

TRANSPORTATION RESEARCH BOARD

# Roadsides as Transportation Assets - Georgia Case Study

**August 16, 2021**

**@NASEMTRB**  
**#TRBwebinar**

# PDH Certification Information:

- 1.5 Professional Development Hour (PDH) – see follow-up email for instructions
- You must attend the entire webinar to be eligible to receive PDH credits
- Questions? Contact [TRBWebinars@nas.edu](mailto:TRBWebinars@nas.edu)

*The Transportation Research Board has met the standards and requirements of the Registered Continuing Education Providers Program. Credit earned on completion of this program will be reported to RCEP. A certificate of completion will be issued to participants that have registered and attended the entire session. As such, it does not include content that may be deemed or construed to be an approval or endorsement by RCEP.*



**REGISTERED CONTINUING EDUCATION PROGRAM**

**#TRBwebinar**

# Learning Objective

Cite examples of successful implementation of sustainable practices in design and life-cycle maintenance of roadside landscapes

**#TRBwebinar**



# Roadsides As Transportation Assets

Matthew J. Quirey  
August 16, 2021

Landscape Design  
and Research Fellow  
The Ray

BS, Horticulture  
MS, Public Horticulture  
MLA and Student ASLA



# Ray C. Anderson (1934-2011)

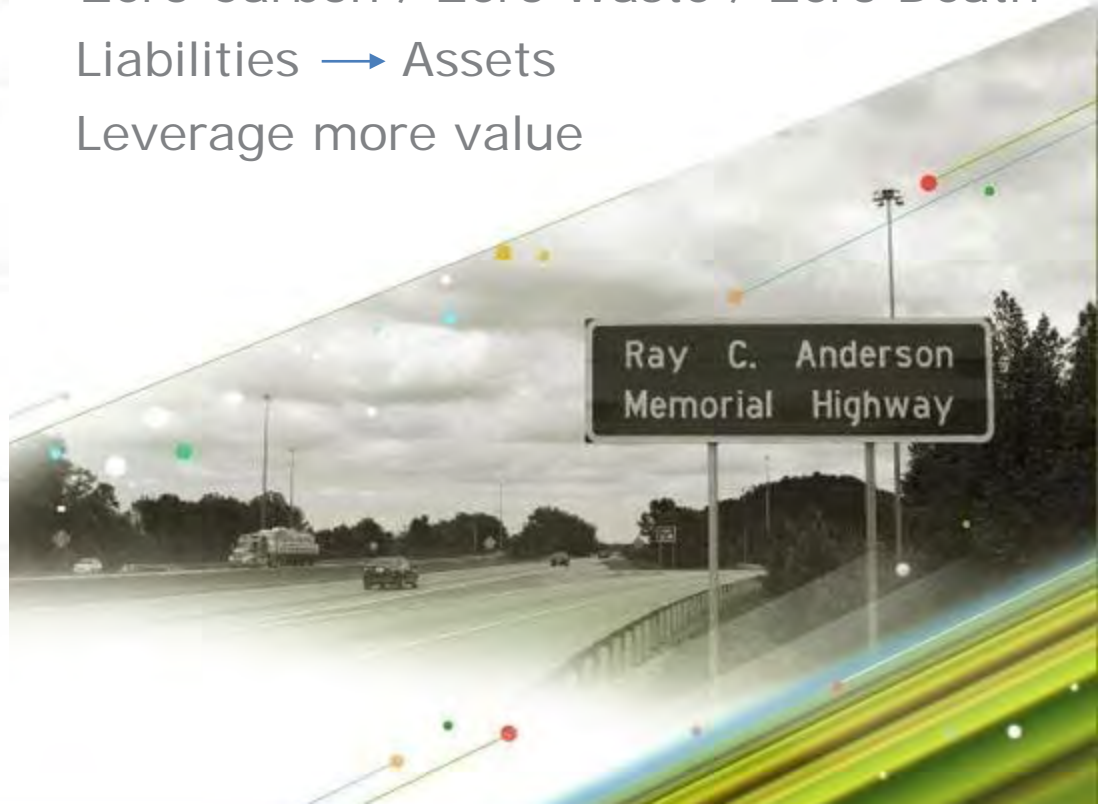
Interface, Inc.

- “America’s Green Industrialist”
- Global pioneer of corporate sustainability
- Circular economy now mainstream



# Better outcomes for communities, the economy and the environment.

Zero Carbon / Zero Waste / Zero Death  
Liabilities → Assets  
Leverage more value



