Departments of Transportation that could be implemented in Pennsylvania along Route 322. First, from Maryland, Figure 5.0 highlights an interesting swale system in the median of the road that our class observed during our trip through Maryland and Virginia. The wider median, along with the swale system, facilitates easier passage and stormwater filtration.

Figure 5.1 showcases a bioretention pond along MD Route 200, an excellent example of good stormwater management practices. Abundant vegetation surrounding the pond, utilizing native plants, and designed by landscape architects to replicate natural wetlands, breaks up the monotony of highway driving and provides additional nutrients and filtration. In Pennsylvania, however, highway bioretention ponds are rarely designed by landscape architects, making most stand out as intrusions within the natural landscape.

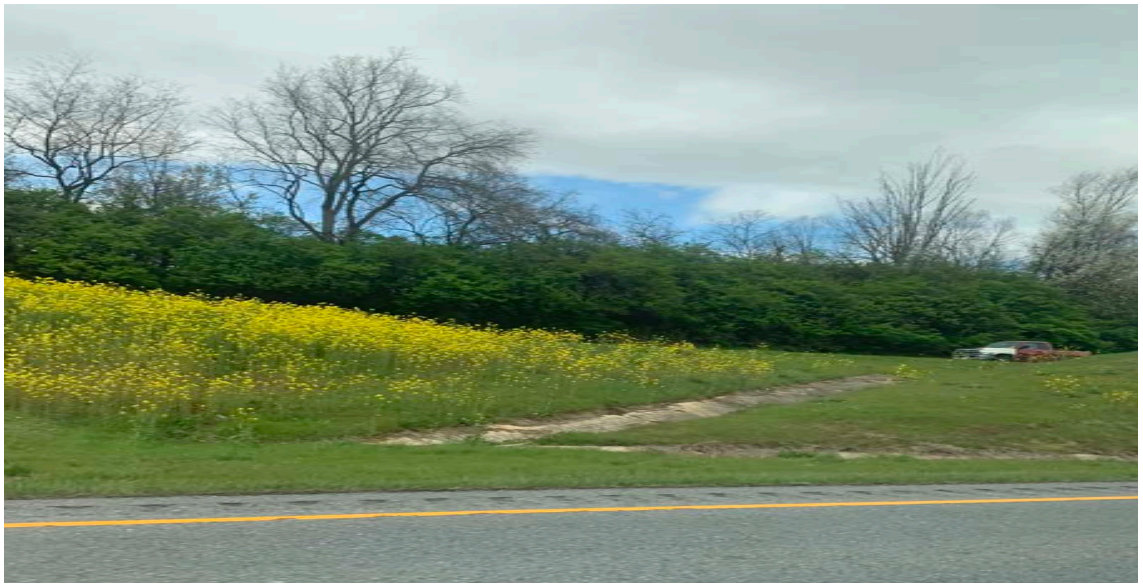

Figure 5.0 - Swale System Along I-70, MD. Image: Adam Braughler

Figure 5.1 - Bioretention Pond Along MD 200. Image: Adam Braughler

Comparing other DOTs

New York

The next example (Figure 6.0) comes from New York along I-87 in the Adirondack Mountains. This system efficiently moves water from one side of the highway into a retention pond on the other side with minimal disturbance. The wide median also allows for effective filtration of runoff before it enters the retention basin.

Similar to the Maryland detention basin, this basin features abundant vegetation that enhances nutrient absorption, filtration, and habitat provision while also breaking the monotony of the continuous tree line typical of the Adirondacks. Both New York and Maryland have landscape architecture divisions within their DOTs.

Figure 6.0 - Swale System Along I-87, NY.

Images: Google Earth Pro

Stormwater in Pennsylvania

What's Missing?

Now that some background has been provided on other DOT highway stormwater facilities, here is an example of a large retention pond just outside State College along I-99 (Figures 7.0 and 7.1). Some key differences are notable:

- There is a lack of an infiltration system, resulting in no slowing down or cooling of runoff as it enters the pond.
- The vegetation is not diverse; while there are some scattered scrub bushes, they do not significantly aid in the stormwater runoff process.
- The pond appears unnatural and awkward, contrasting sharply with the natural beauty of the valley. In contrast, the examples along I-70 and I-87 blend well with their environments and look more natural.

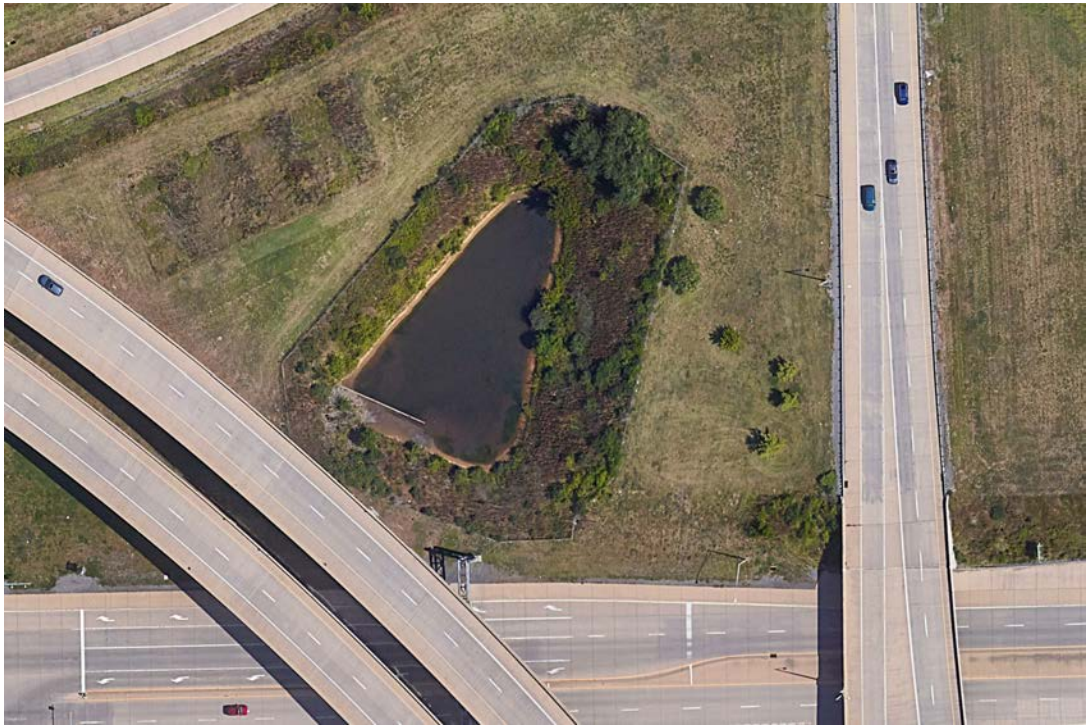

Figure 7.0 - Retention Pond along I-99, State College. Image: Google Earth Pro

Figure 7.1 - Retention Pond along I-99, State College. Image: Google Earth Pro

Climate Change and Stormwater

"We are the first generation to feel the effect of climate change and the last generation who can do something about it."

- Barack Obama

What's going to happen

Climate change has a significant impact on stormwater management due to intensifying rainfall patterns and increased frequency of extreme weather events. Rising global temperatures contribute to more powerful storms through increased atmospheric moisture levels and altered weather patterns.

This intensification leads to heavier precipitation over shorter periods, which overwhelms existing highway drainage systems designed for outdated rainfall norms. The strain on drainage systems exacerbates these challenges, necessitating more resilient stormwater management strategies. Planning resilient infrastructure and policies that account for climate variability are crucial in mitigating the impacts of storms and ensuring sustainable management of stormwater in a changing climate.

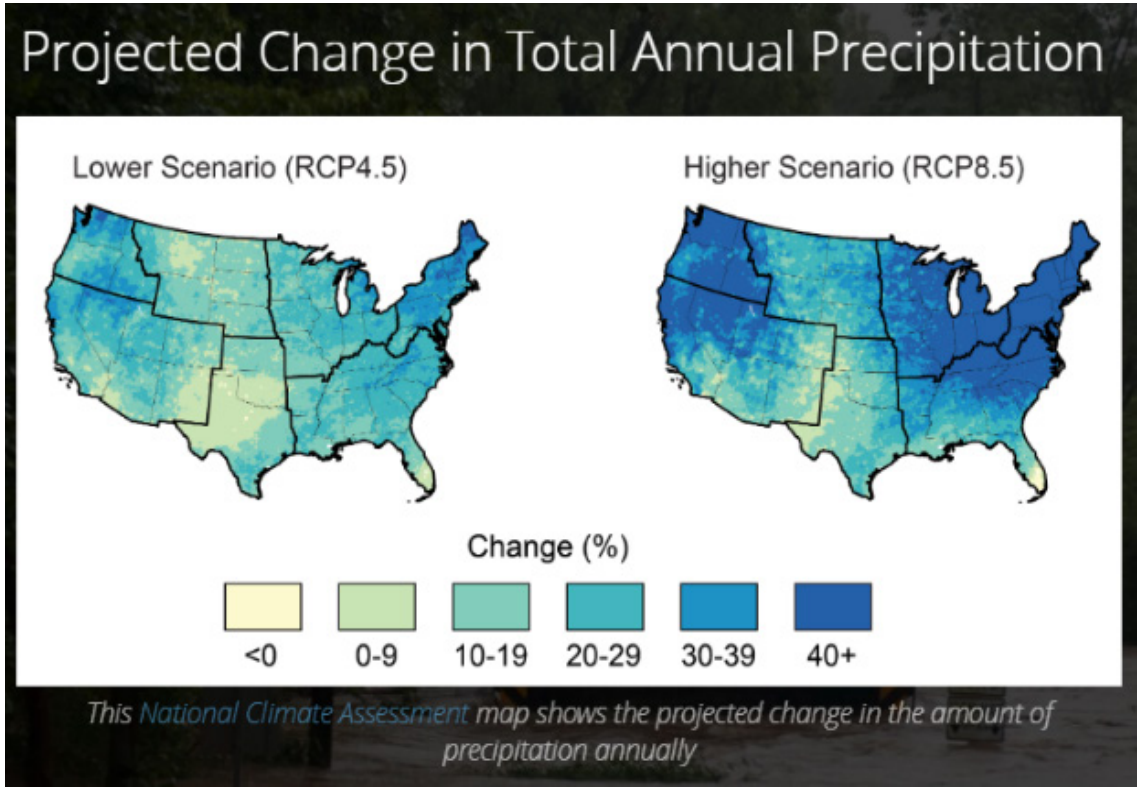

Image: PA Department of Environmental Protection

Biography

Adam Braughler
Third-Year Landscape Architecture Student

Adam is a landscape architecture student whose passions lie in community design and artful rainwater design. As a kid, he spent a lot of time exploring the woods around his house and became mesmerized by the creek that ran through his neighborhood, leading to his affinity for artful rainwater design and nature. This, combined with his interest in designing for unique communities, has fueled his love for landscape architecture.

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Image: Adam Braughler

Image: Cherohala Skyway, TN
Image: mvadingthedragon.com/

Character of Place

Cas Ryan | LARCH 414 | Spring 2024

Strategy

Character of place looks into regional and national examples of effective highway design. In addition to showing how such approaches can enhance safety and the driver's experience, this section seeks to inspire ideas from roads and landscapes that have similarities to different aspects of U.S. Route 322 in Penns-Brush Valley. Each example, whether driven by safety, economic development or environment, responds thoughtfully to the local landscape and cultural traditions of the places and communities featured.

Image: Middleburg, Virginia
Image: Cas Ryan

Traffic calming, through road alignment, textured pavement and plantings, has enhanced safety at this intersection on U.S. Route 50 as part of a Virginia DOT project to better manage commuter and truck traffic.

Introduction

Background

Penns-Brush Valley is known for its verdant landscapes and scenic beauty; however, the existing U.S. Route 322 highway presents several challenges impacting driver safety, roadway infrastructure, and driver engagement. In this section, we will explore examples that illustrate how enhanced safety and efficiency can also enhance the scenic beauty of the corridor.

The examples present a unique opportunity for PennDOT to implement highway improvements that harmonize with the natural beauty of this landscape and enhance the unique identity that each community wishes to portray. The examples are presented as ideas of how states and municipalities have found safe solutions that protect the unique character of their community.

Problem Statement

Improving highway safety and efficiency does not mean that the character of a place needs to be sacrificed. Across the United States, departments of transportation have been working with communities to enhance safety while protecting cherished places and important views. Such an approach to highway design is grounded in the Context Sensitive Solutions (CSS) movement many state DOTs have embraced as a preferred model for community engagement and design.

A representative of Maryland's State Highway Administration (SHA) noted during a presentation at the Preserving the Historic Road conference in 2000, "When we go into a historic community, we make improvements for highway safety and efficiency, and, if we did our job well, when we leave it looks like we were never there." (PHR 2000 Proceedings)

Figure 1.0 - Columbia River Highway Scenic Highway Image: Afuncan.com

Traffic Calming along Historic U.S. Route 50 in Virginia

In the late 1990s, increasing truck traffic, accident rates, and congestion were having a severe impact on the communities along a two-lane segment of U.S. Route 50 in Virginia. The historic towns of Aldie, Middleburg, and Upperville, each with listed historic districts in the National Register of Historic Places, wanted to improve safety without sacrificing the character of homes and cultural landscape in the towns. To improve safety and efficiency, the Virginia Department of Transportation (VDOT) initiated a plan to bypass the three communities with a limited-access expressway. VDOT had already reconstructed a one-mile segment of U.S. 50 west of Middleburg as a four-lane divided highway. The intensive construction, and wide swath of land required for a freeway, was unacceptable to the communities. The municipalities and local advocates argued for a Context Sensitive Solutions (CSS) design as an alternative, but VDOT pressed forward with the freeway project.

After several years of debate and advocacy, including consultations with Dan Marriott at the National Trust for Historic Preservation and civil engineer Ian Lockwood at Glatting Jackson, VDOT agreed to redesign the existing roadway according to CSS principles. The reconstructed U.S. Route 50 has resulted in lower speeds and higher safety. Rumble strips, narrowed segments, and safer turning lanes manage traffic better and use materials that reflect the historic character of the communities and agrarian landscape.

Image: Middleburg, VA. Image: Cas Ryan

Historic Columbia River Highway

Pop Courts

When the Historic Columbia River Highway opened to traffic in 1915, it was considered the most beautiful and safest road in the United States. Constructed with a maximum grade of 5%, the road navigated the steep terrain with ease; state-of-the-art wood guardrails, stonewalls, and concrete barriers protected motorists from cliffs, and broad curves moved vehicles safely above the river. Designed by civil engineer and landscape architect Samuel C. Lancaster, and based on a scenic touring road in Switzerland, the state highway would become a model for roads in the National Parks.

Sadly, sections of the magnificent highway were lost during the construction of Interstate 84 in the 1950s. The remaining segments of the historic road have been restored by the Oregon Department of Transportation (ODOT) and the road is listed as a National Historic Landmark, a National Historic Civil Engineering Landmark, and an All-American Road under the FHWA Scenic Byways Program. Historic barrier walls and rails have been reinforced to meet current safety standards while retaining their historic character. Remote sections, no longer accessible for automobiles, have been remade as a section of the state's bicycle network (Figure 1.0). The historic road is carefully managed by ODOT as directed under an act of the Oregon legislature:

Figure 2.0 - Columbia River Highway Scenic Highway Scenic Highway. Image: Afuncan.com

"The Legislative Assembly declares that it is the public policy of the State of Oregon to preserve and restore... the Historic Columbia River Highway for public use and enjoyment and... to rehabilitate, restore, maintain, and preserve all original roadway and highway-related structures."

Form and Function

Road design encompasses countless effective strategies– some permanent, some temporary, and some periodic. For example, narrowing the space of a road at an intersection can make it easier for pedestrians to cross. Such a change could be a permanent reconstruction of the curb and gutter and extension of the sidewalk pavement, or similarly achieved by the placement of temporary barriers/curbs to "test" the idea.

In some places, additional lanes may be constructed to accommodate peak traffic demand, or the installation of signals and signage can allow for flexible "on demand" use of a roadway to accommodate periodic peak travel times within the existing cross-section of the road. Such systems can also manage specific traffic use. For example, Rhode Island experimented with electronic tolling for trucks to better manage truck traffic; passenger cars passed under the electronic barrier with no toll.

Figure 3.0 - Electronic Truck Tolling in Rhode Island. Image: cdllife.com

Figure 3.1 - Flex Lane. Image: wisconsindot.gov/

Another effective strategy involves not altering the infrastructure of the road itself but rather its usage, as seen with the Madison U.S. Routes 12/18 Beltline Flex lane in Wisconsin. This lane restricts usage during specific times or high-traffic events to alleviate congestion. Applying similar techniques, a reversible central lane could facilitate inbound and outbound event traffic, effectively adding a lane where and when it's most necessary without enlarging the highway's physical profile.

Oversaturation

Hillsboro

Hillsboro, Virginia, a rural community on Virginia State Route 9, found itself in the path of new commuters seeking more affordable housing in neighboring West Virginia. The quiet main street became choked with traffic. To slow speeds and improve safety, Hillsboro undertook extensive traffic calming (roundabouts and narrower lanes) and streetscape enhancements (decorative pavement and bollards) to enhance the town's appeal. However, the use of too many different materials has overwhelmed the rural aesthetic that endeared the town to its residents. Now, granite bollards, oversized for the rural crosswalk, demand attention, and the attractive (and expensive) stonewall blocks a favorite view of adjacent agricultural fields. A traditional, white-painted rail fence would have maintained the view at a much lower cost.

While the town invested in quality materials, the intense concentration of new features shifted attention away from the town's natural charm and the agrarian landscape. In rural communities it is important to select quality materials that reinforce local character; road features should be subordinate to the historic landscape.

Figure 4.0 - Hillsboro, VA. Image: Elijah Pfeiffer

Figure 4.1 - Hillsboro, VA. Image: CES Consulting

Pennsylvania Roads

Rethinking rural and small-town Pennsylvania roads and streetscapes can offer inspired solutions and stunning perspectives that reflect local community values.

The images on this page reflect historic community engagements, such as the Soldiers and Sailors Monument in New Bloomfield or more recent streetscape improvements in West Chester.
The quintessential Lancaster County farm road reflects the harmonious relationship between the Commonwealth's agricultural landscape and its transportation network.

Figure 5.0 - Rural Road, Lancaster County. Caravan Sonnet

Figure 5.1 - New Bloomfield, Perry County. Image: Flickr

Figure 5.2 - Downtown West Chester, Chester County. J. Fusco, Visit Philadelphia

Biography

Cas Ryan
Third-Year Landscape Architecture Student

Cas, a veteran of the U.S. Air Force redirected their career path toward fostering creativity and aiding communities. They found their calling in Penn State's Landscape Architecture program. During their studies, Cas developed a passion for enhancing transportation systems, exploring alternative design solutions, and advocating for marginalized groups, including incarcerated individuals.

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Image: Historic Columbia River bikeway

Image Source: Landscape Architecture Magazine

Image: MDOT Sound Walls
Image: Ella Strzempek

Roadways and Health: A Vital Connection

Ella Strzempek | LARCH 414 | Spring 2024

Strategy

In addition to essential mobility, effective transportation infrastructure design must identify and account for potential impacts on public health within the proposed corridor. Direct and indirect impacts from noise and air pollution need to be studied both within the right-of-way and within the adjacent communities. Properly recognizing and designing to mitigate such impacts can significantly improve the mental wellbeing and physical health for impacted local residents. This project focuses on identifying areas of concern regarding public health and offering successful ways to mitigate noise and air pollution.

Image: People vs. Roads

Image: Jacob Hutton, Midjourney AI

Introduction

Background

When beginning my project, I was inspired to bring awareness to a topic in need of attention - the relationship between human health and roadway design. In past booklets, I didn't see this topic discussed so it struck me as a great opportunity, considering the impact that road infrastructure can have on human health.

To create a project that would give future classes insight, I carefully explored areas of research needed to deepen our understanding of this topic. By identifying places that can be researched further, I was able to expand upon the topic. I look forward to potentially inspiring landscape architects to establish a high standard in design that prioritizes human quality of life.

Image: ScienceNews

Problem Statement

The landscape architecture profession faces a critical challenge: widespread neglect of public health considerations in road design. Within the design process, air quality, noise pollution, physical safety, and the social and mental health impacts of roads are marginalized. Compounding this challenge is the inherent difficulty in perceiving and addressing these invisible health hazards. Without a concerted effort to integrate public health principles into road designs and planning practices, communities will continue to face risks to their well-being, hindering the creation of environments that foster holistic health and thriving urban living.

Image: CNN

Real Life Example

Dangers of Roadside Pedestrian Paths

The pedestrian path shown alongside Interstate 66 and U.S. Route 50 in Northern Virginia (Figures 1.0 and 1.1) may seem safe at first glance, but it poses several health concerns such as car pollution exposure, distracted drivers, debris, and traffic accidents. This example brings about the discussion of how we can look at the bigger picture of human health and roadways.

Figure 1.0 - Pedestrian Path Way, Interstate 66, VA. Image: Ella Strzempek

Current Standards

Many departments of transportation respond to public pressure to develop pedestrian paths to compensate for the excessive space allocated to vehicular traffic. Yet, these paths often fall short in addressing the diverse needs of pedestrians such as safety, health, and convenience amidst the dominance of a car-centric society. Raising awareness about the disparity between what transportation departments provide in terms of pedestrian paths along major roadways and the actual health implications they present sheds light on the issue across many states in our vehicular-dominated country. Understanding these disparities empowers individuals to advocate for higher standards, ensuring that roads are not just built for vehicles but for people

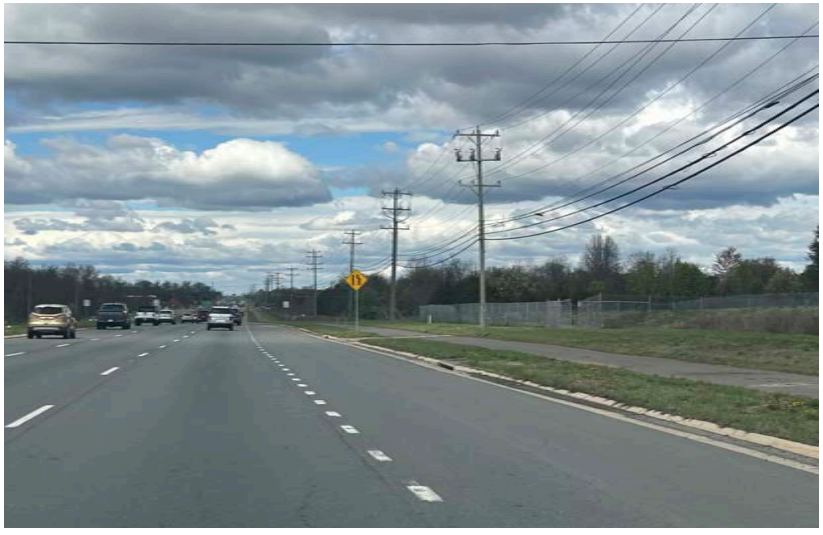

Figure 1.1 - Pedestrian Path Way, Interstate 66, VA. Image: Ella Strzempek

Dynamics of Air Pollution

Distance

Research from the Environmental Protection Agency (EPA) indicates that typical roadways can influence air quality within a few hundred meters (500-600 feet) of the right-of-way. The distance will vary by location, time of day or year, weather, topography, nearby land use, and traffic patterns. To better illustrate this, let's look at the Boalsburg exit in Pennsylvania (Figure 2.0). I have highlighted the limit of effect and the power of the pollutant per distance by color. Now, think of a road near where you live, work, or send your children to school. Regarding the distance chart, in which category of air pollution might you be currently residing?

Speed

The relationship between driving speed and pollution is not perfectly linear. The so-called "sweet spot" for air quality when driving is between 35 and 65 miles per hour. Within that speed range, the average carbon emission per mile barely changes. However, drivers who average about 80 mph emit more carbon due to engine strain. Conversely, people who average below 25 mph, usually in stop-and-go traffic, also have very high carbon emissions per mile.