# The Ray

A Publicly-Accessible Living Laboratory

A Proving Ground for the Transportation  
Infrastructure of the Future

Wildlife  
Conservation



Changing  
Attitudes



Life Safety

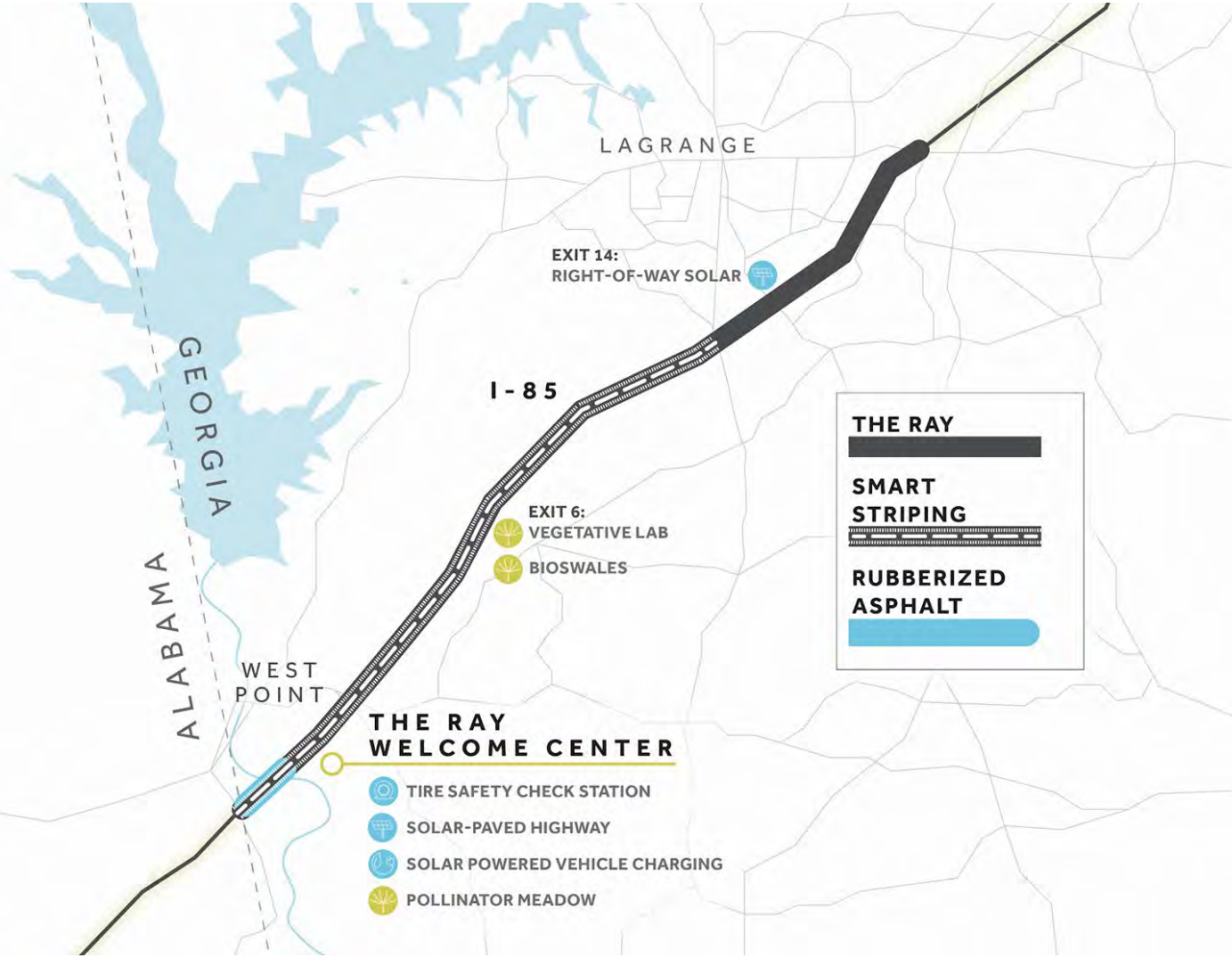


Pollution  
Remediation



Resource  
Efficiency

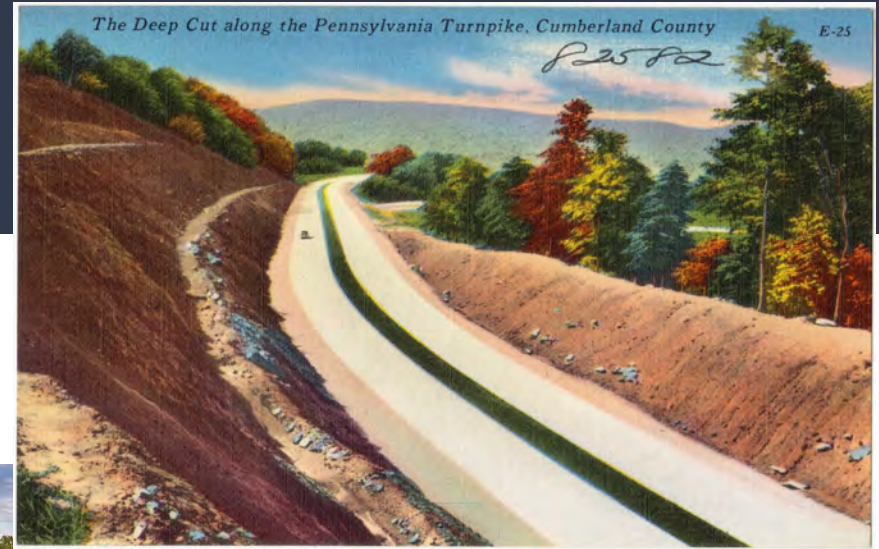




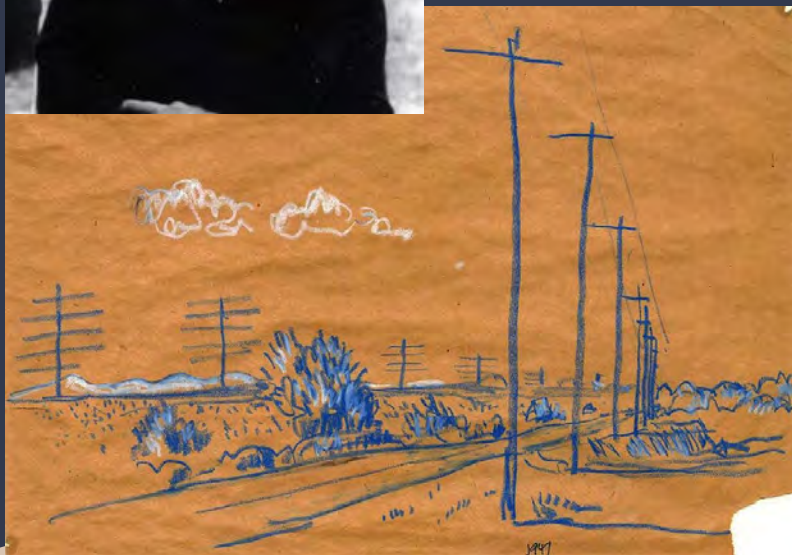


# UGA MLA Thesis

- Background and Inspiration
- Research Questions
- History
- Selected Innovative Projects
- Research Site / The Ray
- Proposed Roadside Typologies and Design Recommendations



<https://www.imagesfromtexas.com/photo/texas-bluebonnets---highway-through-a-sea-of-blue/>