Attempting to develop roadways that reduce the pollution they cause is not just a landscape architect's job. Fixing the pollution surrounding roadways starts with changing the standards of speed limits. Improving speed limits starts with the state's Department of Transportation.

Figure 2.0 - Distance of Air Pollution, Boalsburg PA. Image: Ella Strzempek

Dynamics of Noise Pollution

Speed

The relationship between speed limits and noise pollution is a significant but often overlooked aspect. As vehicles traverse roads at different speeds, the level of noise generated can fluctuate, impacting surrounding communities. High speeds typically correlate with increased noise emissions. Slower speeds, such as congested traffic areas or stop-and-go traffic, can be particularly noisy due to frequent acceleration and deceleration.

Sound

Sound is measured in decibels (dB). To better understand the decibel scale, a whisper is 30 dB, a normal conversation is 60 dB, and a typical vehicle can hit an average of 60-80 dB. Figure 4.1 presents a graphical approach to understanding decibel levels and their associated damage.

Everday Sounds and Noises	Average Sound (decibels)	Typical Response
Softest sound that can be heard	0 dB	
Soft whisper	30 dB	Sounds at these dB levels typically don't cause any hearing damage.
Normal Conversation	60 dB	
Washing Machine	70 dB	You may feel annoyed by the noise
Urban Traffic	71-85 dB	You may feel very annoyed
Motorcycles	95 dB	Damage to hearing possible after about 50 minutes of exposure
Subway Train or Sporting Events	100 dB	Hearing loss possible after 15 minutes
Standing near sirens	120 dB	Pain and ear injury

Figure 4.1 - Decibels Scale. Image: Ella Strzempek

Relationship of Noise Pollution

Figure 4.2 shows the relationship between sound and speed by diagramming a standard gas-powered vehicle, the different speed limits, and the level of noise pollution produced in decibels. When a vehicle increases its speed by 10 mph, the noise level increases by 3 dB. Given that a standard vehicle averages 60-80 dB, the effects of this noise pollution can be significant. Reducing speed limits on roadways and increasing speed enforcement efforts can be the most effective and cost-efficient means of reducing noise.

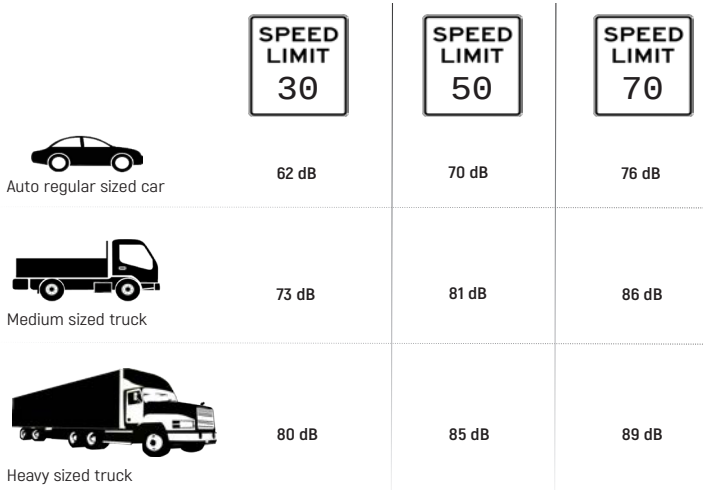

Figure 4.2 - Speed & Sound Relationship. Image: Ella Strzempek

Side Effects - Noise Pollution

Physical Effects from Noise

Noise pollution exacerbates health problems associated with roadway exposure. A 2023 experiment by the Union of Concerned Scientists, on the physical effects of noise pollution exposed participants to traffic noise and tested their health before and after exposure. The study concluded that road noise is linked to an increased risk of high blood pressure, a leading risk factor for heart attack and stroke. Prolonged high blood pressure can also cause severe damage to the heart, brain, kidneys, and eyes.

Mental Effects from Noise

Unwanted noise is often viewed as an unavoidable by-product of roadways, but the mental impact felt by the community cannot be disregarded. Noise annoyance frequently manifests as feelings of distraction, discomfort, and anger. If the noise persists, individuals may feel helpless in trying to control it, which contributes to stress. Research shows that exposure to high levels of noise leads to various mental health problems, including depression and anxiety.

Image: Jacob Hutton, Midjourney AI

Side Effects - Air Pollution

Composition of Pollution

Vehicles produce air pollution throughout their life cycle, including during operation. The five major pollutants associated with roadways and vehicles are particulate matter, volatile organic compounds, nitrogen oxides, sulfur oxides, and greenhouse gasses. Each pollutant is unique in its creation, molecular composition, and side effects of exposure; however, when mixed together, they form dangerous pollutants.

Image: Jacob Hutton, Midjourney AI

Physical Effects from Air

There are many health effects associated with proximity to roads and the resulting air pollution, including cardiovascular disease, reduced lung function, impaired lung development in children, preterm and low birth weight infants, childhood leukemia, and premature death.

Mental Effects from Air

Pollution-related illnesses extend beyond physical health and heavily impact mental health. Even brief exposure to air pollution can increase the risks for psychosocial disorders like depression and schizophrenia, with damage starting as early as childhood. Much of the research on air pollution and mental health has come from studies on mice, demonstrating behavior changes in response to pollution exposure.

In a 2011 study published in "Molecular Psychiatry", researchers exposed mice to increased levels of air pollution for eight hours a day, five days a week, for ten months. This exposure mimics that of an adult living in the suburbs and commuting to an urban environment. Results showed that mice struggled with learning new tasks, such as navigating mazes, and exhibited signs of depression. They quickly gave up on difficult tasks and lost interest in activities they once enjoyed, like drinking sugar water. Researchers also noted significant differences in the brains of the exposed mice compared to baseline mice, finding more cytokines–signs of harmful inflammation–in the brains of the exposed mice. Cytokines are significant contributors to negative mental health.

Overall, long periods of increased air pollution may be related to a 17% increase in bipolar disorder cases, 6% increase in depression diagnoses, and 20% increase in personality disorders. The evidence concludes that air pollution significantly impacts mental health, emphasizing the urgent need to mitigate pollution's detrimental effects on wellbeing.

Solutions

Barriers

The United States Environmental Protection Agency (EPA) is actively engaged in addressing these critical issues. EPA scientists have compiled extensive research, culminating in the book "Recommendations for Constructing Roadside Vegetation Barriers to Improve Near-Road Air Quality".

Road mitigation involves strategizing to minimize or offset the adverse impacts of road construction and transportation on the surrounding environment and communities. For landscape architects, the ideal outcome is to balance transportation infrastructure with community integrity. My proposed solution to fixing previous issues in the least harmful way possible is to use roadside barriers.

Roadside barriers can be walls, well-designed vegetation, or a combination of both built alongside roadways to reduce traffic noise and collect air pollutants. The EPA finds that properly designed roadside vegetation and walls can reduce downwind pollution concentrations near roadways by altering airflow, intercepting pollution, and absorbing noise pollution. These barriers can also enhance the visual appeal of the landscape, contributing to the overall design narrative through thoughtful integration of materials, textures, and vegetation.

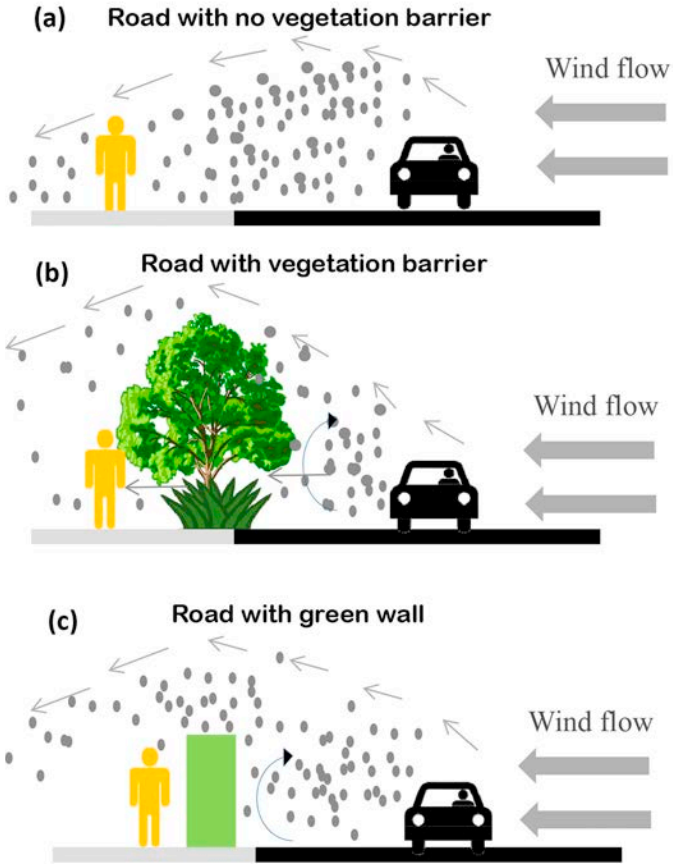

Figure 5.0 - The Effects of Barriers. Image: ScienceDirect

Real Life Examples

Image: Research Gate

Image: ARL Now

Image: Pinterest

Image: Science Direct

Solutions

Better Regulations

Ineffective planning and inadequate regulations can exacerbate pollution issues. Zoning regulations play a critical role in managing near roadways and mitigating traffic congestion in urban areas. By managing land use, zoning regulations can limit traffic on roads and reduce negative health impacts.

Moreover, advocating for zoning regulations that mandate roadways be built at a safe distance from residential areas and schools can prevent additional health impacts.

Introducing additional measures such as zoning policies and design guidelines can significantly steer the location of new developments away from high-traffic zones. These measures not only protect public health in the present but also ensure long-term safeguards against potential mental and physical harm caused by proximity to roadways.

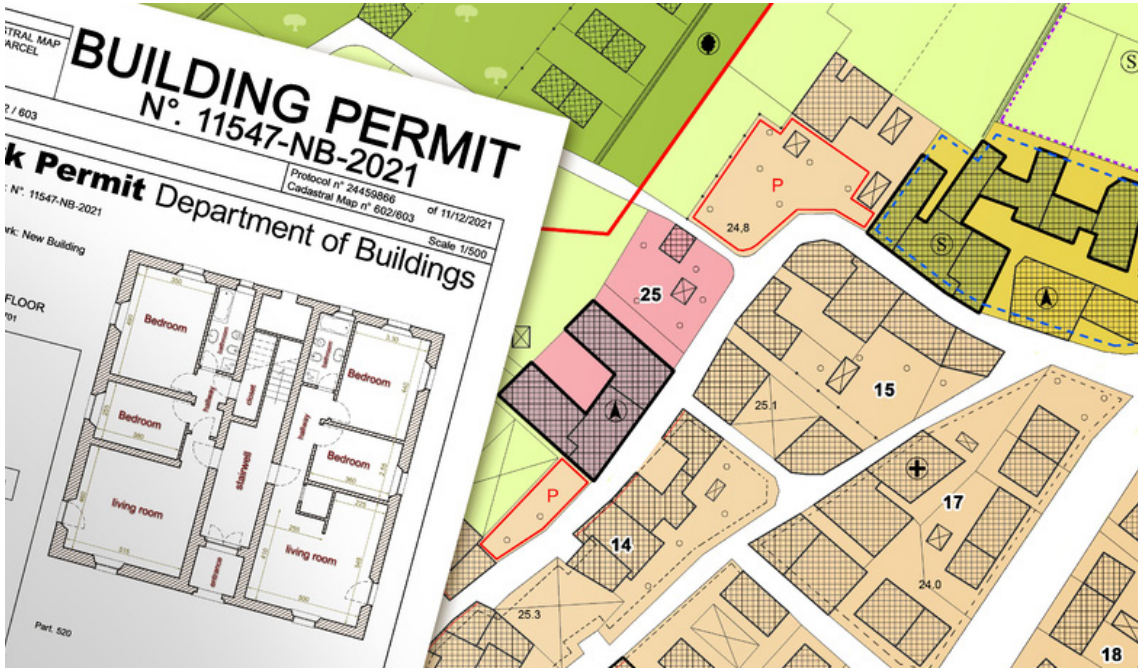

Image: National Property Inspections

Noise Cameras

Reducing noise pollution requires addressing its root cause: the internal combustion engine. Given our current dependence on combustion vehicles, achieving this goal is challenging. Recently, noise cameras have been installed along roadways in European cities. These cameras automatically issue tickets to drivers of vehicles exceeding a specified noise threshold. Introducing similar noise cameras on American roads could significantly benefit public health by curbing noise pollution. Moreover, employing noise cameras promises long-term savings through mitigating the harmful impacts of noise and encouraging vehicle owners to adopt quieter transportation options.

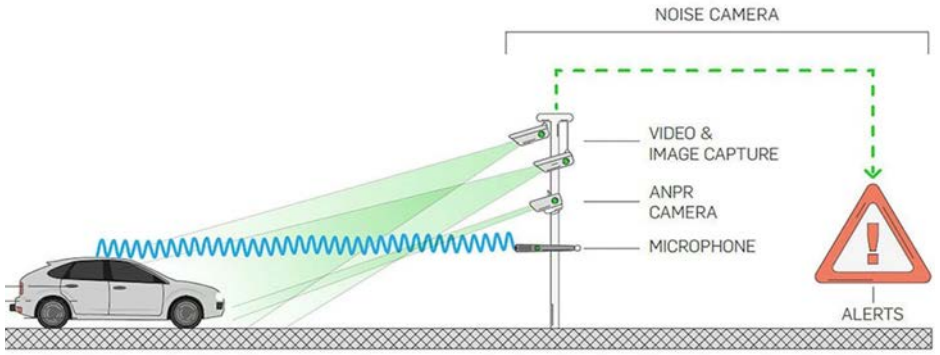

Image: RevZilla

Solutions

Prevention and Awareness

Raising awareness about the impact of roads on our physical and mental health is essential for building healthier communities. Understanding the health risks associated with living near busy roads empowers individuals to make informed decisions. Incorporating health-focused strategies into road design can benefit future generations by equipping them with the knowledge to make informed transportation and living choices.

By integrating health considerations into road planning, communities enable individuals to prioritize their well-being and reduce the risk of road-related health issues. Planning roads with future generations in mind requires careful consideration to ensure residential areas are sufficiently distanced from busy roadways. Emphasizing preventive measures and advocating for policies that prioritize public health regarding roads fosters an environment conducive to both physical and mental wellbeing.

Image: Elijah Pfeiffer

Biography

Ella Strzempek
Third-Year Landscape Architecture Student

Ella Strzempek is a dedicated advocate for nature and community, and has integrated her passion for the environment into her life through her studies in landscape architecture. Raised in Pittsburgh by artistic and outdoors-loving parents, she developed a profound appreciation for nature and a strong commitment to environmental stewardship. Her formative years, spent exploring Allegheny County Parks both as a visitor and employee, deepened her passion for conserving natural sanctuaries while ensuring they remain safe, clean, and inclusive.

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Image: Combined sound wall and vegetation planting along MD 200.

Image: Elijah Pfeiffer

Image: Montgomery County MD Agricultural Reserve
Source: Wikipedia

Agricultural Conservation

Morgan Smith | LARCH 414 | Spring 2024

Strategy

The agricultural landscape in Penns-Brush Valley can be maintained and protected by utilizing strategies of land conservation. The proposed U.S. Route 322 highway corridor will have a significant impact on sustainable and efficient farming practices, family farms, historic landscape patterns within the cultural landscape and responsible growth. The Rethinking 322 project advocates for more attention to the farms and families who have worked the land by featuring perspectives from their experiences and legacy within the Penns-Brush Valley.

Rethinking 322 Agricultural Rendering

Image: Jacob Hutton, Midjourney AI

Agriculture Land Conservation

Background

The proposed expansion of U.S. 322 will have a significant impact to the surrounding agricultural community. This new roadway will directly intersect or adversely affect adjacent farms along the chosen corridor, permanently altering the landscape of these farms. Agriculture in Penns-Brush Valley is not just a business; it embodies culture, community, and family. This initiative is a collaborative effort among government entities and nonprofit organizations, united in their goal to protect prime farmland. The agricultural history of Centre County is a cornerstone of the region, cherished by local residents while visitors value its preservation. Pennsylvania leads the nation in the preservation of farms and agricultural acreage, resulting in an abundant food supply and a robust economy. To fully capture the story of Penns-Brush Valley, it's crucial to highlight the individuals who uphold the longstanding tradition of farming in the limestone valleys of Centre County, Pennsylvania.

Figure 1.0 - Ariel View, Penns Brush Valley. Image: Wikipedia

Figure 1.1 - Preserved Farm Sign, Centre County. Image: Centre County Historical Society

Agricultural History

Timeline of Centre County

Centre County's history began between 1790 and 1830. During this agrarian period small-scale farming prevailed, emphasizing land clearing and fencing. Farm families aimed for "competency," producing goods for both personal use and trade. Global markets flourished while domestic markets gained significance. Agricultural reform and reconstruction influenced regions like Centre County. This era marked a transition from subsistence to market production and resulted in a heightened standard of living through self-sufficiency and trade.

From 1830 to 1920, Centre County saw the emergence of robust local markets and improved transportation, facilitating access to distant markets. Population growth and the operation of iron furnaces contributed to market demand and farm mechanization. Valley farms became highly mechanized, characterized by abundant horses and agricultural implements by 1860. By the 1880s, many farms had acquired a full range of agricultural implements, influenced by high mechanization levels and tenancy rates.

From 1920 to 1950, Centre County transitioned from horse-powered to motorized farming, becoming a state leader in farm mechanization. Local farming focused on growing alfalfa, corn, and hay for dairy production. Centre Hall emerged as an egg supply hub with hatcheries. Tenancy rates remained high, with sharecropping arrangements adjusted to include regular payments for milk.

EARLY DEVELOPMENT:
1790-1830

A HIGH-POWERED GRAIN AND LIVESTOCK ECONOMY:
1830-1920

THE RISE OF MOTORIZED FARMING, DAIRYING, AND POULTRY RAISING:
1920-1950

Figure 2.0 - Timeline of Agriculture, Centre County.

Image: Morgan Smith

Agriculture Land Conservation

What is Land Conservation?

An agricultural conservation easement is a voluntary deed restriction landowners place on their property to protect productive agricultural land and open space. Like other sensitive landscapes, farmland nationwide faces development pressure. Approximately one in five jobs in Pennsylvania is linked to agriculture. Farms provide essential raw materials for food processing plants, restaurants, and grocery stores. Farmland serves as a buffer between urban and natural environments by providing habitats for fish and wildlife, protecting waterways, and improving air quality. Participation in these conservation programs helps to ensure the longevity of these establishments.

Easement Programs

Agricultural Security Areas
Conservation Easements
Ag Land Preservation Board
Centre County Farmland Trust
Century Farms Regional Growth
Boundary Agricultural Zoning

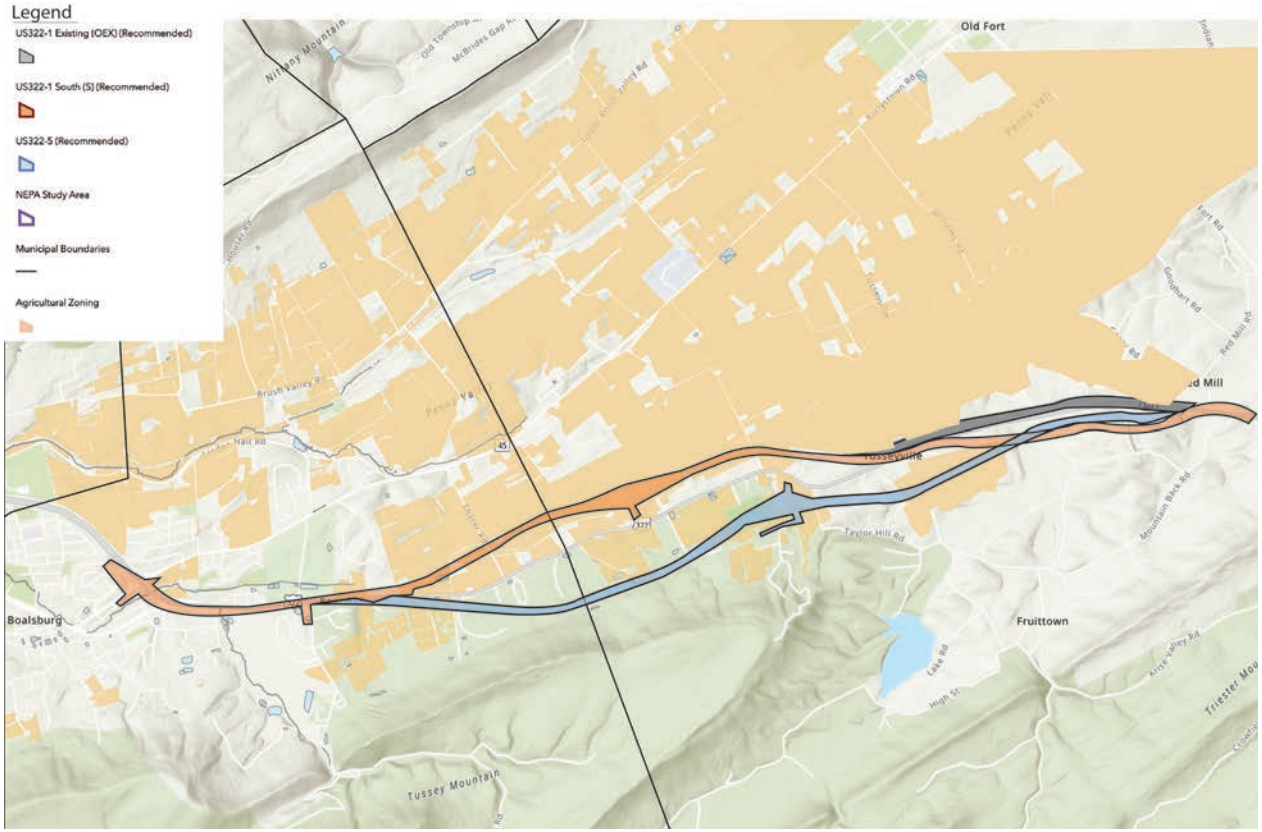

Figure 3.1 - PennDOT Corridor Map, Penns-Brush Valley with Agricultural Zoning. Image: Morgan Smith

Centre County Agriculture Land Easement

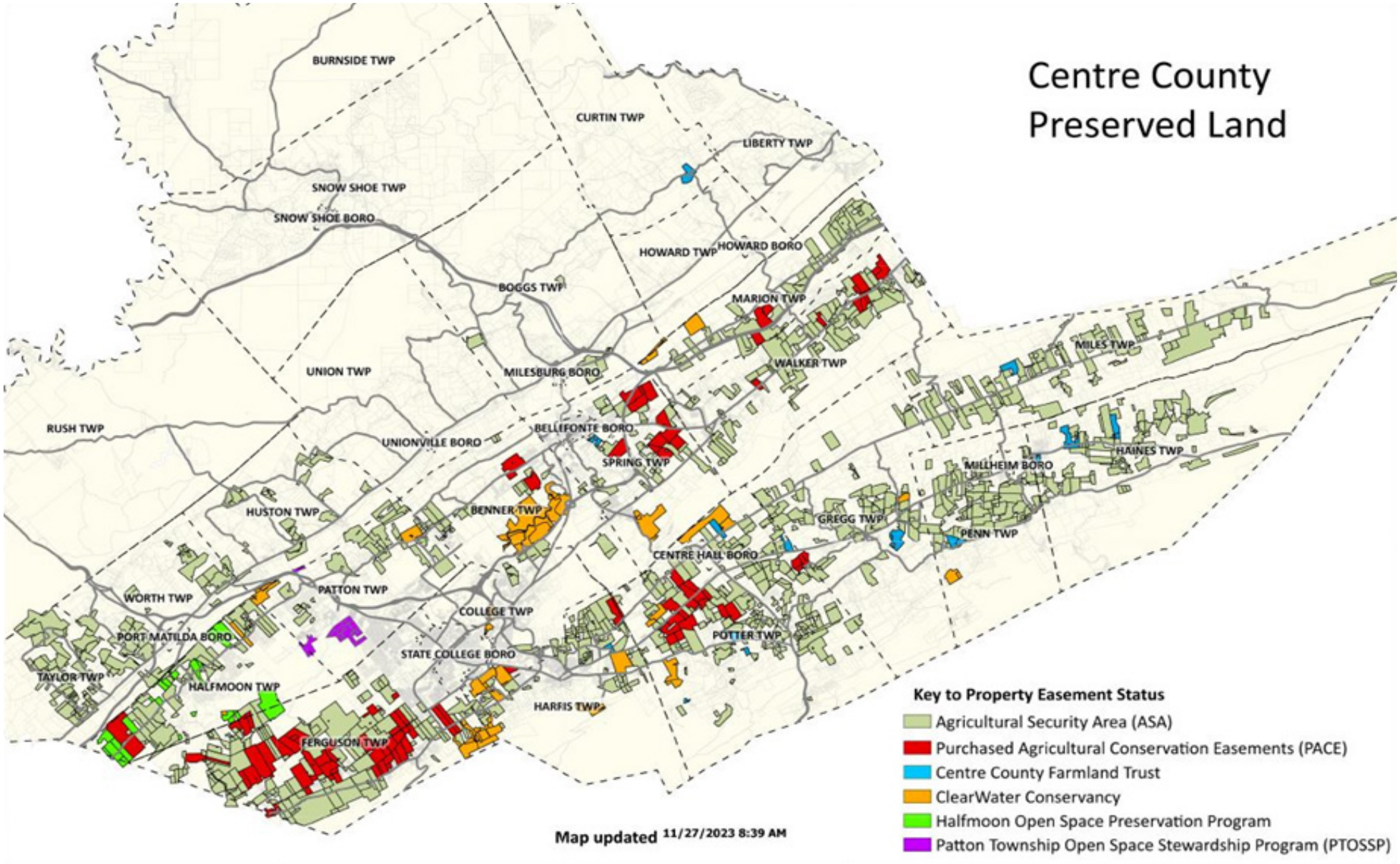

Figure 3.0 - Preserved Land Map, Centre County.