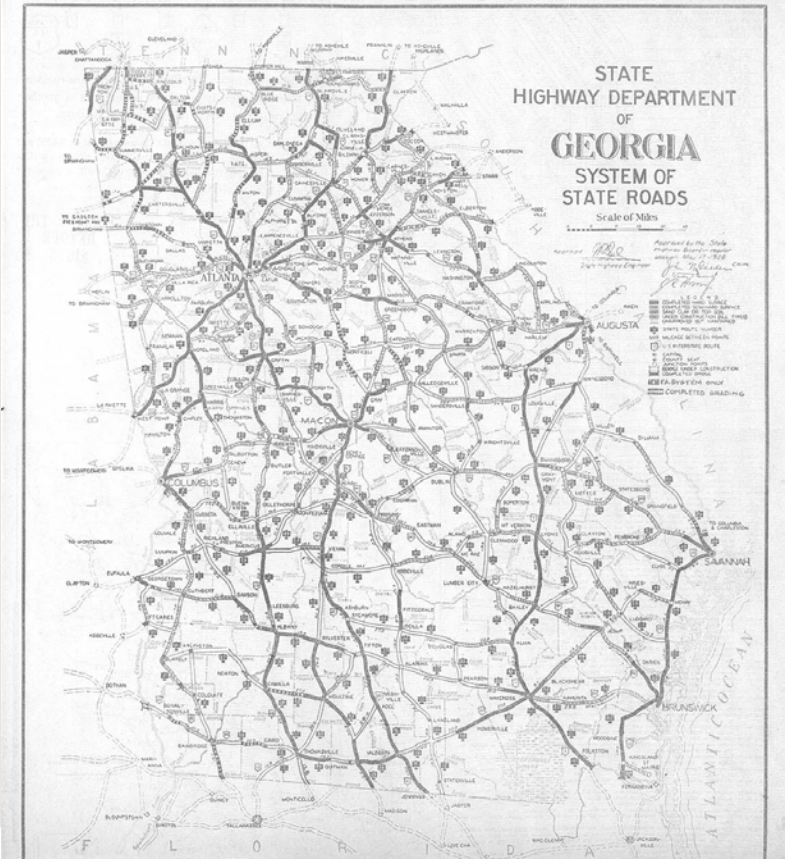


"Telephone Poles" (1947): an ordinary landscape, observed and drawn by J.B. Jackson

"... A liking for this feature of the human landscape of America (the roadside) should not blind anyone to its frequent depravity and confusion and dirt. Its potentialities for trouble—aesthetic, social, economic—are as great as its potentialities for good, and indeed it is this ambidexterity which gives the highway and its margins so much significance and fascination. But how are we to tame this force unless we understand it and even develop a kind of love for it? We have not really tried to understand it as yet."