Image: Centre County, PA

Reality without Intervention - Tait Farms

Family Farming

Marian and Elton Tait purchased their farm along U.S. Route 322 in 1950. Here they raised their three children in a magical landscape with various animals and Christmas trees.

In the late 1970s, their sons returned to the farm, transforming it into a pick-your-own crop destination. In 1986, an abundance of raspberries led to the establishment of Tait Farm Foods. The company, now owned by Kim Tait and Cindy Tait Law, offers more than sixty-five specialty food products, maintaining a commitment to artisanal quality and small-batch production. Although manufacturing was moved to a dedicated facility in Boalsburg, PA in 2014, products are still sold at the farm and through various retailers nationwide. Their farm operates a year-round market that supports over sixty local producers and artisans, bolstering the local economy and supporting other producers and creatives in the area. Their production involves a team of more than twenty people between the farm and production facility, fostering a close-knit community that upholds agricultural traditions.

The proposed PennDOT State College Area Connector corridor U.S. 322-5 could threaten crucial production areas for Tait Farms, including their Christmas tree farm and greenhouses where they grow many crops and develop their propagations for the growing season. Some corridors under study would cut through the stream that runs through the farm.

Sustainability

Tait Farms has prioritized sustainability in its business practices. This commitment includes in-house propagation, stream buffering, and habitat creation. Additionally, Tait Farms secured federal funds for a six-acre reserve designated as a habitat for pollinators. These native pollinators support Tait Farm's agricultural practices and benefit the local community.

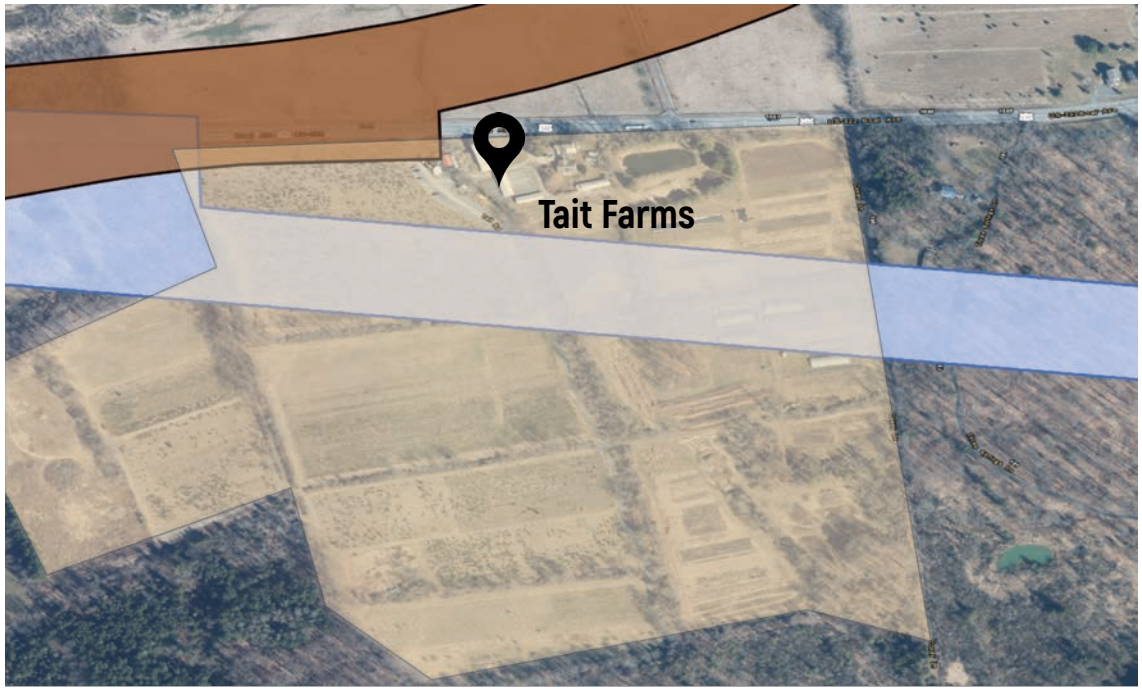

Figure 4.0 - Locator Map, Tait Farms. Image: Morgan Smith

Figure 4.1 - Green houses, Tait Farms. Image: Morgan Smith

Legend

US322-1 Existing (OEX) (Recommended)

US322-1 South (S) (Recommended)

US322-5 (Recommended)

Municipal Boundaries

Reality without Intervention - Kuhns Tree Farm

Kuhns Tree Farm

Kuhns Tree Farm, located seven miles east of State College, Pennsylvania, is a family-owned business founded by Dr. Larry Kuhns, a professor of ornamental horticulture at Penn State. For nearly forty years the farm has been a cherished destination for families seeking the perfect Christmas tree, creating lasting memories with each holiday season. The farm holds deep sentimental value for the Kuhns family, symbolizing their strong familial bonds, particularly for Marianne Kuhns.

After Dr. Kuhns passed away, farm manager Doug Banker took over operations. In 2024, increased development in the surrounding area, coupled with climate change, had caused adverse effects such as runoff and dry seasons, impairing crop production. Figure 5.0 illustrates how corridor U.S. 322-1 South intersects with the farm's most productive land. Since PennDOT began the study for expanding U.S. Route 322, Doug has significantly reduced planting, leading to a declining income for the farm. This is due to the fact that Christmas trees, unlike annual crops, require ten years to mature—making it a challenge to anticipate the future. The prevailing sentiment among the family is anguish of waiting and uncertainty regarding the farm's future.

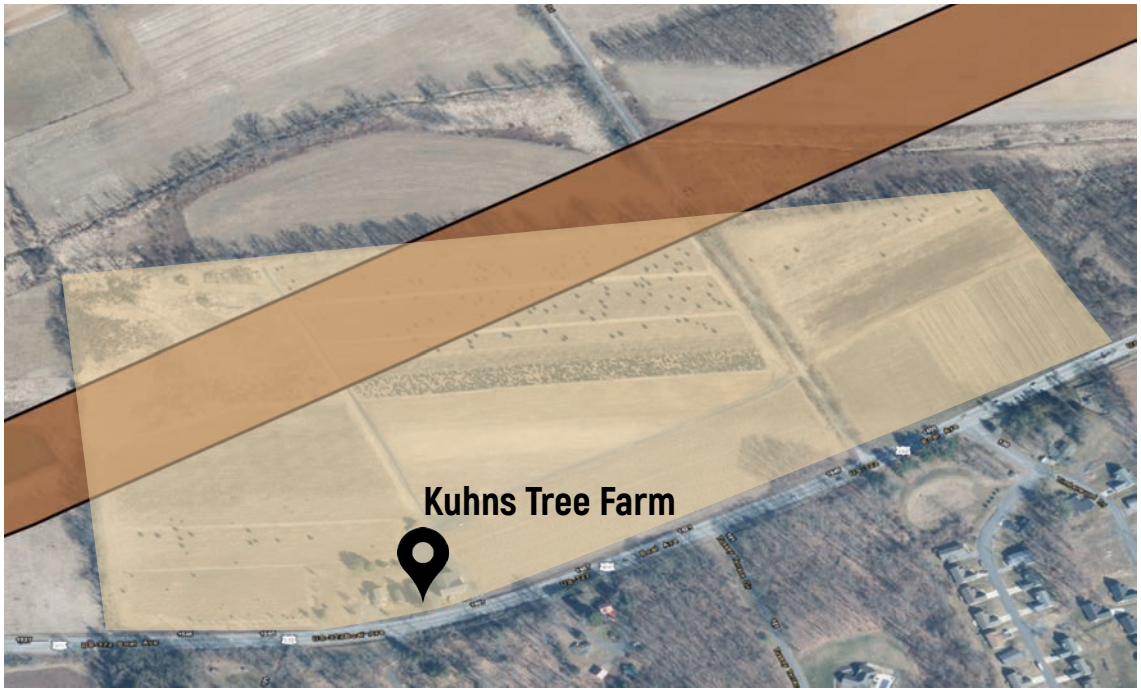

Figure 5.0 - Locator Map, Kuhns Tree Farm. Image: Morgan Smith

Figure 5.1 - View of Barn, Kuhns Tree Farm. Image: Morgan Smith

Legend

US322-1 Existing (OEX) (Recommended)

US322-1 South (S) (Recommended)

US322-5 (Recommended)

Municipal Boundaries

It Is More than Land

Kuhns Tree Farm

"Larry and I were 30 when we moved to State College in 1977 and only 33 when we put every penny we had into starting the farm in 1980. As I look back, I realize we created something that bound our family together in a very positive way. Grandparents watched our children until they were old enough to work at the farm. Those children still work the farm today. My grandson told me this past Christmas he was going to take over the farm when he grew up. I didn't have the heart to tell him that might not happen. There are many other families in the valley who have deeper, longer histories with the land than we do, but I think all of us share a love of the land and have a deep appreciation for the life it allows us to live. Land is a finite resource; but once we lose it to unchallenged development, it's gone forever. Future generations will not experience the joy and satisfaction of living on and with the land."

-Marianne Kuhns

Figure 6.0 - Marianne and Larry Kuhns, Kuhns Tree Farm. Image: Kuhns Tree Farm Facebook

Planning for the Future - Agriculture Reserve

Montgomery County, MD

First conceived in 1964 and formally established in 1980, the Montgomery County (MD) Agricultural Reserve is considered one of the earliest and most successful farmland preservation programs in the United States. Less than 25 miles from Washington, D.C., the 93,000-acre reserve uses a variety of land-use tools and incentives that have protected more than 500 farms through conservation easements, an innovative transfer of development rights (TDR) program, and rural zoning reform to support farming.

Instead of viewing agricultural conservation by individual properties, Montgomery County sees agriculture as a collective effort. Land conservation reflects a holistic approach by treating the entire community as a priority. This approach could be a viable option for Centre County to consider. While placing individual farmland in an easement or trust, as has protected a number of farms in Penns-Brush Valley, harnessing a larger community commitment could strengthen the region's ability to safeguard the productive land that sustains local livelihoods, families, and culture.

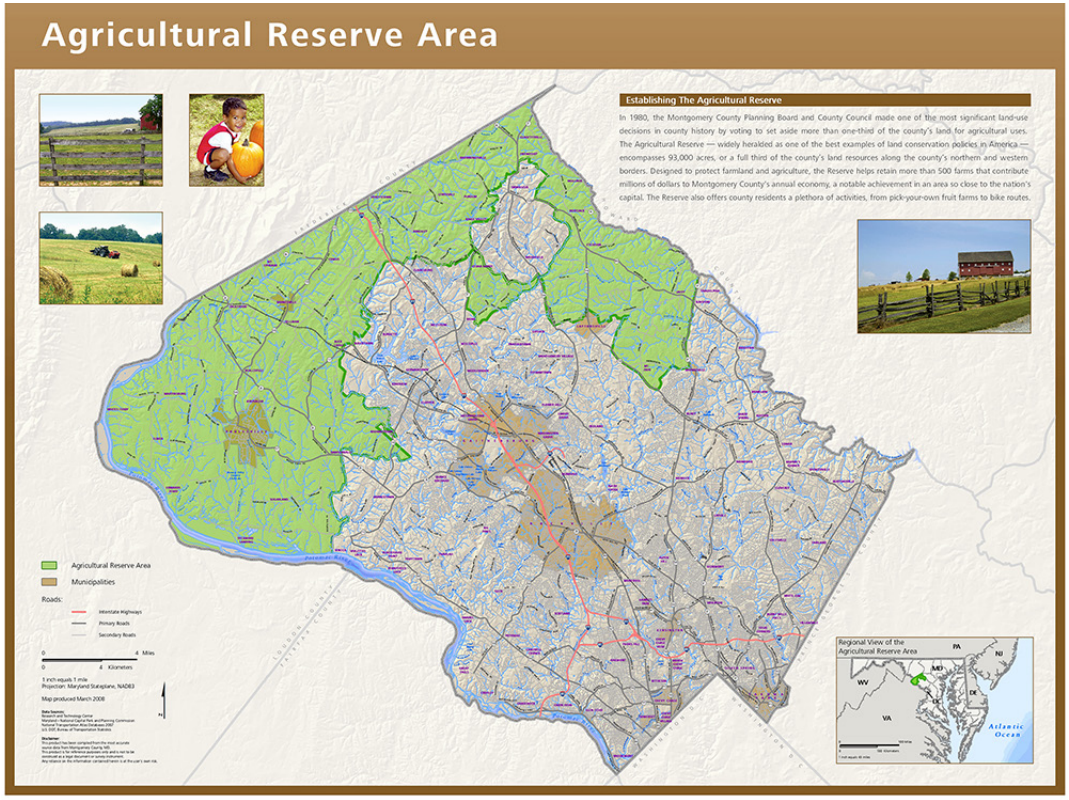

Figure 7.0 - Agriculture Reserve, Montgomery County. Image: American Planning Association

Biography

Morgan Smith
Third-Year Landscape Architecture Student

Morgan is a third-year landscape architecture student from Lancaster, Pennsylvania. She has a particular interest in equitable landscape and conservation. Post-Rethinking 322, she plans to continue pursuing her interests in infrastructure and development and its intersection with landscape architecture. Her most important takeaway from this project is the significance of community and the power it holds.

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Image: Farmers threshing hay

Image: Centre County Historical Society

Image: Brunswick Pedestrian
Image: Eliza Li

Pathways to Safety

Eliza Li | LARCH 414 | Spring 2024

Strategy

In addition to the State College Area Connector (SCAC), it's important to consider adjacent and intersecting roads that will be impacted by the PennDOT proposed project. Possible changes in traffic and use on these roads, as result of SCAC provide a unique opportunity to improve safety, multi-modal travel, and community identity within the corridor. In this strategy to redesign Earlystown Road between the U.S. Route 322 Bypass and Boal Avenue, the Rethinking 322 project showcases an option to improve connectivity in Boalsburg and improve safety for all users that rely on the road for their daily commute. By improving transportation and streetscape infrastructure, we can help reduce pedestrian fatalities by providing safe and desirable spaces for walking and biking. By implementing effective traffic calming and road diet solutions, we can create safer pathways for both pedestrians and drivers.

Rethinking 322 Multi-model Transportation Render

Image: Jacob Hutton, Midjourney AI

Existing Conditions

Background

In Boalsburg, Pennsylvania, the intersection of Route 45 (Earlystown Road) and Boalsburg Avenue serves local and regional traffic by connecting commuters traveling to State College and nearby areas. This intersection is characterized with its vehicle-centric design and well-maintained roads that lack comprehensive facilities for pedestrians and cyclists.

Existing Conditions

The intersection of Earlystown Road and Boal Avenue in Boalsburg poses significant safety concerns for pedestrians and cyclists. The area lacks pedestrian-friendly infrastructure, discouraging walking and biking. The triangular refuge island–intended to provide a safe crossing point–lacks protection or vegetation, leaving pedestrians exposed and uncomfortable while waiting in the middle of the intersection. Crosswalks are poorly maintained, with faded markings (Figure 1.2) and tire tracks (Figure 1.3) indicating frequent vehicle encroachment suggest a high-risk exposure to pedestrians.

Furthermore, sidewalks along Route 45 leading up to the intersection are discontinuous (Figure 1.0), restricting residents' ability to walk safely to their destinations. The absence of separation between pedestrian areas and traffic increases the risk of accidents. Wide shoulders prioritize vehicle use without providing adequate space or barriers for non-motorized users. Inadequate lighting further compromises safety, particularly for residents and pedestrians walking at night. These issues underscore the urgent need for comprehensive street design improvements to enhance pedestrian safety and accessibility.

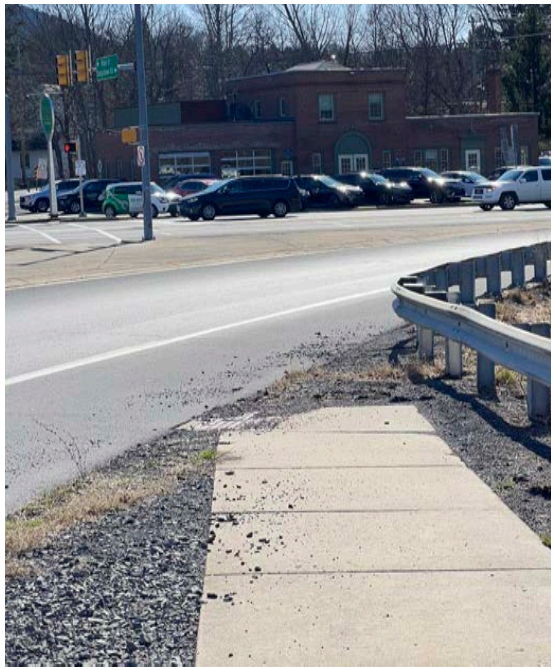

Figure 1.0 - Intersection of Earlystown Rd. and Boal Ave. Boalsburg, PA. Image: Eliza Li

Figure 1.1 - Pedestrian Crossing at Earlystown Rd. PA. Image: Eliza Li

Figure 1.2 - Intersection of Earlystown Rd. and Boal Ave. Boalsburg, PA. Image: Eliza Li

Figure 1.3 - Triangular Island at Intersction of Earlystown Rd. and Boal Ave. Boalsburg, PA. Image: Eliza Li

Pedestrian and Cyclist Fatalities

Statistics

According to data from PennDOT, pedestrian-related crashes comprise 2.8% of all reported traffic incidents but account for 15.6% of all traffic-related fatalities. Similarly, bicycle crashes constitute 0.7% of reported crashes and 1.3% of traffic deaths. **Figure 2.0** and **Figure 2.1** illustrate that fatalities involving pedestrians and bicyclists are notably high on state highways.

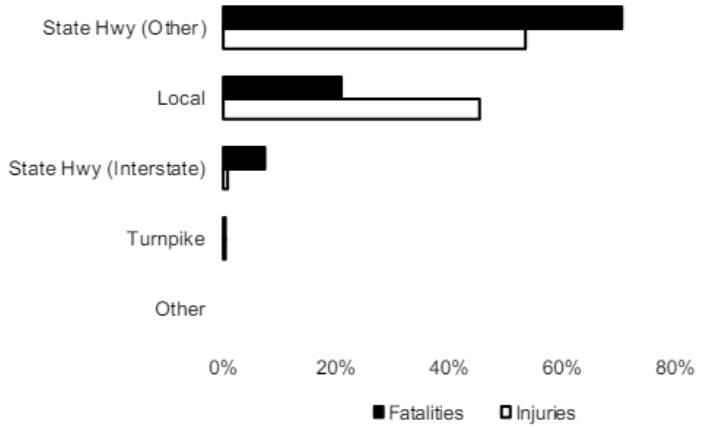

Figure 2.0 - Pedestrain Fatalities By Road Type. Image: Eliza Li

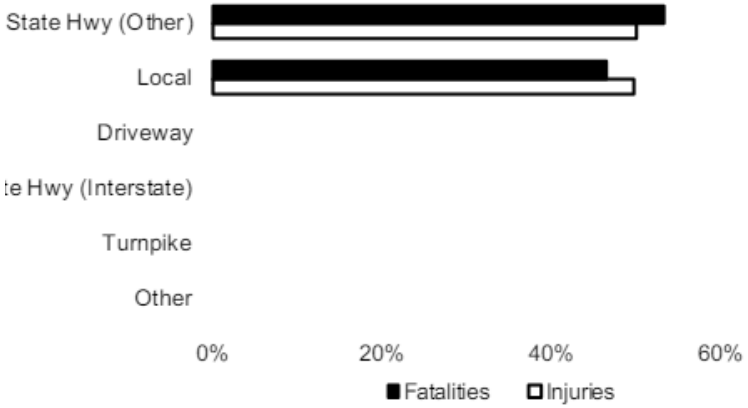

Figure 2.1 - Bicyclist Fatalities By Road Type. Image: Eliza Li

Street Design Improvements

"Complete Streets" is an approach that ensures safe access for all users. Road diets can effectively reduce vehicle speeds and the number of lanes pedestrians need to cross while also providing space to introduce new pedestrian amenities.

Figure 2.2 -Franklin Boulevard Complete Street, Sacramento, CA. Image: Benette Engineering Services

Street Design Improvement

Reimagining Earlystown Road

Imagine the intersection of Earlystown Road (Route 45) and Boal Avenue transformed to have more vegetation and a narrowed road design to slow traffic and increase safety. Pedestrian crossings would become clearer with well-delineated paths and vegetation on both sides would serve as a protective barrier while creating a welcoming aesthetic. This greenery would enhance the area's appearance and contribute to environmental health and air quality. A more attractive and safer streetscape would encourage residents to walk, reducing their automobile dependency. For instance, residents of Liberty Hill–who live just a ten-to-fifteen-minute walk from downtown Boalsburg–would be more inclined to walk rather than drive if the route were safer and more pleasant. This redesign would promote physical activity, thereby improving public health.

These elements align with the Complete Streets concept, which aims to design and operate streets to enable safe access for all users. Adding dedicated bicycle lanes would invite a diverse group of users, connecting different neighborhoods more effectively. These bike lanes provide a safe route for cyclists, reducing accident rates and promoting healthier, more sustainable transportation options.

Figure 3.0 - Liberty Hill Entrance, Boalsburg, PA. Image: Eliza Li

Figure 3.1 - Triangle Pedestrian Island, Boalsburg, PA.
Image: Eliza Li

Figure 3.2 - Redesigning Triangle Pedestrian Island, Boalsburg, PA.
Image: Eliza Li

Park Avenue Road Design

Reimagining Earlystown Road

Earlystown Road could adopt similar qualities to State College's Park Avenue. Park Avenue features a pedestrian refuge island (Figure 4.0), which shortens crossing distances and provides a safe stopping point in the middle of the road. The street is well-lit with numerous light posts, enhancing nighttime visibility and safety. Park Avenue also includes a road median (Figure 4.3) and narrower drive lanes, which calm traffic and create a safer environment for all users. Wider sidewalks offer more space for pedestrians and the addition of vegetation (Figure 4.2) beautifies the area while acting as a natural barrier between pedestrians and vehicles. This design encourages walking and cycling, making the area inviting and accessible. By adopting a similar approach, Earlystown Road could become a safer, more attractive route that connects neighborhoods and promotes more sustainable modes of transportation.