J.B. Jackson,  
*Landscapes: Selected Writings of J. B. Jackson.*

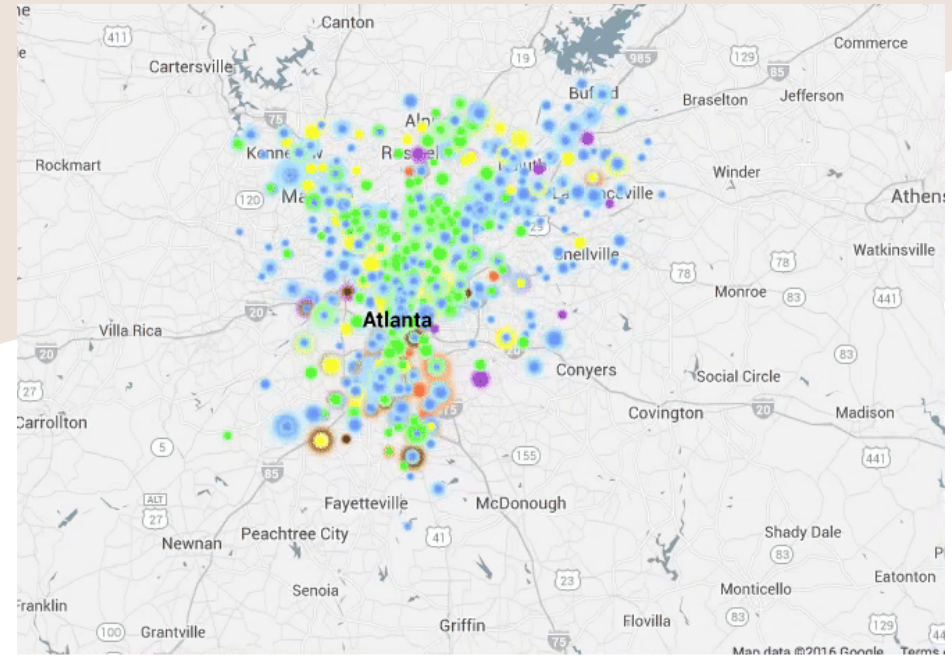
OCTOBER, 1929.



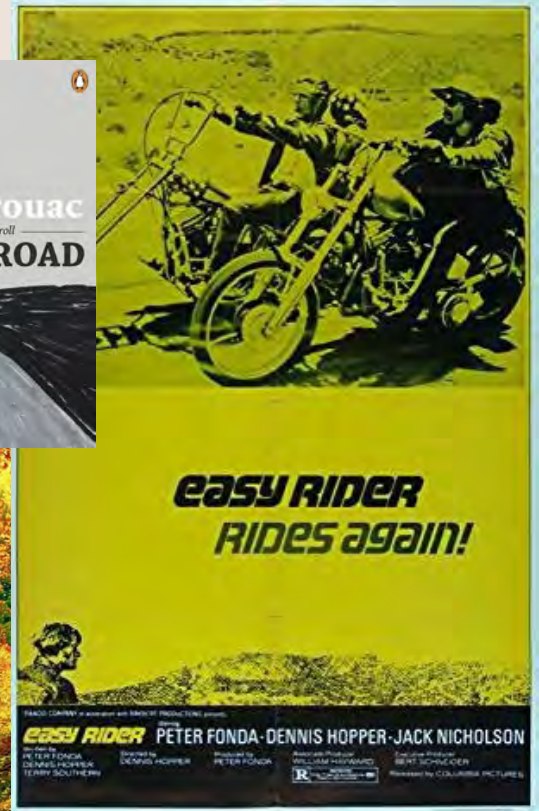
1929 Georgia Road Map

# Background and Inspiration

## 2016 Metro Atlanta Area Daily Commutes



COMMUTERS WORK IN: 1 GWINNETT COUNTY 2 FULTON COUNTY 3 HENRY COUNTY 4 COBB COUNTY 5 COWETA COUNTY OTHER



### The Road Not Taken

By Robert Frost

TWO roads diverged in a yellow wood,  
And sorry I could not travel both  
And be one traveler, long I stood  
And looked down one as far as I could  
To where it bent in the undergrowth;

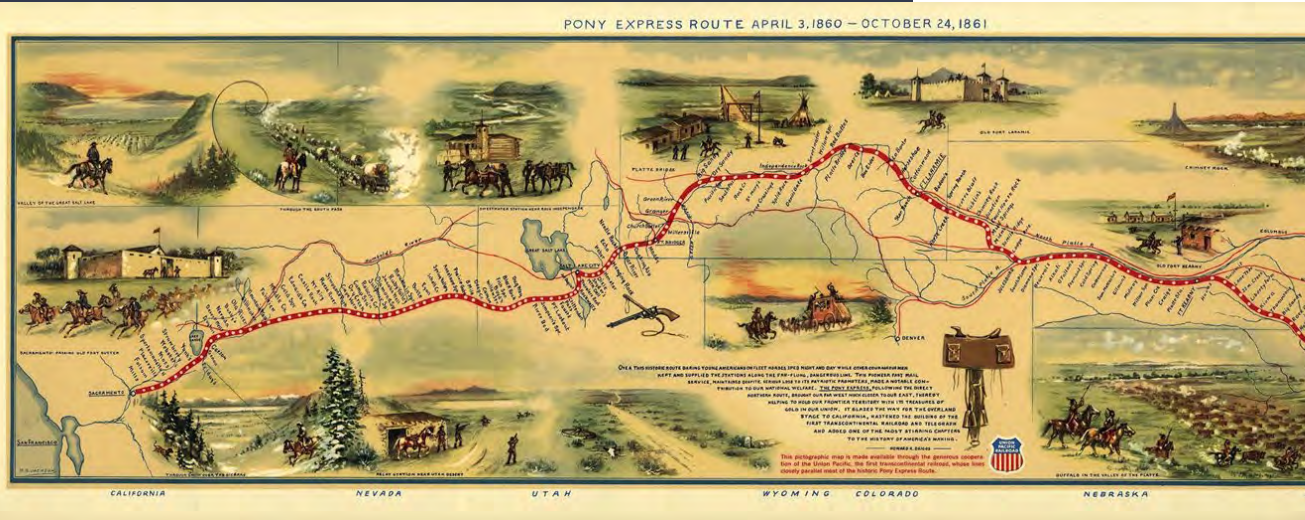
Then took the other, as just as fair,  
And having perhaps the better claim,  
Because it was grassy and wanted wear,  
Though as for that the passing there  
Had worn them really about the same,

And both that morning equally lay  
In leaves no step had trodden black.  
Oh, I kept the first for another day!  
Yet knowing how way leads on to way,  
I doubted if I should ever come back.

I shall be telling this with a sigh  
Somewhere ages and ages hence:  
Two roads diverged in a wood, and I—  
I took the one less traveled by,  
And that has made all the difference.



# 1860 Pony Express Route



<http://parkcityhistory.org/exhibits/the-pony-express/central-pacific-railroad-photographic-history-museum/>

Dixie  
Highway  
Map  
1919



# NBW Proposal, Houston Memorial Park, 2015



<https://www.asla.org/2016awards/172658.html>



<https://land8.com/land-bridge-is-an-ecological-masterpiece/vancouver-landbridge6/>

Vancouver Confluence Land Bridge, 2008

# Background and Inspiration

## Reimagining Roadside Landscapes in Georgia

As of 2011, there are 18,000 miles of state highway and over 1,200 miles of interstate highway in the state of Georgia.<sup>1</sup> These roads are valuable for many reasons, but for most in our society they are primarily used to get from point A to point B. In the minds of almost every American, as Edward Hume states, “The car is the star.”<sup>2</sup> This mindset grew quickly after the invention of the automobile because of the freedom and independence the car brought to daily life. Since the 1960s, driving has been the primary mode of transportation in the United States. In a 2011 report from the U.S. Census Bureau, “The private automobile’s dominance among travel modes used for the commute represents a longstanding pattern. ... the number of workers who commuted by private automobile increased continuously between 1960 and 2009, from about 41 million to about 120 million.”<sup>3</sup>

But when and why was the interstate system created? What were some early challenges to the creation of the highways and specifically the roadsides? Are there any examples of people or organizations involved with the improvement of the roadside landscape? What trends can be seen in roadside landscape design? What are the contemporary, 21<sup>st</sup> century views of the roadside landscape and how are they tied to changes in views about climate change, sustainability, and car culture in America?

These questions will be the framework for exploring the contemporary discourse about the roadside landscape in America. Examples from current work by UGA students and professors with the Georgia Department of Transportation will be discussed as well.

## Roadside Research

Prof. MacDonald / EDES 6550  
Proposal / Sept. 2017

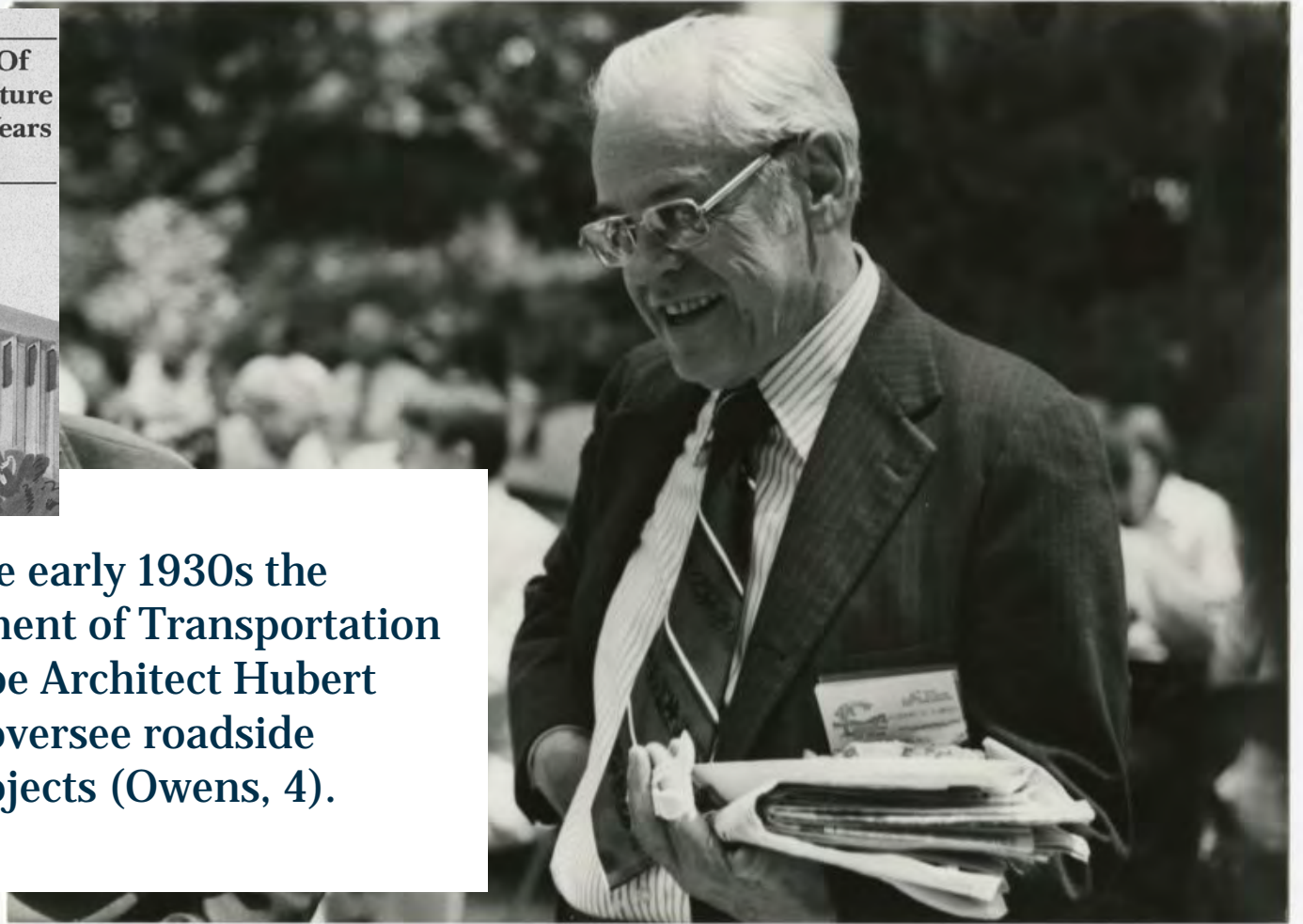
Final Paper / Dec. 2017  
18 pages / 47 references