Figure 4.0 - Pedestrian Island, Park Ave, State College,PA
Image: Eliza Li

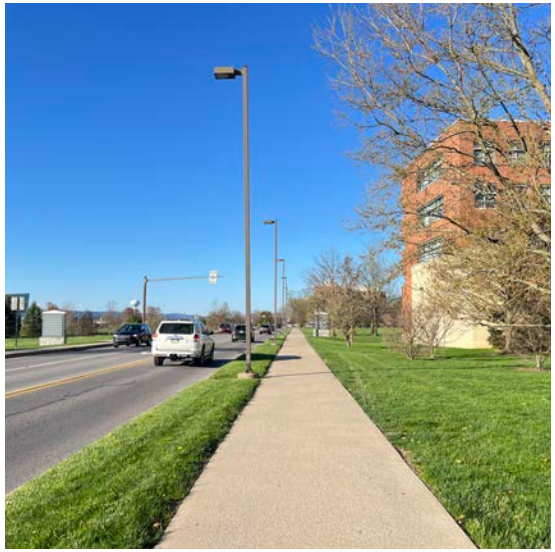

Figure 4.1 - Park Ave 's Light Post, State College,PA
Image: Eliza Li

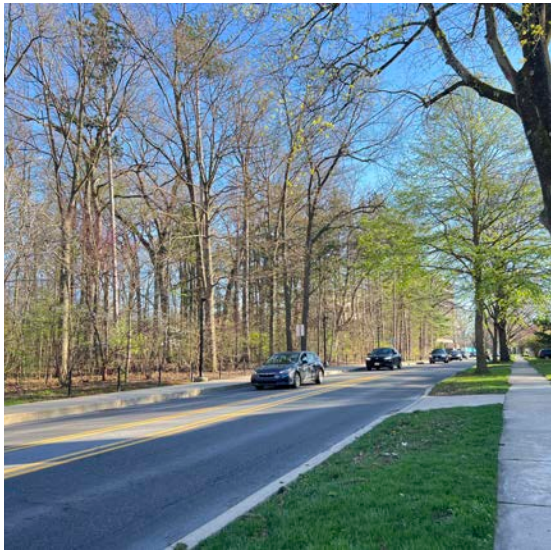

Figure 4.2 - Park Ave. Vegetation, State College,PA
Image: Eliza Li

Figure 4.3 - Park Ave.'s Road Median, State College,PA
Image: Eliza Li

Earlystown vs. Park Ave.

Road Design Comparison

Comparing the road designs of Earlystown Road and Park Avenue reveals stark differences in layout and functionality. Earlystown Road (Figure 5.1) appears noticeably empty when compared with Park Avenue (Figure 5.0). Park Avenue's multi-modal accommodations, despite its narrower road width, presents a significant opportunity to rethink design improvements on Earlystown Road. The extended width of Earlystown Road prioritizes vehicle traffic over pedestrian access and connections with historic Boalsburg Village.

In contrast, Park Avenue boasts wider sidewalks on both sides, providing ample space for pedestrians. The presence of vegetation and pedestrian-friendly features on Park Avenue creates a welcoming and safe environment for all users. By adopting similar design elements, Earlystown Road could significantly enhance its accessibility and appeal, encouraging sustainable modes of transportation more effectively. The bike lanes provide a safe route for cyclists, reducing accident rates and promoting healthier, more sustainable transportation options.

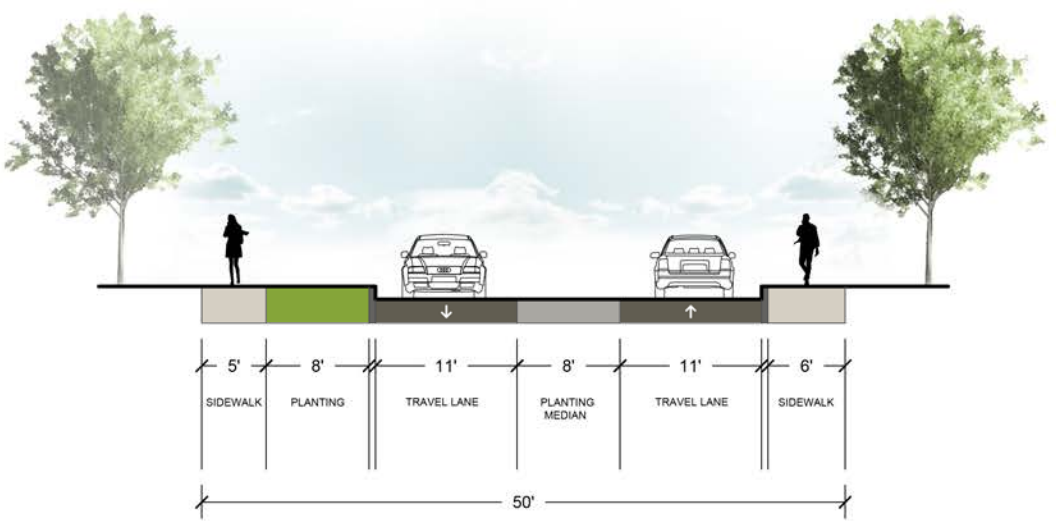

Figure 5.0 - Existing Section of Park Avenue, State College, PA. Image: Eliza Li

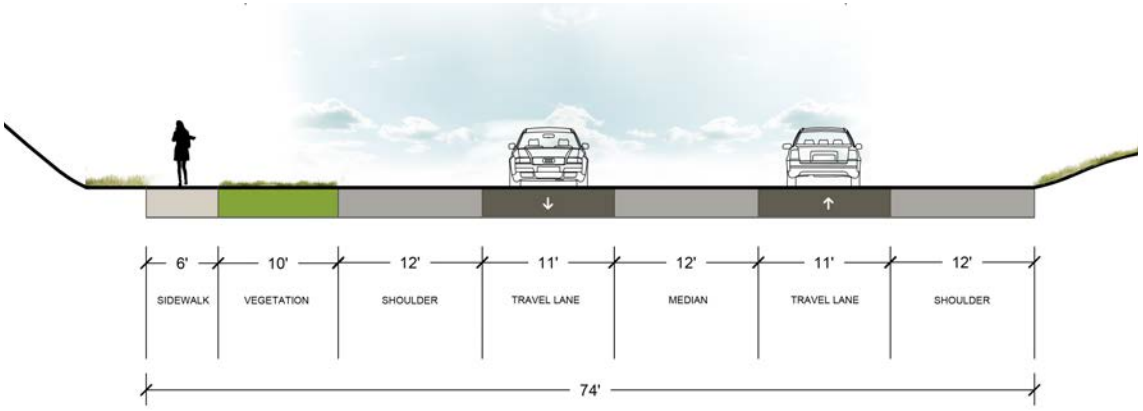

Figure 5.1 - Existing Section of Earlystown Road, Boalsburg, PA. Image: Eliza Li

Traffic Comparison

Annual Average Daily Traffic

According to the Annual Average Daily Traffic (AADT) statistics, Park Avenue experiences a significantly higher traffic flow with an AADT of 13,633 (Figure 6.1) compared to Earlystown Road, which has a significantly lower AADT of 6,129 (Figure 6.0). Despite handling more than double the traffic, Park Avenue maintains narrower driveways, effectively managing the higher volume of vehicles. This comparison suggests that implementing a road diet on Earlystown Road would not negatively impact its traffic flow. Instead, it would transform Earlystown Road into a safer, multi-modal transportation corridor.

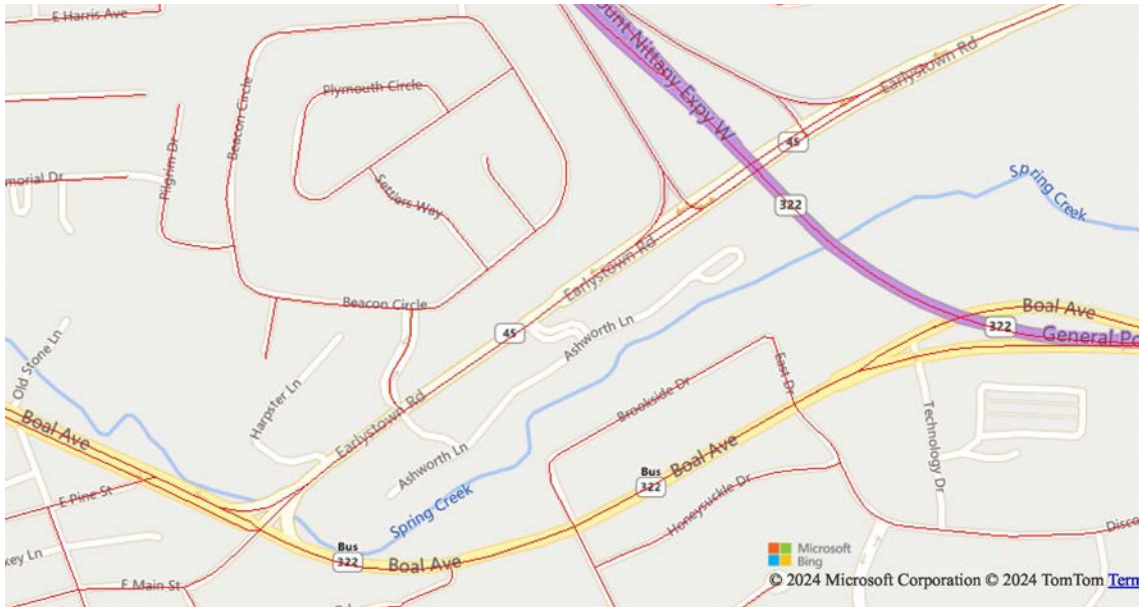

Figure 6.0 - AADT in Park Avenue, State College, PA. Image: PASDA

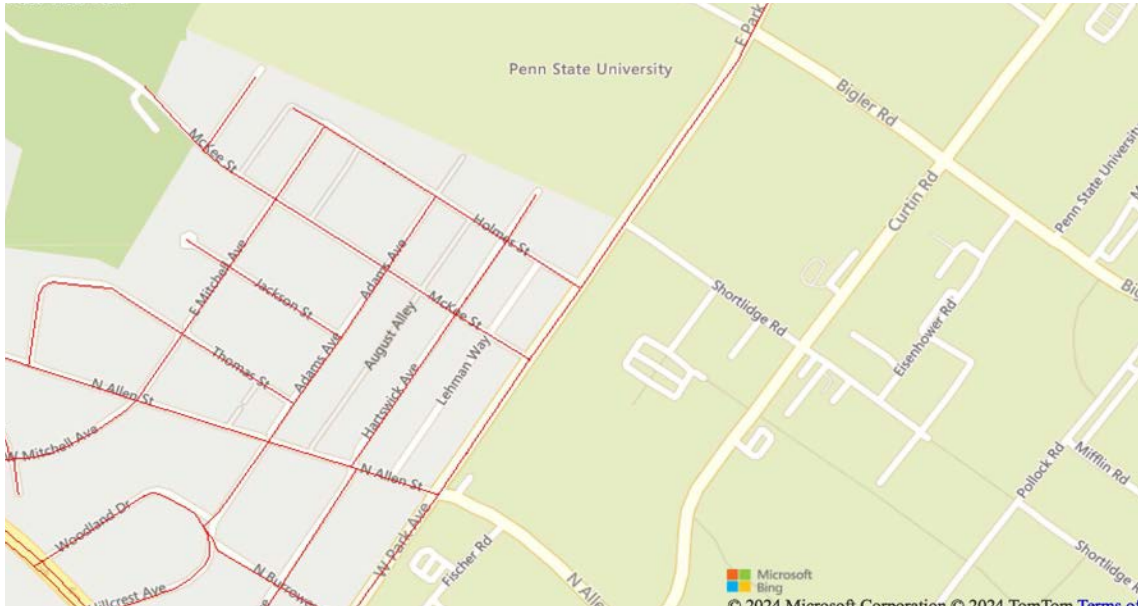

Figure 6.1 - AADT in Route 45 Earlystown Road, Boalsburg, PA. Image: PASDA

Redesigning Earlystown Road

Design Approaches

Redesigning Earlystown Road using a Complete Streets and Road Diet approach aims to ensure safe access for all user groups. By implementing this design, adding bicycle lanes and continuous sidewalks could significantly improve connectivity, allowing people to travel safely and comfortably regardless of their chosen mode of transportation. Narrowing the drive lanes would lower vehicle speeds, creating a pedestrian-friendly environment. Reducing car dependence would also contribute to lower air pollution and emissions.

Introducing vegetation, such as trees and pollinator plants, would enhance ecological health, human wellbeing, and aesthetic appeal, making it more inviting for residents and visitors alike. Improved lighting through the installation of light posts would increase safety at night.

These improvements would encourage residents to walk to downtown Boalsburg and other neighborhoods, reducing vehicle dependence and fostering a stronger sense of community. This holistic approach addresses various needs, fostering a more inclusive and sustainable environment.

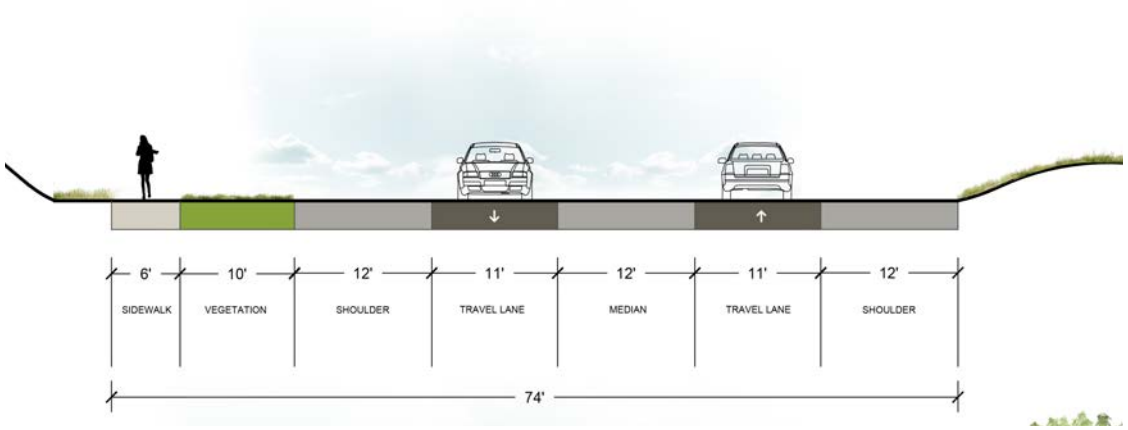

Figure 7.0 - Exsiting Design of Earlystown Road, Boalsburg, PA. Image: Eliza Li

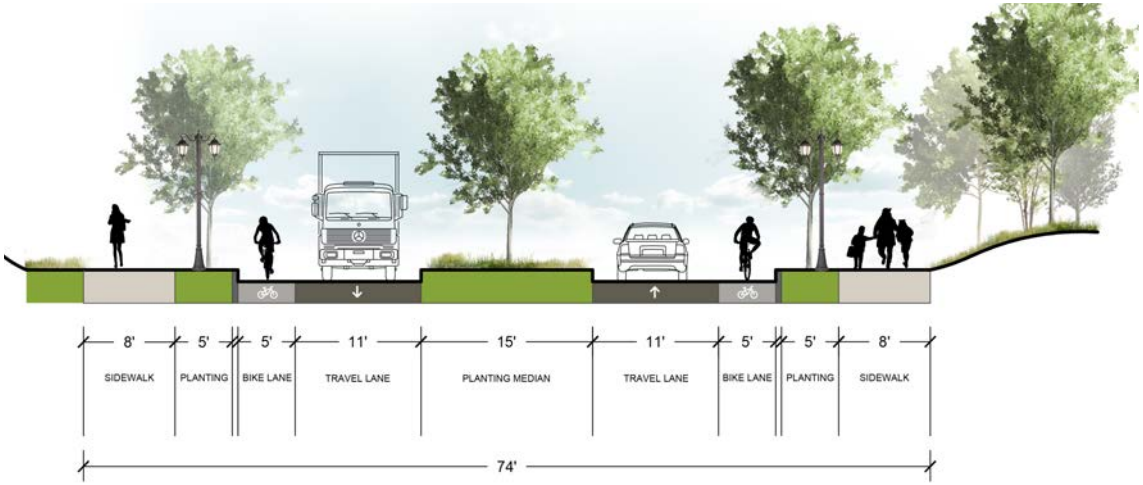

Figure 7.1 - Redesign of Earlystown Road, Boalsburg, PA. Image: Eliza Li

Biography

Eliza Li
Third-Year Landscape Architecture Student

Eliza Li is a third-year landscape architecture student from Xiamen, China. She is passionate about urban and community design. She is deeply dedicated to creating spaces that foster meaningful connections, instill a sense of belonging, and promote environmental sustainability. Eliza aspires to further her expertise by pursuing a master's degree in landscape architecture. She aims to explore innovative approaches to designing inclusive and sustainable spaces.

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Image: Traffic Calming Park Vista Drive, Layhill, MD

Image: Paul Daniel Marriott

Image: Nittany View Conceptual Interpretive Center

Image: Jacob Hutton Midjourney AI

An Interpretive Center for Nittany Valley

Sarah Scutti | LARCH 414 | Spring 2024

Strategy

A Centre Region interpretive center adjacent to the proposed State College Area Connector corridor offers an exceptional opportunity to showcase the cultural history and environmental complexity of the area within the shadow of Mt. Nittany. This strategy recommends a location and offers a prototype structure to welcome visitors, provide important information, and instill respect and curiosity for all this region offers. Within the building and the adjacent landscape, engaging exhibits and insightful interpretation will be presented for both adults and children, with a particular emphasis on educating children in a fun and immersive destination. This can inspire them to being more environmentally conscious and appreciative of the ridge and valley ecology of Central Pennsylvania.

Image: Mount Nittany

Image: nittany.org/trails/

Interpretive Centers

"The primary role of the interpretation center is to engage and educate the community."

- South African National Parks on Mokala National Park

Background

The Centre County region is full of history both culturally and naturally; however, there are few places in the area for visitors to learn about the richness of the valley. The addition of an interpretive center will ensure the history of the region continues to be passed along.

Problem Statement

The addition of an interpretive center to the region will provide educational programs that teach visitors about Centre County's cultural, natural, and historical significance. The center will engage local and out-of-town visitors to foster sustainable tourism and provide a bridge between the two.

Image: Hayward Shoreline Interpretive Center: Hayward, CA

Image Source: H.A.R.D. Foundation

Image: Henry M Jackson Memorial Visitor Center: Ashford, WA

Image Source: Devil's Lake Wisconsin

Interpretive Centers

"noun. (at a place of interest, such as a country park, historical site, etc.) a building or group of buildings that provides interpretation of the place of interest through a variety of media, such as video displays and exhibitions of material, and, often, includes facilities such as refreshment rooms and gift shops."

- Collins English Dictionary, HarperCollins Publisher

What Makes an Interpretive Center?

Interpretive centers are informal educational venues that are typically located in a place of interest such as: state parks, archeological sites, historical buildings, wildlife preserves, and landmarks. They are open to and serve the general public by offering educational programs that give a better understanding of the surrounding natural and cultural heritage.

Interpretive centers encourage cultural and environmental education for the community and visitors through programs such as hands-on learning opportunities, video and art displays, informational kiosks, demonstrations, interactive art activities, walking tours, and short films.

Figure 1.0 - Nittany View Information Desk, Nittany View Interpretive Center. Image: Jake Hutton, Midjourney AI

Interpretive Centers

Site Location

The proposed site location for an interpretive center is at the current Oak Hall Regional Park and the Nittany View Park. This site is conveniently located off U.S. Route 322 and is already an established park. Under this proposal, the two parks, Oak Hall and Nittany View, would be linked for bike and pedestrian access, providing better park connectivity as well as better park access for residents in Boalsburg. In addition to enhancing existing park resources, the location of the interpretive center with Mt. Nittany as its backdrop could also serve as an important gateway or welcome facility for Happy Valley.

Mt. Nittany is viewable from both of these parks and would be the main focal point of the Nittany View Interpretive Center.

Image: Oak Hall Regional Park View Image Source: Google Earth

Image: Site location of Nittany View Interpretive Center Image: Google Earth

Site Location

This location is also reachable by current walking and bike paths and can help facilitate the proposal of additional paths to connect the Boalsburg area more conveniently with the surrounding Centre County region, specifically State College, Lemont, and Bellefonte.

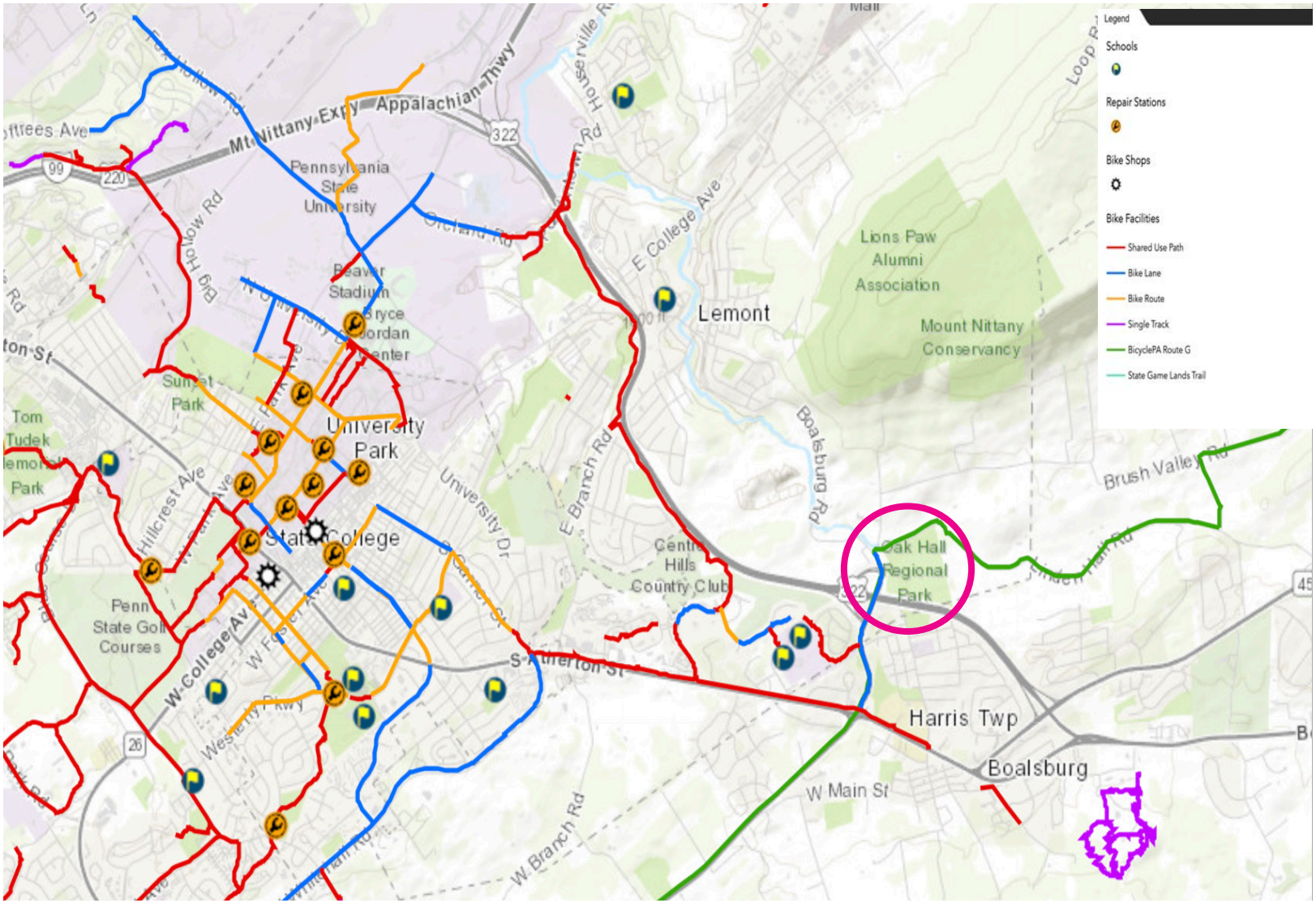

Image: Bike/Footpaths in State College Area

Image: Centre Region Council of Governments

Interpretive Centers

Site Location

Mt. Nittany, a prominent feature within the Centre County landscape, would be an iconic landmark for an interpretive center placed within view of the mountain Happy Valley. In addition, the protected lands on Mt. Nittany would be an inspiration for education regarding the value of conserving special landscapes.