**Personal History Of  
Landscape Architecture  
In The Last Sixty Years  
1922-1982**

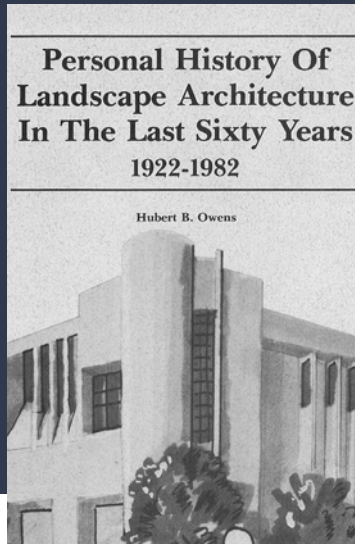
Hubert B. Owens



In Georgia, in the early 1930s the Georgia Department of Transportation named Landscape Architect Hubert Bond Owens to oversee roadside development projects (Owens, 4).







**In Georgia, in the early 1930s the Georgia Department of Transportat named Landscape Architect Hubert Bond Owens to oversee roadside development projects (Owens, 4).**

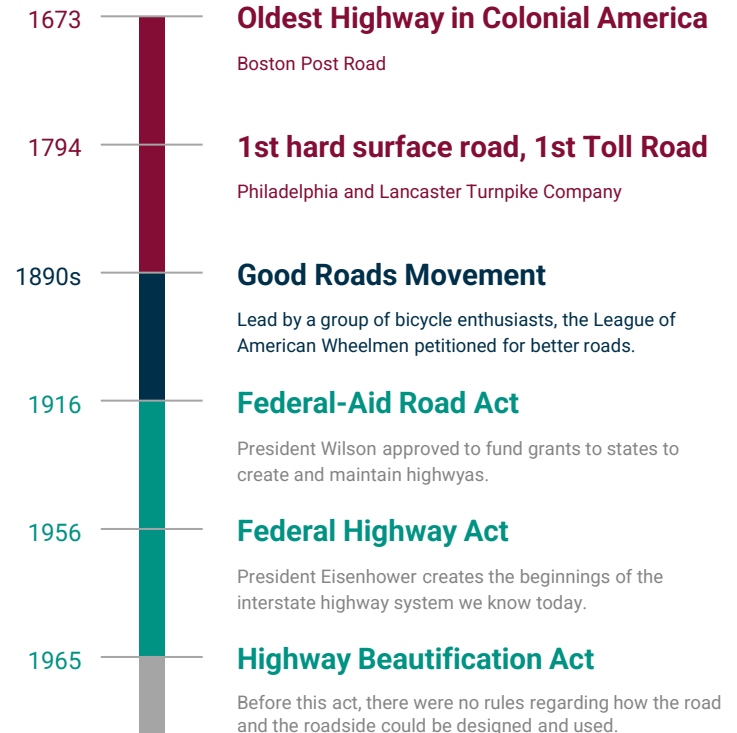


A Roadside Development Project. The Federal Bureau of Public Roads embarked on a program of roadside development in the respective state highway departments during the early 1930s. The work consisted primarily of widening the shoulders of the few paved, two-lane roads in existence at that time; sloping the adjacent banks to a pleasing, graceful grade and sodding them with grass; and removing illegally placed advertising.

# Research Questions

## PRELIMINARY

1. What are current examples of ecologically innovative roadside design projects across the United States?
2. What roadside landscape recommendations can be made for the 18-mile section of Georgia I-85 associated with The Ray?



# The Highway Beautification Act of 1965



# Literature Review

## KEYWORD SEARCHES

1. Highway Design
  - Multi-search / Books 3,935 / Journals 65,775
2. Roadside Design
  - Multi-search / Books 256 / Journals 4,209
3. Highway Innovation
  - Multi-search / Books 671 / Journals 5,600
4. Right-Of-Way (ROW) Landscape
  - Multi-search / Books 46 / Journals 627
5. Roadside Landscape
  - Multi-search / Books 494 / Journals 3,214
6. Highway Landscape
  - Multi-search / Books 1,744 / Journals 10,135

## Consensus of Sources

- Roadside landscapes are underutilized
- Federal and State policies acknowledge that native plants should continue to be used in roadside landscapes
- Since 1987, it is required that 1% of budget is used for native wildflower planting of federally funded highway projects.
- By 1994 only 38 States had program level support for native wildflowers.

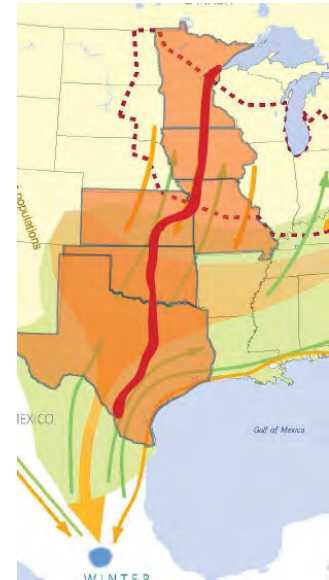
# Methodology / Descriptive Strategies

## Selected Innovative Roadside Landscape Projects

12 projects in 18 states were reviewed

### Projects Topics

- Biofuel Production
  - Utah—Freeways to Fuel
- Solar Production
  - Oregon—Solar Highway
- Carbon Sequestration
  - New Mexico—Slowing Climate Change
- Habitat Restoration
  - Monarch Highway



The background is a dark, starry space scene. It features numerous small white stars scattered across the field. Several bright, diagonal streaks of light, primarily in shades of yellow and white, cut across the lower right portion of the image, suggesting motion or data flow. The overall aesthetic is futuristic and technological.

# Tools and Technologies for Roadside Asset Inventory and Management

# Methodology / Classification Schemes

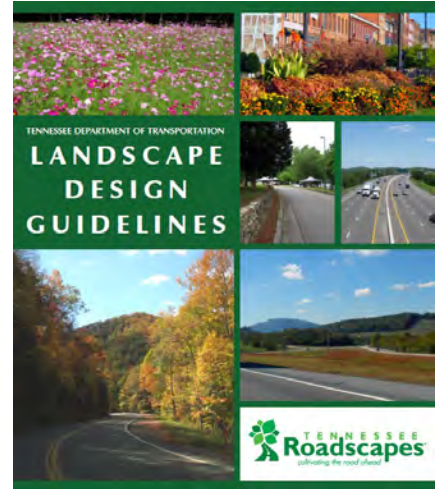
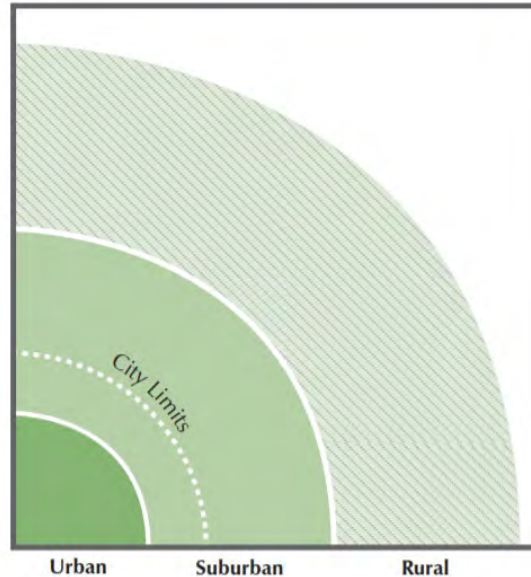
## Tennessee Roadside Typologies

### Classifications

1. Urban
2. Suburban
3. Rural

### Landscape Types

1. Interchanges
2. Right-Of-Way
3. Intersections
4. Highway Facilities
5. Scenic Roadways
6. Gateways



*Landscape Design Guidelines,*  
Tennessee Department of Transportation, 2010

# Methodology / Classification Schemes

## Washington DOT Roadside Land Use Categories

1. Operational Right-of-Way
2. Non-operational Right-of-Way
3. Formal Landscape
4. Resource Conservation Area
5. Environmental Mitigation Sites