Image: Nittany View Interpretive Center

Image: Jacob Hutton Midjourney AI

Interpretive Centers

Programming: Agriculture

Agriculture is an important part of the history of the area and the current livelihood of many of the region's residents. Featuring historical information from partners such as the Grange Fair and Penn State's Pasto Agricultural Museum would act as an educational feature within the center.

Programming: Mt. Nittany

The significance of Mt. Nittany continues with James Potter as he exclaimed, "By heavens ... I have discovered an empire," upon seeing the valley which would lead to the development of Boalsburg.

Image: Tent Camp, Centre County Grange Fair.

Image: The Grange Fair

Image: Centre County Historical Society

Interpretive Centers

Programming: Historic Boalsburg

Boalsburg, considered to be the birthplace of Memorial Day, is home to several of the area's historical features such as Duffy's Tavern and the Pennsylvania Military Museum.

Image: NightWatch Paranormal

Image: Sarah Gaffney

Programming for Children

An example of an interpretive center for children is the Peggy Notebaert Nature Museum in Chicago pictured at right. My niece, who was infatuated with the center's hands-on Riverorks display, is allowing children to see how the mechanics of the Chicago river system works.

Image: Peggy Notebaert Museum

Interpretive Centers

"The children of today are the decision makers of tomorrow in respect to environmental stewardship. A garden like this one can teach them to welcome nature into their own back yards and instill an awareness and a pride of place, a love for the region that we live in - the history, the flora, the geography - everything that makes Central Pennsylvania what it is."

- Shari Edelson, director of horticulture and curator, at The Arboretum at Penn State

Children's Garden at the Arboretum

An excellent example for interpretation, and children's interpretation in particular, is the Children's Garden at The Arboretum at Penn State. This facility provides local insight into the positive impact of an accessible space designed to inspire growth through hands-on experiences for children and the community.

Childhood's Gate is a vibrant garden where curiosity thrives, designed to inspire children and anyone young at heart. This enchanting space celebrates the plants, animals, and geography unique to central Pennsylvania, fostering a deep connection with the natural world.

Families, Penn State alumni, and visitors from the State College area and beyond are invited to immerse themselves in this dynamic environment. With engaging design and interactive features, the garden offers children aged 3 to 12 an exciting space to play, learn, and explore their surroundings in a hands-on way.

Image: The Arboretum at Penn State

Image: The Arboretum at Penn State

Image: Penn State's Childhood's Gate

Image: Didier Design Studios

Biography

Sarah Gaffney
(She/Her/Hers)
Second-Year Landscape Architecture M.L.A. Candidate

Sarah is a second-year Master of Landscape Architecture candidate. She previously received a B.S. in Human Development & Family Studies. She worked as an early childhood educator before discovering the field of landscape architecture through an interest in adventure playgrounds. Sarah hopes to bring her two interests together, child development and outdoor environments, by challenging the current view of playgrounds to expand on developmentally challenging outdoor spaces for children in the United States.

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Image: Mount Nittany

Image Source: Happy Valley Adventure Bureau

Image: U.S. Route 322
Image: Google Earth

Bird Mortality and Migration Disruption

Hayley Mahoney | LARCH 414 | Spring 2024

Strategy

The expansion project for the proposed U.S. Route 322 highway corridor presents an opportunity to address potential impacts on bird habitats and migration patterns. While highway expansions can pose challenges to avian ecosystems by altering habitats and migration routes, there is also the chance to implement environmentally sustainable practices that protect local bird populations. Strategies like wildlife crossings, habitat preservation, dark skies lighting, increased signage, and riparian buffers are vital for minimizing the ecological impact of highway expansion and maintaining the delicate balance of bird habitats in the region.

Image: U.S. Route 322

Image: Google Earth

Bird Death and Habitat Damage

"The one process now going on that will take millions of years to correct is the loss of genetic and species diversity by the destruction of natural habitats. This is the folly our descendants are least likely to forgive us."

- E.O. WIlson, *Biophilia*

Background

The proposed expansion of U.S. Route 322 poses significant threats to local bird populations. As vehicle speeds increase, bird collisions with vehicles become more common, especially among species that nest or forage near the road. The expansion project further fragments habitats, disrupting breeding areas and migration routes for many indigenous bird species in the region. Endangered and threatened species such as the Eastern Meadowlark and American Kestrel face heightened risks from habitat fragmentation and loss caused by highway development. Wetland-dependent species, including various waterfowl and wading birds, are particularly vulnerable to habitat destruction along U.S. Route 322.

Problem Statement

Without adequate mitigation, such as wildlife crossings and habitat restoration, bird mortality and habitat loss along Pennsylvania's highways, and within the Centre Region, will likely continue to rise. Efforts to balance transportation infrastructure needs with wildlife conservation are crucial for mitigating the impacts of highway expansion on Pennsylvania's bird populations.

Image: Jacob Hutton, Midjourney AI

Habitat Fragmentation

"Fragmentation of habitats is the greatest threat to the survival of birds."

- George Divoky

Mitigation Tactics

Mitigating the impact of highway expansions on bird populations requires a multifaceted approach tailored to different species' needs. Ground-nesting birds benefit from wildlife crossings and elevated walkways for safe passage. Aquatic birds require wetland buffers and protected crossings to safeguard their habitats and migration routes. Nocturnal birds benefit from dark skies-friendly lighting and carcass-management programs. Habitat preservation and clearly marked nesting zones are essential for ground nesters. Frugivores thrive with native plantings along highways, while migrant landbirds find refuge in designated resting areas and habitat restoration projects. Artificial bodies of water and protective barriers support water-dependent birds. Collectively, these strategies contribute to conserving bird life amid the challenges of highway development.

Image: Jacob Hutton, Midjourney AI

Bird Type	Design Tactics for Highways
Water Birds	- Wildlife crossings (e.g., land bridges, tunnels)
	- Wetland buffers along highways
	- Protected crossings for aquatic passages
Walking Birds	- Wildlife crossings (e.g., land bridges, tunnels)
	- Elevated walkways or pathways
Scavengers	- Carcass management programs (prompt removal of roadkill)
	- Wildlife-friendly infrastructure design (e.g., roadkill composting sites)
Owls	- Dark sky-friendly lighting and signage
	- Reduced lighting intensity near owl habitats
Ground Nesters	- Habitat preservation and restoration
	- Well-marked nesting zones to prevent disturbance
Migrant Landfalls	- Designated resting areas along migration routes
	- Habitat restoration projects
Water Finches	- Artificial water bodies near highways
	- Protective barriers to prevent collisions with traffic

Image: Graph of Bird Type and Mitigation Tactics.

Types of Birds Affected

Frugivores:
American Robin (*Turdus migratorius*)
Cedar Waxwing *(Bombycilla cedrorum)*
Northern Mockingbird *(Mimus polyglottos)*

Ground Nesters:
Killdeer *(Charadrius vociferus)*
Eastern Meadowlark *(Sturnella magna)*
Savannah Sparrow *(Passerculus sandwichensis)*

Migrant Landfalls:
Yellow Warbler *(Setophaga petechia)*
American Redstart *(Setophaga ruticilla)*
Blackpoll Warbler *(Setophaga striata)*

Water Finches:
American Goldfinch *(Spinus tristis)*
House Finch *(Haemorhous mexicanus)*
Purple Finch *(Haemorhous purpureus)*

Water Birds:
Mallard Duck *(Anas platyrhynchos)*
Great Blue Heron *(Ardea herodias)*
Canada Goose *(Branta canadensis)*

Images: https://ebird.org/explore

Walking Birds:
Wild Turkey *(Meleagris gallopavo)*
Northern Bobwhite *(Colinus virginianus)*
American Woodcock *(Scolopax minor)*

Scavengers:
Turkey Vulture *(Cathartes aura)*
Bald Eagle *(Haliaeetus leucocephalus)*
Black Vulture *(Coragyps atratus)*

Owls:
Great Horned Owl *(Bubo virginianus)*
Barred Owl *(Strix varia)*
Eastern Screech-Owl *(Megascops asio)*

Image: Jacob Hutton, Midjourney AI

Mitigation Tactics and Design Implementations

Wildlife Crossings

Integrating wildlife crossings into highway expansions provide crucial protection for various avian species, particularly those facing increased risks from roadway collisions. These crossings–such as vegetated underpasses and overpasses–allow birds to safely traverse the area on foot or by flight, reducing the probability of collision. Aquatic birds can find refuge in designated aquatic passages and protected crossings, preserving their habitats and migration patterns. Furthermore, connecting tree canopies facilitates the safe movement of arboreal species, ensuring their habitats remain interconnected despite highway development. These specific types of wildlife crossings play a pivotal role in conserving avian life amidst the expansion of Route 322. **{Excerpt taken from U.S. Department of Transportation-Federal Highway Administration}**

Image: Midjourney AI

Increased Signage

Image: Midjourney AI

Highway signage plays a crucial role in reducing bird mortality during expansions by catering to the needs of various species. Signs can direct drivers away from areas where ground-nesting birds cross roads, thereby minimizing risks. Additionally, strategically placed lighting and signage that acknowledges nocturnal travel patterns helps to prevent collisions with owls. Marking areas with high roadkill incidents can serve to warn travelers and safeguard scavenging birds. Signs denoting nesting zones and protected habitats are particularly vital for ground nesters, while signage plantings, resting areas, and ongoing habitat restoration projects are important for frugivores and migrant birds. Moreover, signs alert drivers to artificial bodies of water and barriers that safeguard habitats crucial for water-dependent bird species.

Dark Sky Lighting

Implementing dark sky lighting along highways offers significant benefits to nocturnal wildlife. This type of lighting reduces light pollution by directing the light upwards, thereby lowering the risk of avian disorientation and collision. It also preserves natural behaviors and habitat-use patterns, which depend on darkness for hunting and navigation. Owls in particular are highly sensitive to artificial light, which can disrupt their foraging and reduce their reproductive success. Additionally, dark skies lighting supports nocturnal ecosystems by minimizing disturbance to other wildlife such as bats and certain mammals, which rely on darkness for feeding and shelter. Overall, implementing dark skies lighting along highways improves road safety while supporting the conservation of nocturnal biodiversity, ensuring essential habitats remain intact for owls and other nocturnal species. **{Excerpt taken from U.S. Fish and Wildlife Services]**

Image: Midjourney AI

Dark Skies Lighting

Image: NJ Conservation

Image: NJ Conservation

Image: NJ Conservation

"Blue light emitted from LED lighting can damage human retinas and be disruptive to nocturnal animals."

Ideal Roadway for Bird Safety and Habitat Protection

Image: Midjourney AI

Image:Midjourney AI

Image: Midjourney AI

Key Factors:

- Dark Skies Lighting
- Riparian Buffers
- Wildlife Crossings
- Protection of Water Habitat
- Increased Signage

Source: Midjourney

Biography

Hayley Mahoney
3rd-year Landscape
Architecture Student

Hayley is a 3rd year landscape architecture student originally from Buffalo, New York.

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Image: Route 322

Image: Google Earth

Image: Habitat under MD200. (Raja Veeramachaneni Memorial)
Image: Yuqing Peng

Habitat Fragmentation

Yuqing Peng | LARCH 414 | Spring 2024

Strategy

Habitat fragmentation occurs in parts of a habitat that are negatively impacted or destroyed. This results in smaller, unconnected areas that can disrupt wildlife migration. An example of habitat fragmentation would be the construction of a road through a wetland. The proposed U.S. Route 322 highway corridor presents an opportunity to carefully manage the risk of habitat fragmentation both by PennDOT and local government advocacy groups. While habitat fragmentation can challenge local animal populations and ecosystems, implementing riparian buffers, or setting aside protected corridors, can provide a seamless transition between highway infrastructure and local habitats. This approach helps to safeguard the delicate ecosystems, ensuring they remain resilient and protected.

Habitat Fragmentation

Image: Jacob Hutton, Midjourney AI

Existing Conditions

Background

Habitat fragmentation is a global issue. Climate change and human activities contribute to habitat fragmentation, reducing habitat size and quality, which in turn leads to biodiversity loss and ecosystem degradation. Considering habitat fragmentation during the planning process is essential. Different strategies should be implemented to enhance connectivity between habitats, promoting harmonious coexistence between humans and nature.

Problem Statement

In the study area, intact habitats do exist; however, many habitats between these intact areas are scattered, which may negatively impact wildlife. Additionally, pollution from waste areas can affect habitat integrity. Agriculture is also a primary contributor to habitat fragmentation. All these factors collectively damage habitats to varying degrees, leading to gradual habitat loss.

Image: Interchange, U.S. Route 322, Park Avenue and Interstate 99, showing fragmented woodlands and wetlands.

Image: AndyArthur.org (Section: State College, PA)

A Snapshot of the Area

Introduction

In Penns-Brush Valley, early farms created a type of habitat fragmentation as land was cleared for planting and pasture. Over the years, wildlife adjusted and new habitats as hedgerows and wood lots were established (Figure 1.0). Currently, new retail and residential developments are the leading cause of habitat fragmentation. The proposed State College Area Connector, depending on its design and alignment, can either protect habitat or lead to increased fragmentation.

Habitat Perforation

Habitat perforation is the initial stage of habitat fragmentation, characterized by blank areas within intact habitats. These intact habitats become fragmented as barriers and disruptions are inserted within them. Without intervention, these blank areas can expand, leading to the loss of a significant amount of habitat. While habitat perforation may not be severe, it should not be ignored. Addressing it early is crucial since it represents the first stage of fragmentation. Early detection of issues can help prevent the higher governance costs associated with advanced fragmentation (Figure 1.1).

Habitat Degradation

Pollution from areas such as junkyards, cemeteries, landfills, dumps, spills, storage tank sites, etc., diminishes the quality of habitats. Harmful chemicals from these sites adversely affect organisms within habitats. Toxins settle on land and in water surfaces, harming animals, plants, and aquatic life (Figure 1.2). These toxins can also alter the chemical composition of the soil and water, rendering the environment uninhabitable for certain species.

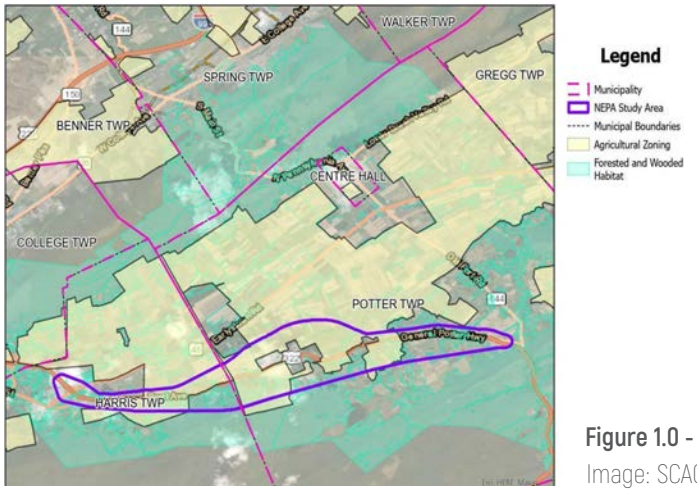


Figure 1.0 - Agricultural fields.
Image: SCAC Resrouces Public Map

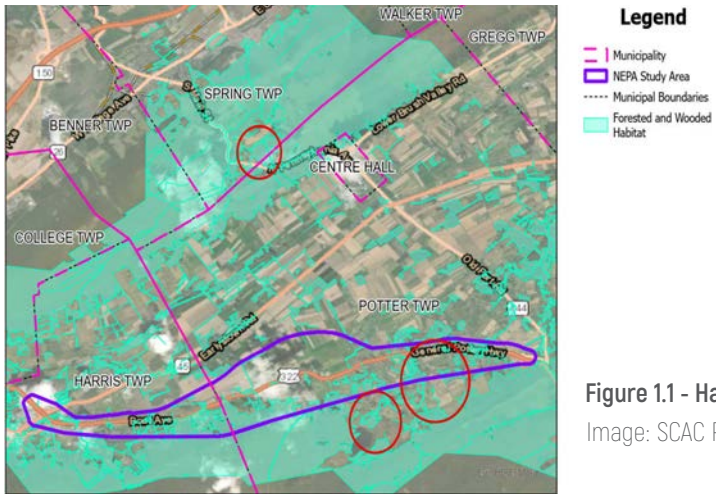


Figure 1.1 - Habitat Perforation.
Image: SCAC Resrouces Public Map

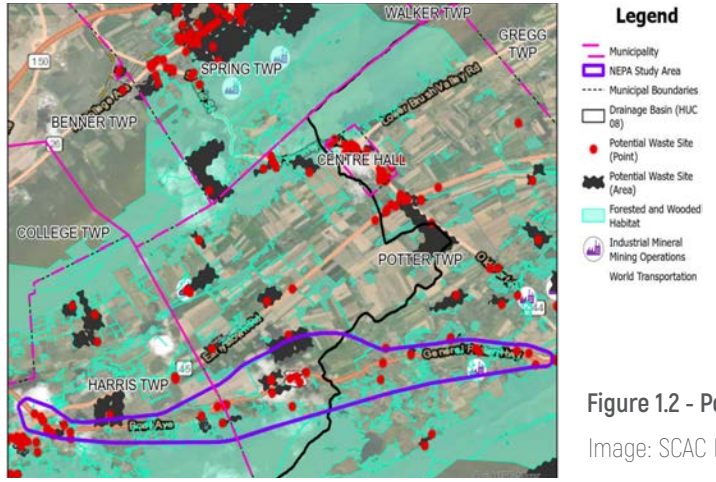


Figure 1.2 - Pollution areas.
Image: SCAC Resrouces Public Map

Strategy 1

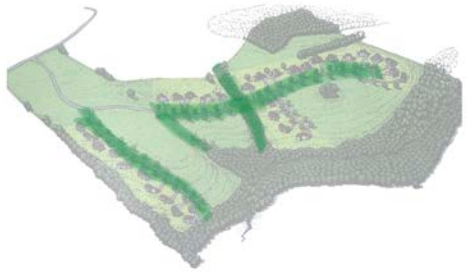
Conservation Design

Although agriculture has often been criticized for causing deforestation, biodiversity loss, and habitat fragmentation, agricultural lands can also serve as habitat linkages if farms and ranches are well managed. With appropriate assistance and incentives, farmers can manage their lands sustainably and profitably while protecting habitats. Integrating habitats with farms can yield both economic and conservation benefits. As Aldo Leopold famously stated, "A good farm must be one where the wild flora and fauna has lost acreage without losing its existence."

Before conservation design: scattered trees and scattered habitats. Animals may feel lost in the space. Land use and the planning is not effective.

Figure 2.1

Image:Conservation Design for Subdivisions, A Practical Guide to Creating Open Space Networks, by Randall G. Arendt



Conservation design does not reduce the number of units compared to conventional design. It uses the space more effectively and it can preserve natural resources of the area.

Figure 2.2

Image: Abigail Rodgers Rethinking 322 Booklet in Fall 2022

Figure 2.0

Image: National Geogrphic

A hedgerow is a line of trees or shrubs that forms a barrier or boundary on a site. It is often used to mark the boundaries of an area. In the context of habitat fragmentation, hedgerows can provide linkages between fragmented habitats. They are commonly planted alongside agricultural roads, providing wildlife with corridors to migrate between habitats. Hedgerows also offer protection and habitat for butterflies, bats, birds, hedgehogs, and other species.

Before & After Conservation Design

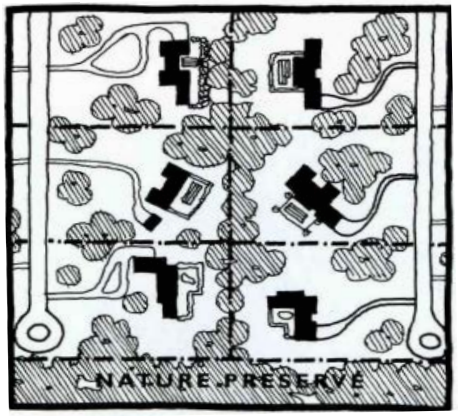


Figure 2.3

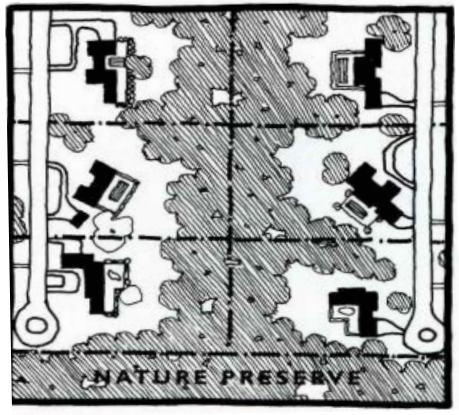


Figure 2.4

Image: *Landscape Ecology Principles in Landscape Architecture and Land Use Planning*

Strategy 2

Stepping Stones

In this case, stepping stones are not the ones in the backyards, they are "stepping stones" for animals.

Stepping stones are small patches between larger habitats that enable species to move across fragmented landscapes (Figure 3.0). In the study area, vacant or unused areas can be selected for building stepping stones to enhance connectivity between Mt. Nittany and Rothrock State Forest. When placing stepping stones, the distance between gaps should be carefully considered (Figure 3.1); smaller species require shorter distances between stones, and visibility between successive stones is crucial. Protecting existing patches is essential as the loss of a stepping stone can hinder species movement, leading to habitat fragmentation. Clustering stepping stones (Figure 3.2) can increase internal linkages among patches, allowing species to choose multiple routes while maintaining a linear overall direction of movement.

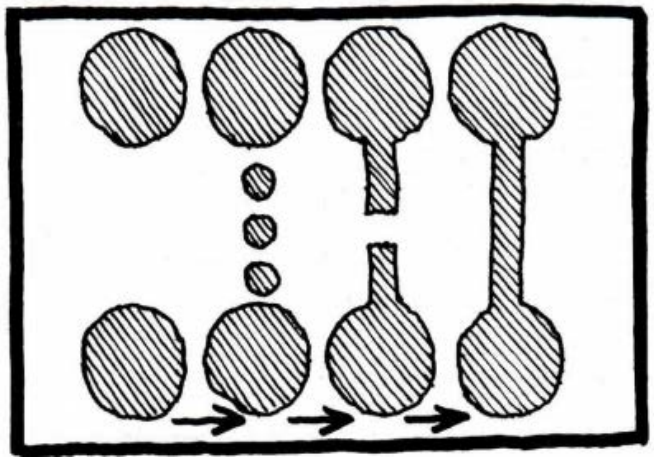


Figure 3.0

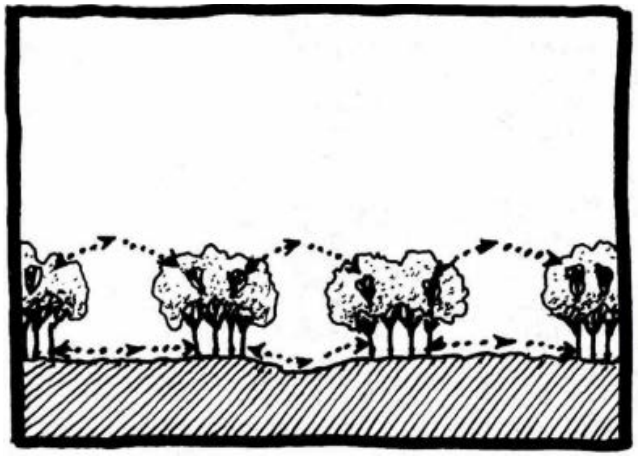


Figure 3.1

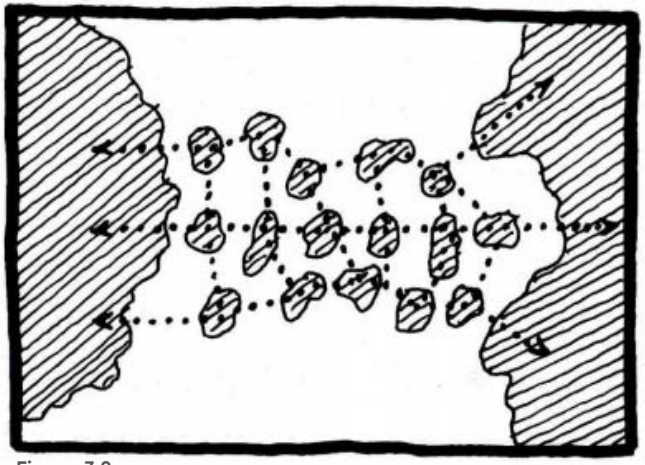


Figure 3.2

Strategy 3

Riparian Buffer

As mentioned in the problem statement, poor habitat quality can contribute to habitat fragmentation. Water quality is crucial for habitat integrity; therefore, safeguarding water quality from pollutants resulting from human activities is essential.

Riparian buffers offer numerous benefits, including trapping sediment and pollutants and providing habitat for fish, as well as small mammals like the white-footed mouse and eastern cottontail. Riparian forest buffers prevent erosion caused by flowing water, reduce sedimentation rates, and mitigate the impacts of pesticides, fertilizers, and animal waste from agricultural fields.

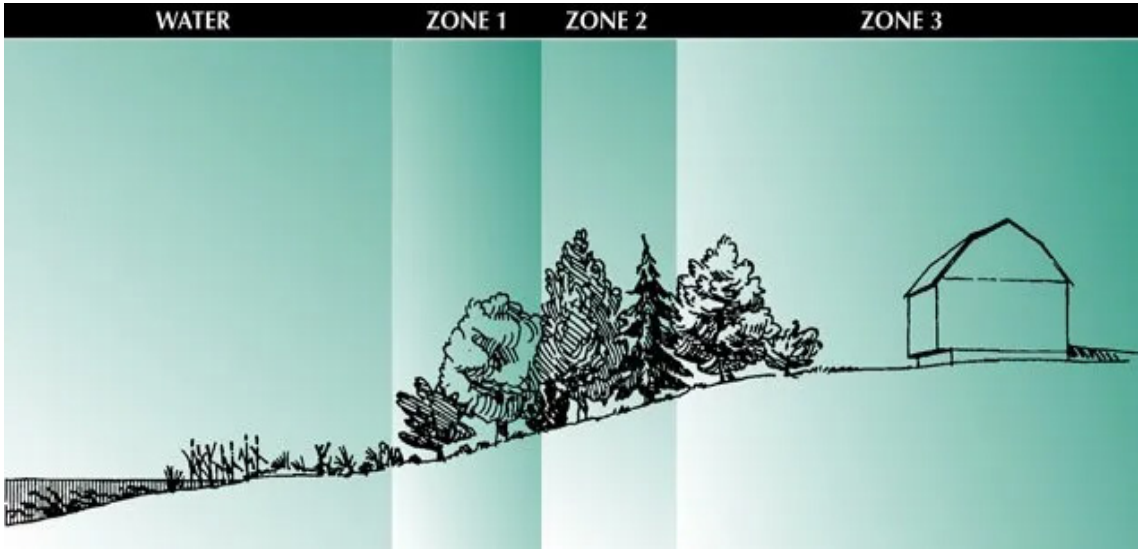
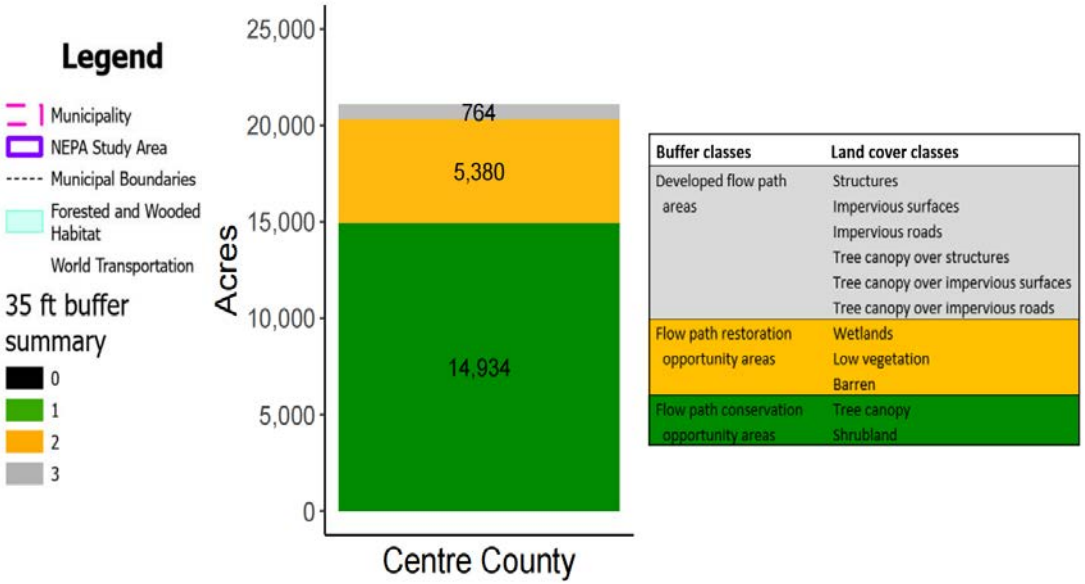


Figure 4.0

Image: Penn State Extension

Figure 4.1 - SCAC Study area highlighting areas without sufficient coverage of buffers.



Buffer classes	Land cover classes
Developed flow path areas	Structures
	Impervious surfaces
	Impervious roads
	Tree canopy over structures
	Tree canopy over impervious surfaces
	Tree canopy over impervious roads
Flow path restoration opportunity areas	Wetlands
	Low vegetation
	Barren
Flow path conservation opportunity areas	Tree canopy
	Shrubland

Figure 4.2

Image: Chesapeake Conservancy

Centre Hall Case Study and Restoration Suggestion

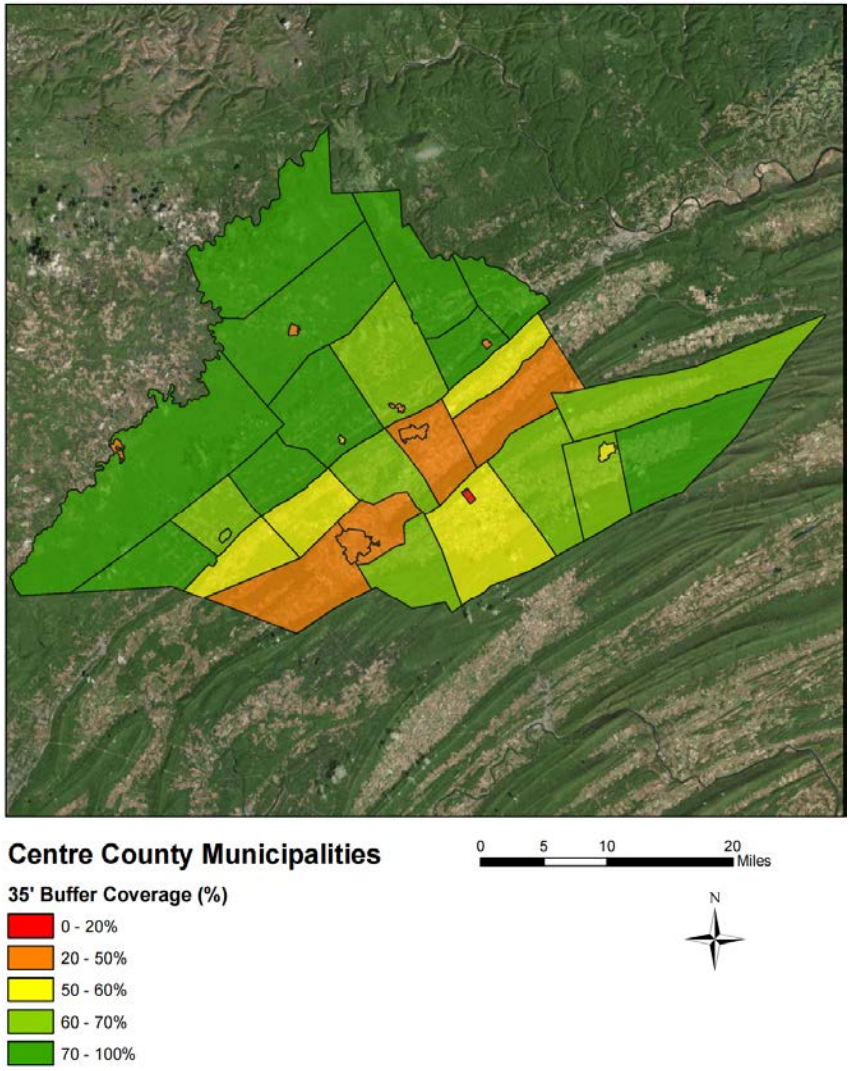


Figure 5.0

Image: Chesapeake Conservancy

Centre Hall (red area) buffer coverage: 19%

Suggestion

Figure 5.0 illustrates areas with restoration opportunities that, once restored, can provide habitats for wildlife. It is evident from the map that Centre Hall currently has only 19% buffer coverage, indicating a need for buffer restoration. Pennsylvania offers a plant restoration tool on the Pennsylvania Natural Heritage Website (https://www.naturalheritage.state.pa.us/pacrtt/index.html). This tool allows users to select a target area on the map and generate a report recommending suitable plant species based on environmental characteristics and species composition of the area. It assigns specific plant communities similar to the target area for effective restoration efforts.

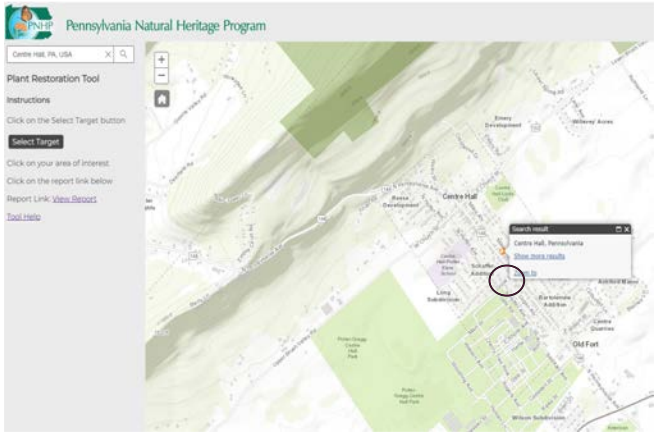


Figure 5.1

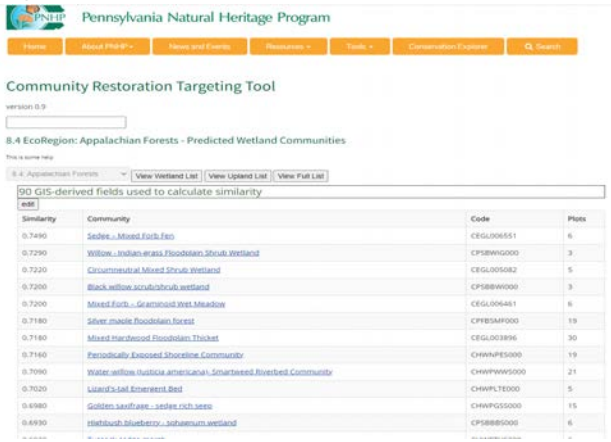


Figure 5.2

Figure 5.3

These three pictures (Figure 5.1-3) shows the steps of finding out the suitable plants for buffer restoration.

Planning Rural

Harris Township has established new planning policies to better balance development with the rural landscape.

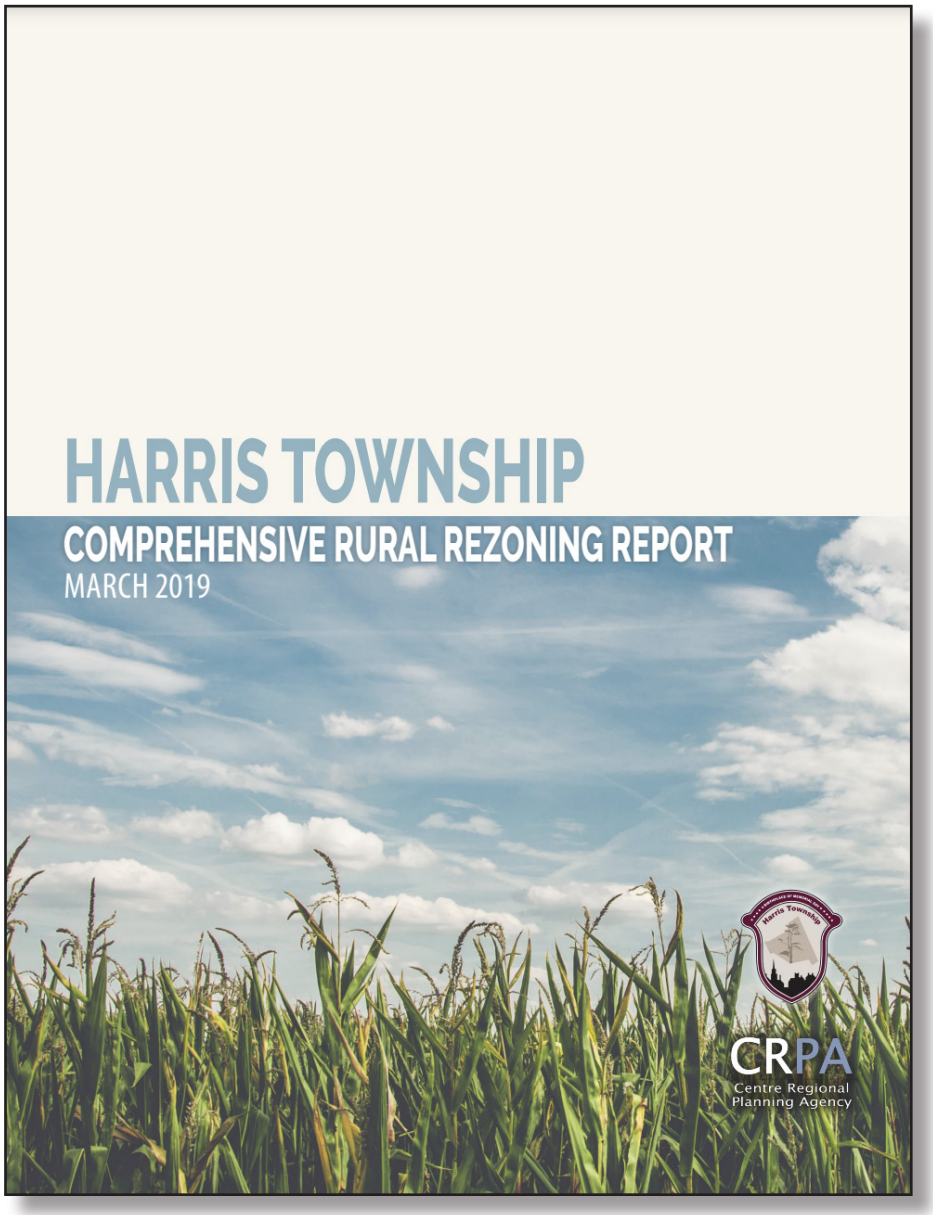


Image: Centre Regional Planning Agency

Biography

Yuqing Peng
Third-year Landscape Architecture Student

Yuqing Peng is from Shanghai, China. She's interested in ecological design. She hopes to go to graduate school to further study landscape architecture.

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Power Plants Phytorememdiation Garden « Landezine International Landscape Award LILA. landezine-award.com/power-plants-phytorememdiation-garden.

Image: Aaron Solderich

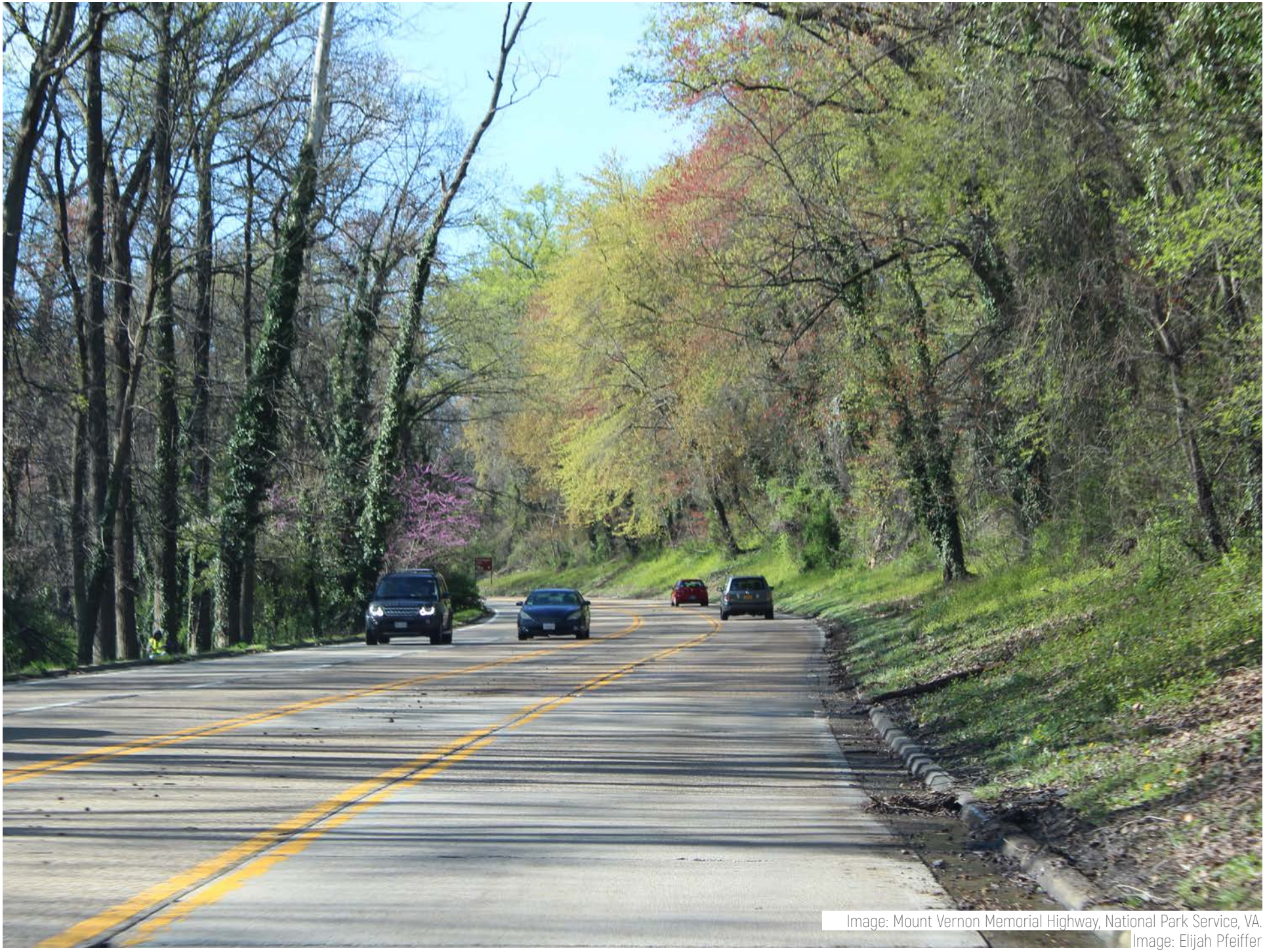

Image: Mount Vernon Memorial Highway, National Park Service, VA.
Image: Elijah Pfeiffer

Conserving Ecosystems

During and Following Construction

David A. Khenkin | LARCH 414 | Spring 2024

Strategy

When designing highways such as the proposed State College Area Connector (SCAC) in Penns-Brush Valley, it is crucial to consider the extent of area dedicated to habitat conservation. In areas with dense animal populations, various strategies can be employed to address potential challenges posed by the highway. Effective approaches, such as wildlife bridges and species relocation, offer long-term solutions to mitigate impacts and support the wellbeing of local ecosystems.

Image: Jacob Hutton, Midjourney AI

Introduction

Background

Pennsylvania's U.S. Route 322 serves as a vital artery of the state's transportation network, connecting urban centers, rural communities, and economic hubs. However, the construction and expansion of highways like Route 322 often intersect and fragment natural ecosystems, presenting challenges to biodiversity and environmental sustainability. Recognizing these impacts, transportation authorities, including PennDOT, are increasingly focused on integrating ecological considerations into highway development projects. By examining approaches from sites in Colorado and Maryland, which have faced similar challenges, valuable insights for the Centre Region emerge for balancing infrastructure needs with ecological conservation efforts.

Image: Interstate 70, MD.

Image: Elijah Pfeiffer

Problem Statement

With the proposal of a new connector along U.S. Route 322, it is important to understand that most highways in Pennsylvania intersect and fragment established ecosystems. This section will highlight trends within the Pennsylvania ecosystem in relation to highways and major roads. It is crucial to understand some of the strategies that PennDOT could apply during both the design and construction process for the proposed SCAC. Additionally, we will examine how other state's DOTs address issues regarding the conservation of their ecosystems while continuing to develop their transportation systems.

Image: Interstate 70, MD.

Image: Elijah Pfeiffer

Land Usage

Land Distribution

To begin considering conservation, it is essential to recognize our land usage as well as our ecosystems and their current circumstances. The proposed connector would pass through Penns-Brush Valley within Centre County. It is important to note that Penns-Brush Valley is currently 67% forested land. Overall, 51% of Centre County's land is forested. Additionally, agriculture constitutes 26% of Penns-Brush Valley's land and 27% of Centre County's land, including family farming businesses such as Darlington Farms, Tait Farms, and Kuhns Tree Farm. With both forested and agricultural lands making up 78% of Centre County, ecosystems within these forested lands and businesses within the agricultural lands could be negatively affected by the U.S. 322 SCAC.

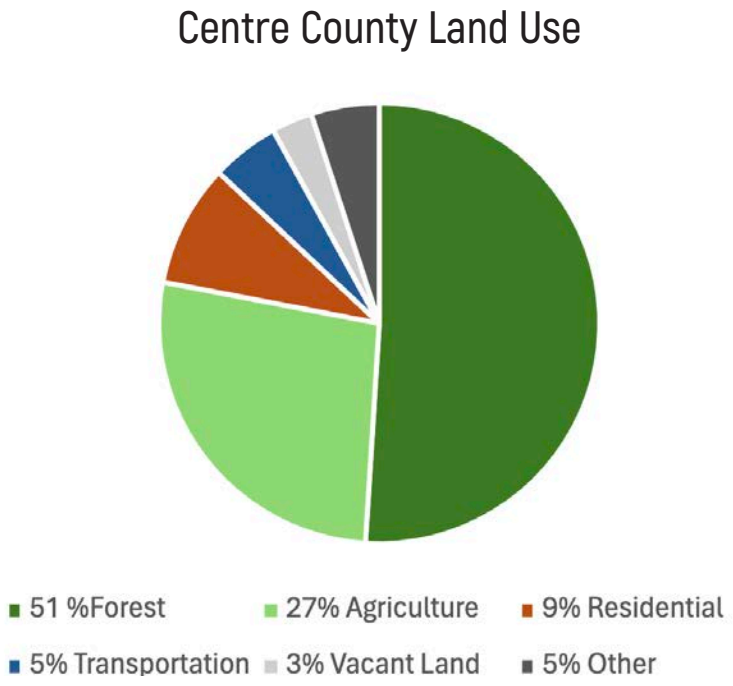

Figure 5.1 - Land Usage (Centre County).

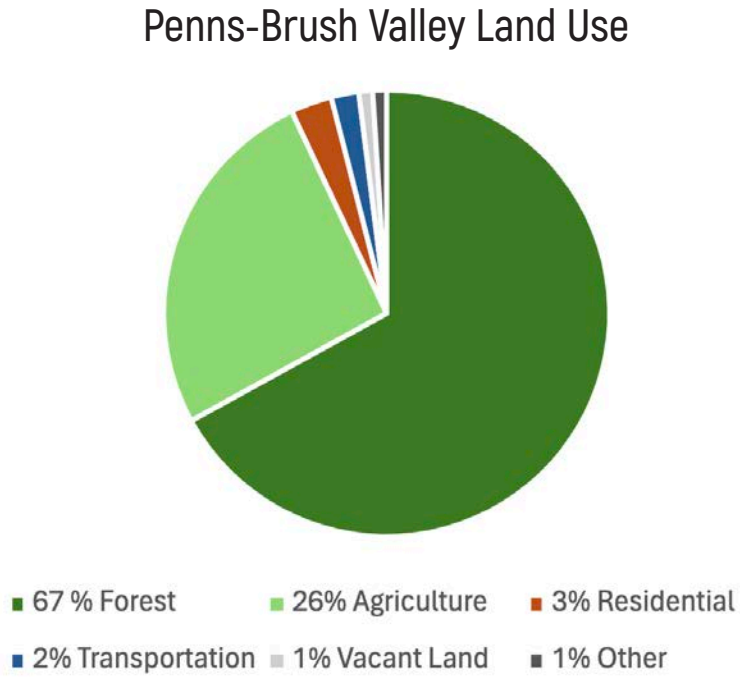

Figure 5.2 - Land Usage (Penns-Brush Valley).

Native Species

Pennsylvania is home to over 480 animal species and over 2,100 plant species. Among these, 90 animals and 349 plants are considered endangered. Below are some of the species that can be found in the Centre County area.

Appalachian Cottontail (Threatened)

Eastern Fox Squirrel

Indiana Bat (Endangered)

Red Bellied Cootre (Threatened)

Grey Wolf (Endangered)

Allegheny Woodrat (Endangered)

Bachmans Sparrow (Endangered)

Fox Squirrel (Threatened)

Willow Oak (Endangered)

Eastern Showy Aster (Threatened)

Spotted Bee Balm (Endangered)

American Holly (Threatened)

Bearberry (Threatened)

Bur Oak (Threatened)

Sweet bay Magnolia (Threatened)

Conservation Strategy 1

Design Highways Complementary to Existing Topography

Even when done properly, highway construction funnels various types of pollutants into surrounding ecosystems. When done improperly, it can cause erosion, inundation, and major topographic changes.

Pennsylvania has a long history of designing roads to cut straight through major mountains and natural landscapes, which destroys ecosystems, displaces animals, and affects potential agricultural sites.

Figures 7.1 and 7.2 show two scenarios to locate a limited access highway through mountainous terrain. In Figure 7.1 we see a typical cut through rock on a straight alignment that works against the natural landforms. In addition to the visual scar to the landscape, such construction often increases problems with fallen rock, erosion, and land slips. In Figure 7.2 we see an alternative design traversing the same landscape. The road follows the topography, minimizing cut and fill, and enhancing the beauty of the local landscape. The wide median allows the road to travel on two independent alignments, also minimizing land disturbance. In states with landscape architecture divisions at the DOT, or policies to contract with landscape architecture firms during design, we typically see more attractive roadways with a lower impact on land and ecology.

Figure 7.1

Figure 7.2

Images: Jacob Hutton, Midjourney AI

Strategy 1 Examples

I-83, Maryland

We were fortunate to visit Maryland earlier this year and drove through some wonderful examples of highways built with existing topography in mind. One such example is Interstate 83 in Maryland, with the images taken entering Baltimore County after leaving York County, Pennsylvania.

Thriving plants are seen from the road, those nearest to the road slightly elevated to avoid contact with the highway. Aesthetically, the road is soothing to look at and provides users with a constantly changing environment, keeping them intrigued and alert.

Figure 8.1

Figure 8.2

U.S. Route 322, Pennsylvania

Conversely, on the same trip, when leaving State College, we drove through rough rock cuts, deteriorating hillsides and destroyed habitats caused by highway construction that cut straight through the land's natural topographic flow along U.S. Route 322 and Interstate 83 in Pennsylvania. It felt like an intimidating roadway that confines users and further stresses already struggling habitats.

Figure 8.3

Figure 8.4

Images: Elijah Pfeiffer

I-70, Pennsylvania

Interstate 70, between the Maryland state line and Breezewood, Pennsylvania, traverses Town Hill Mountain, crossing spectacular woodlands with expansive vistas. The mature trees in the median helped the interstate to work in harmony with the ecology of the place. This beautiful and sustainable landscape no longer exists. Figure 9.2, dated October 2023, shows the forested median that once separated the eastbound and westbound lanes that has been cut down, destroying the landscape for, what PennDOT District 9 representatives said when we contacted them, were sight lines for cameras. Figure 9.3 shows the same location just four months later. This major land alteration, authorized by PennDOT, spans over 6.5 miles along I-70. This drastic action has accelerated erosion and stream/water contamination, affecting local fish. Within months, PennDOT placed erosion barriers along I-70 due to water and falling rock.

Affected Section of I-70

Figure 9.1

I-70, Pennsylvania - October 2023

Figure 9.2

Images: Google Earth Pro

I-70, Pennsylvania - April 2024

Figure 9.3

Images: Google Earth Pro

Conservation Strategy 2

Incorporate More Wildlife Bridges and Corridors

When it comes to safe wildlife crossings and corridors, Pennsylvania is lacking. The state has thirty-three wildlife crossings. Colorado has almost double that number, with sixty-five corridors. However, despite being much smaller states, Maryland has twelve more wildlife crossings than Pennsylvania, and Vermont eight more. (Figure 10.2). Additionally, as of 2023, Pennsylvania has ranked second among all states in wildlife collision rates, with a 1 in 59 chance of vehicle collision, only behind Montana. Despite being a more densely populated state, neighboring Maryland's wildlife collision rate is almost half of Pennsylvania's, with a 1 in 116 vehicle collision rate.

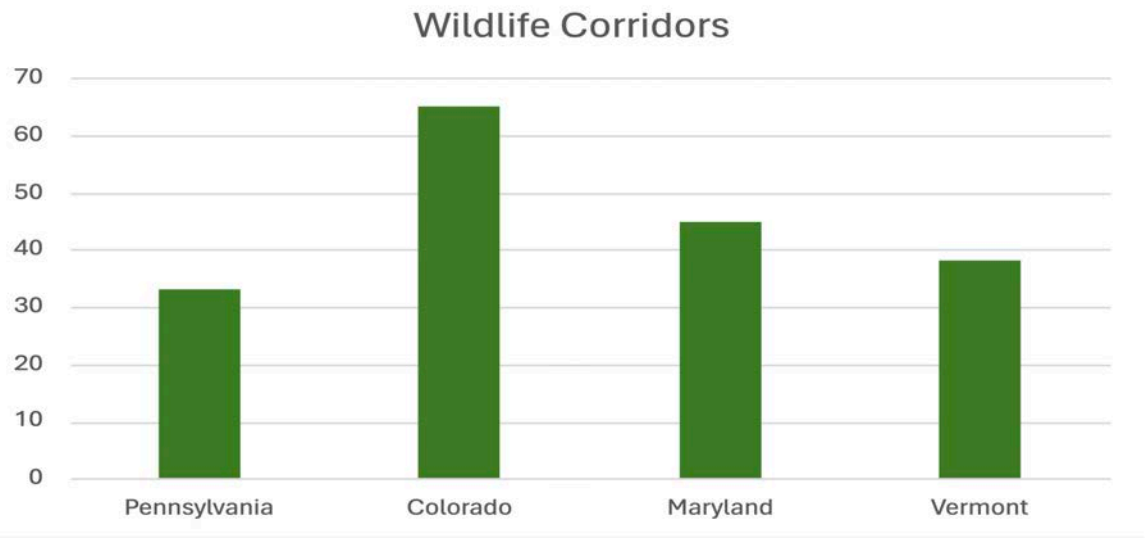

Figure 10.1 - Wildlife Corridors.

Figure 10.2 - States.

States	Likelihood of accidents involving Wildlife	Ranking
Montana	1 in 53	1
Pennsylvania	1 in 59	2
West Virginia	1 in 60	3
Michigan	1 in 60	4
Wisconsin	1 in 60	5
Iowa	1 in 63	6
Mississippi	1 in 64	7
South Dakota	1 in 69	8
Virginia	1 in 78	9
Missouri	1 in 80	10
Minnesota	1 in 81	11
North Dakota	1 in 82	12
Wyoming	1 in 83	13
South Carolina	1 in 83	14
Maine	1 in 83	15
North Carolina	1 in 87	16
Arkansas	1 in 88	17
Kentucky	1 in 91	18
Alabama	1 in 93	19
Kansas	1 in 93	20
Rhode Island	1 in 96	21
Ohio	1 in 97	22
Indiana	1 in 100	23
Tennessee	1 in 107	24
Georgia	1 in 108	25
Massachusetts	1 in 109	26
Vermont	1 in 110	27
Maryland	1 in 116	28
Oklahoma	1 in 119	29
Nebraska	1 in 127	30
Idaho	1 in 136	31
New York	1 in 144	32
Delaware	1 in 148	33
Illinois	1 in 152	34
New Hampshire	1 in 169	35
Texas	1 in 191	36
Lousiana	1 in 193	37
Oregon	1 in 197	38
Utah	1 in 205	39
New Jersey	1 in 213	40
Colorado	1 in 240	41
New Mexico	1 in 262	42
Connecticut	1 in 267	43
Washington	1 in 286	44
California	1 in 388	45
Florida	1 in 487	46
Arizona	1 in 508	47
Alaska	1 in 522	48
Hawaii	1 in 710	49
Nevada	1 in 770	50

Figure 10.3 - Wildlife Collision Rates.

Strategy 2 Example

MD 200, Maryland

Maryland Route 200 was designed to minimize wildlife conflicts and maintain healthy habitats. For instance, wildlife underpasses must be a minimum height of 30 feet to ensure plants receive the necessary sunlight to grow and flourish, supporting a familiar habitat. MD Route 200 is an example of wildlife corridors when DOT, park agency and state environmental policies are coordinated.

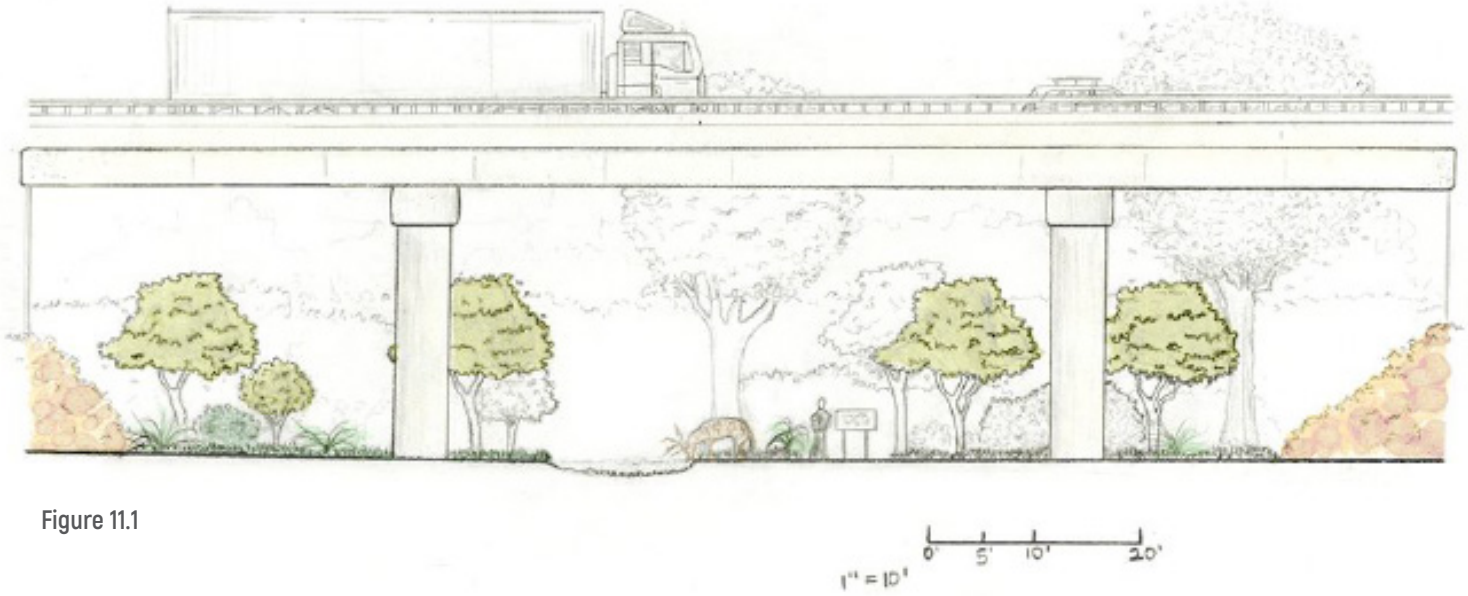

Figure 11.1

Figure 11.2

Figure 11.3

Images: Elijah Pfeiffer

Strategy 3

Temporary Species Relocation

During the construction of Maryland Route 200, also known as the Inter-County Connector (ICC), the Maryland DOT partnered with Towson University to temporarily relocate 900 native eastern box turtles. This relocation was intended as an experiment to determine if it could be a valid solution for habitat conservation. There were three variables in this process. The first was to leave some turtles in their native habitat, the second was an on-site relocation, and the third was an off-site relocation. The experiment was deemed a success by scientists at Towson University. While all three variables had low mortality rates, each of the relocations proved to be effective options for the turtles. There are two animals I propose PennDOT relocate during the construction of the U.S. Route 322 Connector: the threatened fox squirrel and the endangered Bachman's sparrow. Both of these animals are native to Pennsylvania and essential to its ecosystem.

As presented in their paper, "Responses, Movements, and Survival of Relocated Box Turtles During Construction of the Intercounty Connector Highway in Maryland," in Transportation Research Record 2362, authors Scott D. Farnsworth and Richard A. Seigel, noted the role of the MDOT:

"Although box turtles are not listed as threatened on the state or federal level, this is a species that the public is heavily interested in. Starting in fall 2007, the Maryland State Highway Administration funded a research program to determine the effectiveness of on-site versus off-site relocations for box turtles, to prevent direct mortality from [DOT] construction activities."

"From this perspective (though limited), the on-site relocation as practiced in this study would have to be deemed a success, for it prevented large-scale mortality among the turtles moved from the ICC footprint, while avoiding the costs and complications of moving turtles to new habitats."

- Seigl & Farnsworth of Towson University

Figure 12.1 www.Marylandbiodiverstiyproject.com

Figure 12.2 www.Marylandbiodiverstiyproject.com

Biography

David A. Khenkin
Third-Year Landscape Architecture Student

David is a landscape architecture student whose passion for urban and community landscape design stems from his upbringing in Brooklyn, New York. Living near the park where the term landscape architecture originated, his artistic nature and background in landscape design drew him to urban planning. David strongly advocates for introducing and maintaining natural spaces within urban environments, aiming to foster this connection among those unfamiliar with it.

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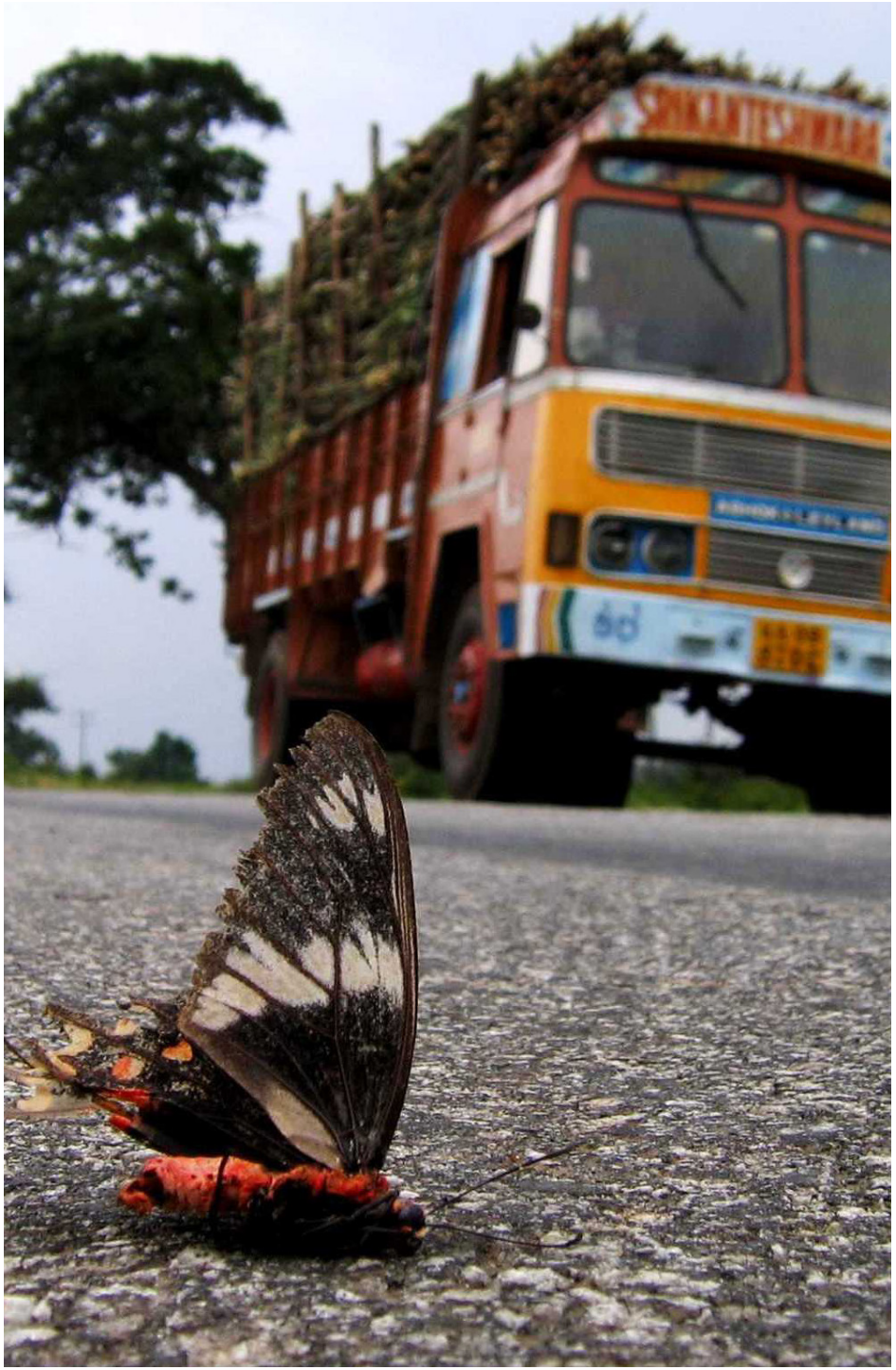
Polinator Right of Way
Image: XcelEnergy

Powerline Right of Way & Pollinator Mortality

Paige Swope-Ginley | LARCH 414 | Spring 2024

Strategy

Although many animal species are accounted for when transportation agencies plan for mitigating roadkill, pollinators are often overlooked. Humans depend on pollinators to survive as much of the food we consume relies on protecting habitat for their continued existence. This project brings awareness to the issue of pollinator deaths on highways. Implementing Integrated Vegetation Management [IVM]for PennDOT's proposed State College Area Connector will increase the biodiversity of roadside vegetation and conserve vital habitats for pollinators to prevent mortality.



Insect Roadkill

Image: Wikimedia Commons

Power Lines & ROW

Background

In my study area, which spans about nine miles between the Boalsburg Interchange and Potters Mill, I am focusing primarily on two critical environmental aspects: utilizing powerline corridors for pollinator habitats and enhancing road verges to reduce bee mortality. The significance of pollinator populations for ecosystem health and agricultural productivity cannot be overstated. Establishing pollinator habitats within powerline corridors will create essential refuges and foraging areas for bees, butterflies, and other pollinating insects. By incorporating native flowering plants and habitat features in these corridors, we can bolster pollinator populations and contribute to biodiversity conservation.

What is Powerline Right of Way?

A powerline right-of-way (ROW) is a designated strip of land where utility companies install and maintain power lines. Integrated Vegetation Management (IVM) is a key strategy utilized within these corridors to control vegetation growth. IVM involves a combination of techniques such as cutting tree sprouts, periodic mowing, herbicide applications, and the planting of native vegetation.

By implementing IVM, utilities can effectively prevent trees and other woody plants from encroaching on power lines, thereby reducing the risk of outages caused by vegetation interference. More importantly, when managed properly, ROWs can serve as valuable habitats for various plant and animal species. Mimicking natural grasslands, these corridors can support the growth of native grasses, forbs, and flowering plants, which in turn attract bees and other pollinators.

Power Company Policies

FirstEnergy (a six-state utility which includes Met-Ed, Penelec, Penn Power, and West Penn Power in Pennsylvania) is working to develop 225 acres of pollinator habitat across its service territory by 2025, which includes creating new habitat in transmission ROWs, at its electric substation properties, and at parks and nature preserves.

West Penn Power and Powell Valley Electric in Tennessee are two power companies that use herbicides to control plants growing under their power lines. Duke Energy (in the Southeast and Midwest) also utilizes a mix of herbicides to spray aerial areas, including Triclopyr, Krenite, Escort, and Method. This approach highlights concerns about ROW management practices on pollinators.

Figure 1.0 - Bees buzzing through a right-of-way in Des Plaines, IL, have a new place to call home. ComEd is installing two beehives to help preserve honeybee habitats.

Image: ComEd

Power Line Corridors

Four powerline corridors, each approximately one mile long, traverse suburban neighborhood forests and local farms. Some corridors are also situated near large open spaces in Penns-Brush Valley, underutilized areas, and road verges, which could potentially foster beneficial pollinator habitats.

I carefully selected corridors in the SCAC study area that avoid direct passage through residential or agricultural properties. These chosen areas are currently underutilized or not used at all. Corridor 1 runs through a forest behind homes and is positioned opposite Tait Farm. Corridor 2 stretches between the edge of Tait Farm and the edge of Sharer Road. Corridor 3 passes near Potters Mill through a forested area. Corridor 4 is adjacent to Route 322.

Figure 2.0 - This image highlights four powerline corridors that can serve as polinator habitat. Image: Swope

ROW Maintence

Powerline ROWs, owned and managed by entities such as FirstEnergy and West Penn Power in this case, are critical corridors for the transmission of electricity across vast landscapes. Maintenance crews are dispatched periodically to manage these corridors, typically every four to five years. This maintenance often involves the use of herbicides, which poses risks to pollinators in these areas. While meadows and other pollinator plantings can thrive with minimal maintenance, neglect can lead to the invasion of invasive species and woody plants, compromising the habitat's integrity. To mitigate these risks, management strategies such as grazing, controlled burns, and selective mowing can promote biodiversity while safeguarding pollinators.

1

4

2

3

Image: Google Earth

Pollinator Mortality

"At least 9.3 billion butterflies and 24 billion bees and wasps are are killed by vehicles each year."

- Baxter-Gilbert, Ecologist

Road Development

The expansion of road networks worldwide is a significant catalyst for environmental strain. Currently, these roads span approximately 32 million kilometers (20 million miles) globally (IRF, 2017), with projections indicating an additional 25 million kilometers by 2050. While much research has focused on the impact of roads on vertebrates, there is increasing evidence suggesting that roads also affect invertebrates–particularly insects–due to vehicle collisions leading to mortality.

What is a Road Verge?

Road verges, the strips of land along roadsides, are increasingly recognized as crucial habitats for pollinators. These areas often host a diverse array of plant species that attract bees, butterflies, moths, and other pollinating insects seeking nectar and pollen. The linear structure of road verges facilitates connectivity between fragmented habitats, enabling pollinators to traverse landscapes and access vital resources. Therefore, conserving and enhancing road verges can greatly aid pollinator conservation, bolstering the vitality and variety of pollinator populations.

Precedents

Image: Whitney Pipkin

Figure 3.0 - A sign on Virginia State Route 7 near Purcellville lets drivers and maintenance crews know that the median is used to grow habitat for pollinators.

Image: Pheasants Forever Habitat Org

Figure 3.1 - A new collaboration has been established between Pheasants Forever and IDOT to protect pollinator habitat and vital wildlife corridors across the state.

DOT Pollinator Habitat Plans

While PennDOT has a Pollinator Habitat Plan, it is not as well developed as in other nearby states. The Maryland State Highway Admistration (SHA) designs and installs meadows in roadway construction projects without compromising sightline clearances, vehicle recovery zones, or safety offsets. The Wildflower and Pollinator Habitat Program of Virginia DOT researches, plans, implements, and evaluates conservation measures and best practices to support natural areas along state-maintained roads and properties.

The goals of the MDOT SHA Pollinator Habitat Plan are to create, enhance, restore, and manage habitats that support bees, butterflies, and other threatened and impacted pollinators by:

1. Prioritizing the use of native plants in our mitigation and planting designs for highway development projects.
2. Establishing perennial wildflowers and meadow grasses that provide persistent and stable food sources, nesting locations, and overwintering sites for pollinators.
3. Installing educational, and informational signage about pollinators and their habitat for public understanding.
4. Utilizing social media and other media outlets to promote pollinator habitat awareness and management best practices.
5. Providing a network of pollinator habitats to connect Maryland's green spaces.
6. Tracking, evaluating, and applying for funding that supports pollinator habitats, native plants, and invasive species control.

Habitat Quality Matters

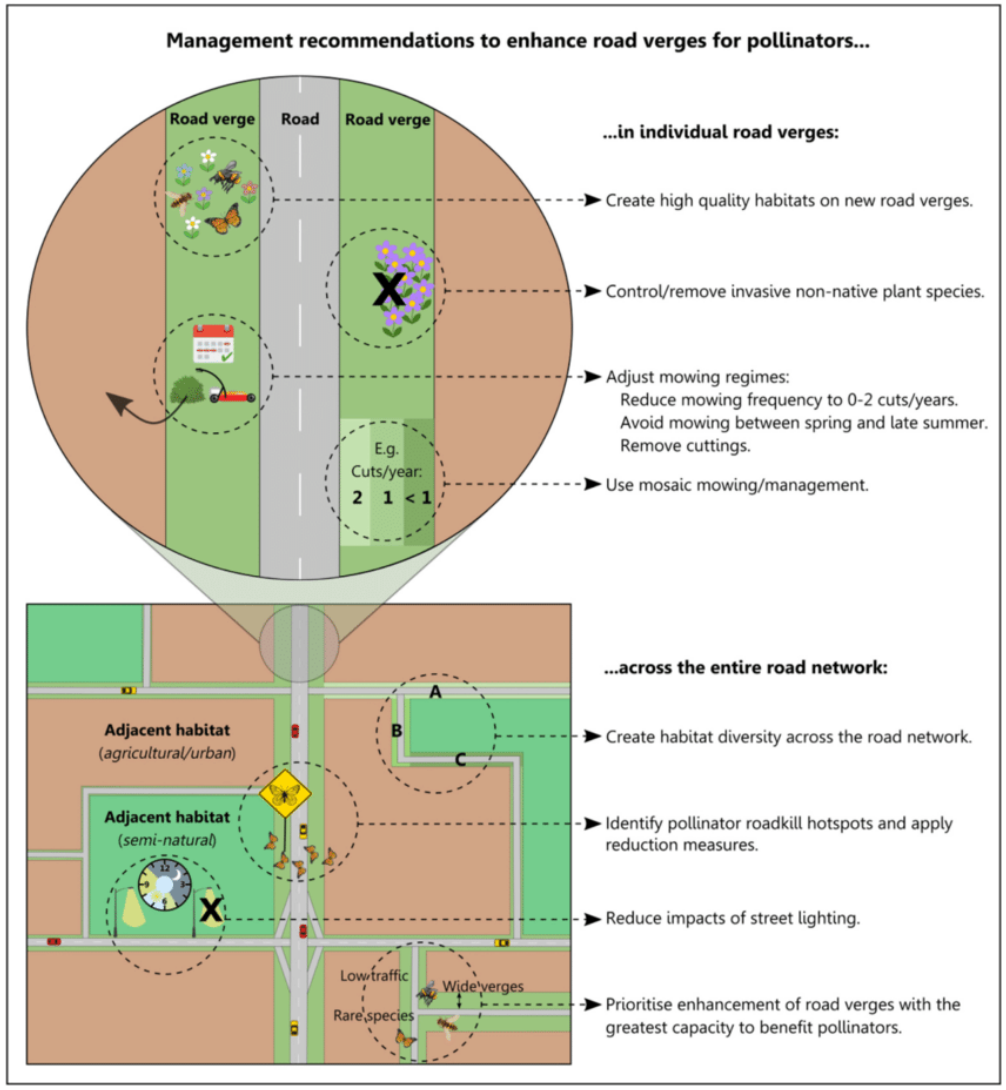


Figure 4.0 - Management recommendations for enhancing road verges for pollinators.

What is a Low-Quality Habitat?

A study conducted in Iowa highlighted a significant difference in pollinator mortality rates between roadsides with mowed grass, typically considered low-quality pollinator habitats due to limited plant diversity. The research revealed that pollinator fatalities from traffic were twice as frequent on roadsides where grass was regularly mowed. Low-quality habitats, such as mowed grass, offer pollinators fewer foraging resources, heightening their susceptibility to vehicle collisions. Bees and other pollinators must cross these roads more often in search of adequate resources, thereby increasing their risk of exposure to traffic.

What is a High-Quality Habitat?

High-quality habitats, characterized by diverse roadside vegetation, attract a broader array of pollinator species and experience significantly lower mortality rates. Diverse vegetation in these habitats plays a crucial role in mitigating pollinator deaths from traffic incidents. Abundant flowering plants ensure pollinators have ample access to nectar and pollen sources without needing to venture onto roadsides, where collisions with vehicles are more likely. Moreover, the increased availability of resources in high-quality habitats enables pollinators to spend more time foraging, thereby reducing the frequency of crossings in search of food.

Low Quality Roadside

No Plant Diversity

Mowed Every Year

Frequent Use of Herbicides & Pesticides

Image: 322 Swope

High Quality Roadside

Include Native Grasses and Wildflowers

Limit Mowing

Reduce the Use of Herbicides & Pesticides

Biography

Paige Swope-Ginley
Fourth-Year Landscape Architecture Student

Paige, from Cambridge, Massachusetts, is deeply passionate about ecological design and urban planning. With a strong commitment to sustainability, she strives to create spaces that harmoniously meet the needs of both humans and wildlife. Through her work, Paige aims to seamlessly integrate nature into urban environments, fostering biodiversity, resilience, and overall wellbeing. Her vision extends to cities that are not only aesthetically pleasing but also environmentally conscious and inclusive, where the natural world coexists in harmony with the built environment.

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Image: Kentucky Farm Bureau

Image: Jacob Hutton, Midjourney AI

Graphic Continuity

Jacob Hutton | LARCH 414 | Spring 2024

Strategy

Graphic continuity is about generating a consistent and recognizable style of graphics to use across Rethinking 322 Volume 3 with the assistance of Artificial Intelligence. Developed by Jake Hutton, these visual references offer the reader continuity via a common visual style to provide harmony and familiarity with the reader, thus allowing the reader to better compare and evaluate the ideas within the different sections of Rethinking 322. By utilizing AI, we can effectively and efficiently produce high-quality graphics to reinvasion and Rethink 322.

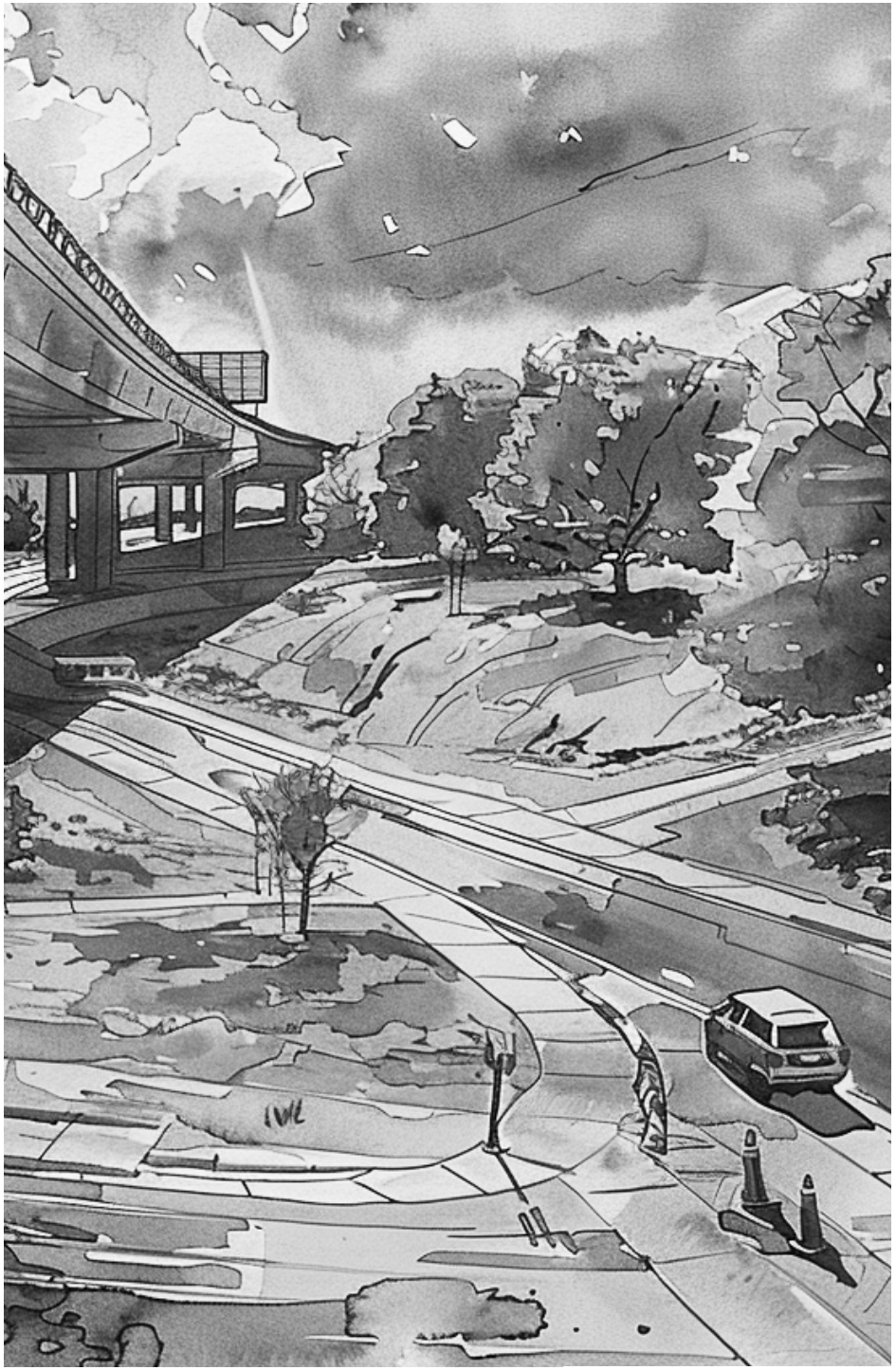


Image: Jacob Hutton, Midjourney AI

Alternative Solutions

Background

When planning strategies for a major project such as PennDOT's State College Area Connector for the U.S. Route 322, visualizing concepts is essential. Utilizing AI-based image rendering enables us to swiftly generate and visualize how these ideas will function and appear. This tool not only aids in understanding potential outcomes but also facilitates iterative refinement of concepts. By transforming abstract ideas into tangible visuals, we enhance our ability to communicate our vision effectively and ensure alignment with project goals.

Comparing current conditions with proposed concepts is crucial in reimagining specific areas of Route 322. This comparative analysis helps to identify strengths, weaknesses, and opportunities for improvement. Through scenario analysis, we pinpoint areas needing enhancement and develop precise solutions. This structured approach ensures informed decision-making, leading to practical and beneficial outcomes.

Moreover, AI-based image rendering enhances our capacity to engage stakeholders and local communities. Clear visual representations facilitate better understanding of proposed changes, fostering collaborative and transparent decision-making. Engaging stakeholders effectively allows us to address concerns and gather valuable feedback, ensuring the final design is functional, aesthetically pleasing, and aligned wth the needs of all stakeholders.

Image: Representation of existing conditions along route 322 - Jacob Hutton, Midjourney AI

Image: Concept of proposed solutions - Jacob HuttonMidjourney AI

Biography

Jacob Hutton
Third-Year Landscape Architecture Student

Jake was raised between the contrasting landscapes of Pittsburgh and La Jose, Pennsylvania. This stark contrast between urban and rural environments inspired him to bridge the gap between people and the natural world, fostering a deeper connection with nature. After completing his bachelor's degree in landscape architecture, Jake plans to pursue his master's degree in landscape architecture at Penn State.

References

Midjourney AI: Image Rendering
StableDiffusion AI: Image Rendering

Image: Jacob Hutton, Midjourney AI

Source: Mary Sorensen
Image: Clareigh Ellis, author of "Writing Continuity", and Jake Hutton, at the College Township Offices before the Rethinking 322 final community presentation, April 2024.

Writing Continuity

Clareigh Ellis | LARCH 414 | Spring 2024

Strategy

Writing continuity focuses on the compiling of the project sections for "Rethinking 322, Strategies for the proposed State College Area Connector in Penns-Brush Valley," as well as the editing, revising, fact checking, and formatting of this guidebook. Each volume of the "Rethinking 322" publication undergoes a thorough editing process with several rounds of revisions. Once the text and formatting is complete, it goes through initial editing, it is read through by Rethinking 322 studio Professor Marriott, then by the Centre County Historical Society and Stuckeman School. In addition, Penn State Sustainability and the Penn State Larson Transportation Institute are consulted on specific topic matters. While the process is rigorous, it is rewarding and ensures the booklets share a common voice and are high quality–presenting accurate and reliable information.

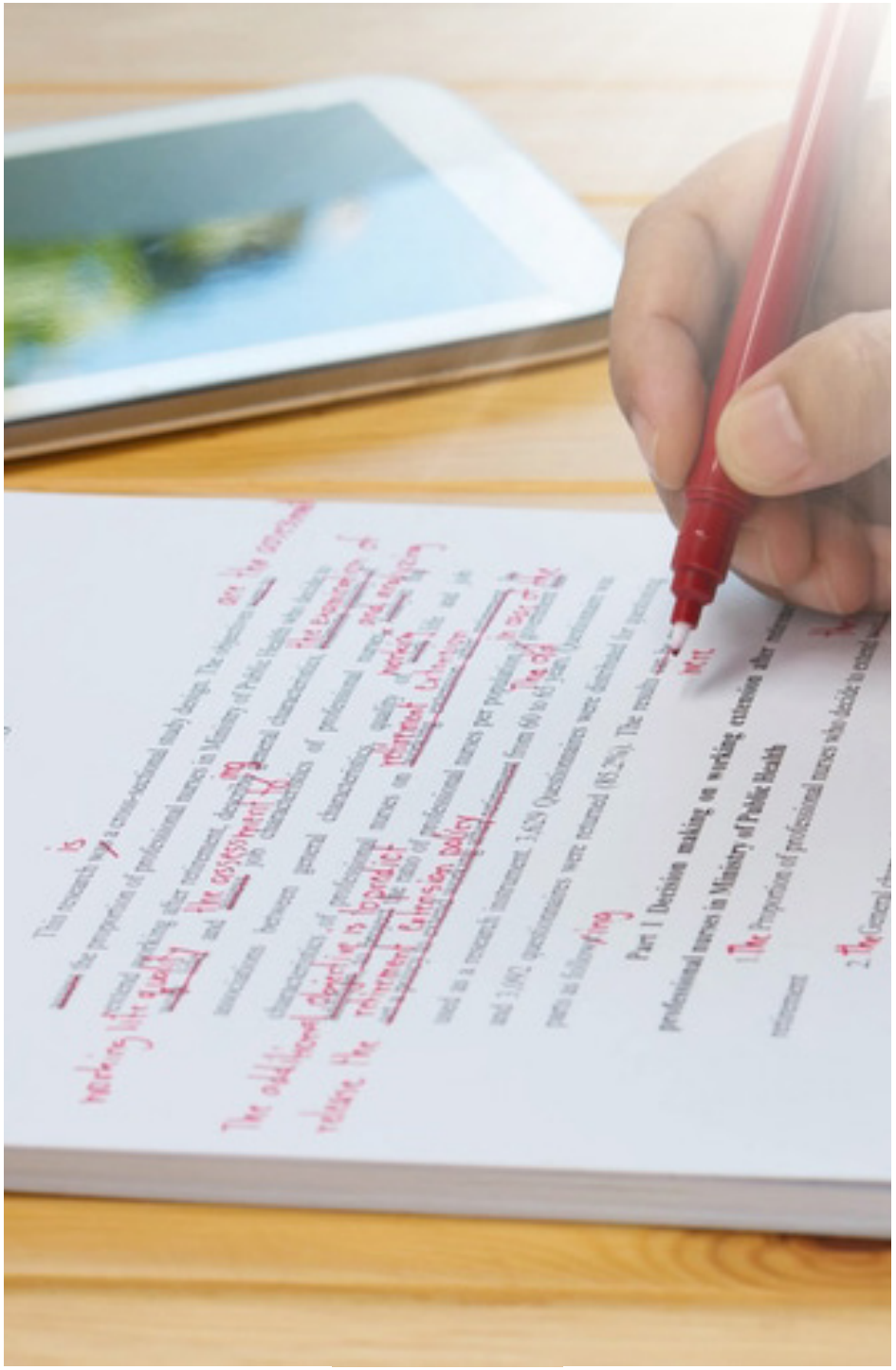


Image: Paper Editing Source: TeacherToolkit

Alternative Solutions

Behind the Scenes

Writing continuity is, by necessity, a tedious process. Nevertheless, it is very necessary for a high-quality booklet. In contrast to a traditional landscape architecture studio project, working behind the scenes on the booklets has been a great learning experience for my professional career.

The writing process enters several stages before producing a finished product. For this booklet, the projects were mindfully compiled for a dynamic viewing experience. Each project has an introduction written by the editor to provide a common voice and a smooth transition between projects. Each project was then run through several rounds of editing, revising, and fact-checking before final inspections by the Department of Landscape Architecture and the Stuckeman School, other Penn State partners and the Centre County Historical Society.

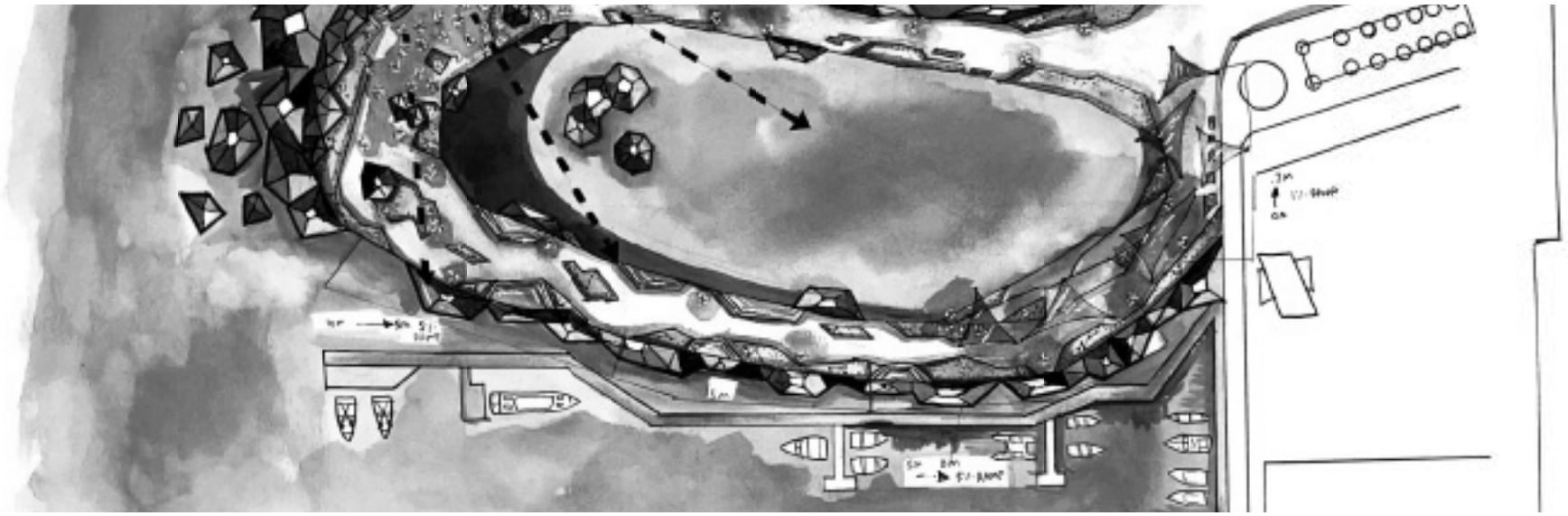
This project has left me appreciative of the work editors go through to make sure projects are suitable for public viewing. It has provided me a unique opportunity to work on the types of projects I envision for my career—projects that raise awareness of the skills and contributions of landscape architects to our communities and environment.

Image: Mary Sorensen

Biography

Clareigh Ellis
Fourth-Year Landscape Architecture Student

Clareigh found interest in landscape architecture when she was growing up in rural Connecticut. As an oil painter, she uses her love for painting in her illustrations. She is most passionate about playground design for advocating for Universal Design. Outside of landscape architecture, she enjoys crocheting, cooking, gardening, and taking care of her cat Mystic.



Appendix

Appendix

Planning Documents and Information

1. State College Area Connector Website:
   https://www.PennDOT.pa.gov/RegionalOffices/district-2/ConstructionsProjectsAndRoadwork/SCAC/Pages/default.aspx
2. Harris Township Comprehensive Rezoning Planning Report
   https://centreregioncog.govoffice2.com/vertical/Sites/%7B6AD7E2DC-ECE4-41CD-B8E1-BAC6A6336348%7D/uploads/Rural_RezoningReport_March_19_2019.pdf

Penns-Brush Valley Studio

1. Community Engagement and Outreach:

01/21/2024- Paul Daniel Marriott receives 2023 Education and Advocacy award from Centre County Historical Society.
02/13/2024- Ian Lockwood, PE, Toole Design, Orlando, FL, virtual visit to studio.
03/14/2024- Patrick Kennedy, Principal and Regional Director of Planning at HKS in Dallas, TX, in-person studio visit.
04/04/2024- Field visit, MD 200, Intercounty Connector, sound barriers and wildlife crossings.
04/04/2024- Meeting with Montgomery Countryside Alliance, Poolsville, MD.
04/05/2024- Field visit, George Washington Memorial Parkway, National Park Service, VA.
04/05/2024- Middleburg Town Hall, U.S. Route 50 Traffic Calming.
04/05/2024- Field Visit, Brunswick, MD, roundabout program and land-use policy.
04/11/2024- Cindy Zerger, National Practice Lead for Urban Design, Toole Design, Orlando, FL virtual visit to studio.
04/24/2024- "Rethinking 322" final public presentation, College Township Municipal Building.
04/26/2024- Liberty Hill Community Presentation, Paul Daniel Marriott, Elijah Pfeiffer.

2. Published Article:

Penn State News: https://www.psu.edu/news/arts-and-architecture/story/stuckeman-school-students-help-local-community-advocate-design
College of Arts & Architecture: https://arts.psu.edu/news/stuckeman-school-students-help-local-community-advocate-for-design-solutions/

Penns-Brush Valley Rural Historic District, National Register of Historic Places

1. Centre County Historical Society
   https://centrehistory.org/wp-content/uploads/2022/03/Penns-Brush-Valley-NR-Nomination_email.pdf

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RETHINKING 322