*WSDOT Maintenance Manual M 51-01.10,*  
WSDOT, 2010

## Washington DOT Roadside Functional Categories

1. Operational
2. Environmental
3. Visual
4. Auxiliary

*WSDOT Maintenance Manual M 51-01.10,*  
WSDOT, 2010



# Proposed Typologies for The Ray

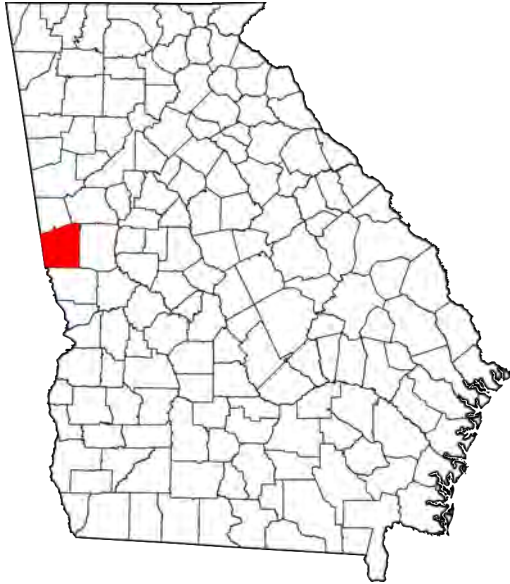
## Roadside Landscape Typologies

1. Right-of-Way
2. Medians
3. Streams and Wetlands
4. Interchanges
5. Behind the Guardrail
6. Gateways

## Functional Zones for each Typology

- A. Operational
- B. Environmental
- C. Transition / Buffer

# The Ray



# The Ray

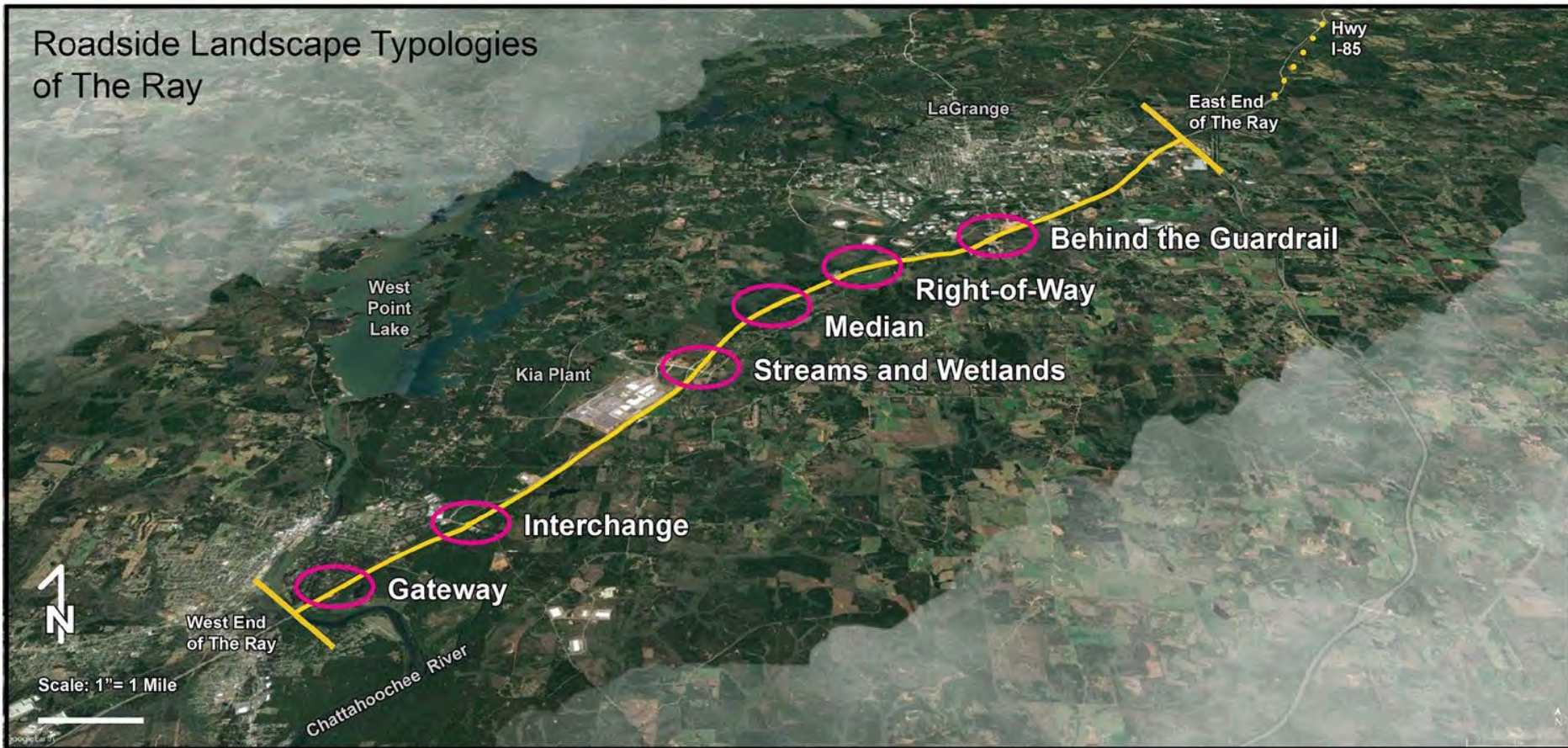
## Current Projects

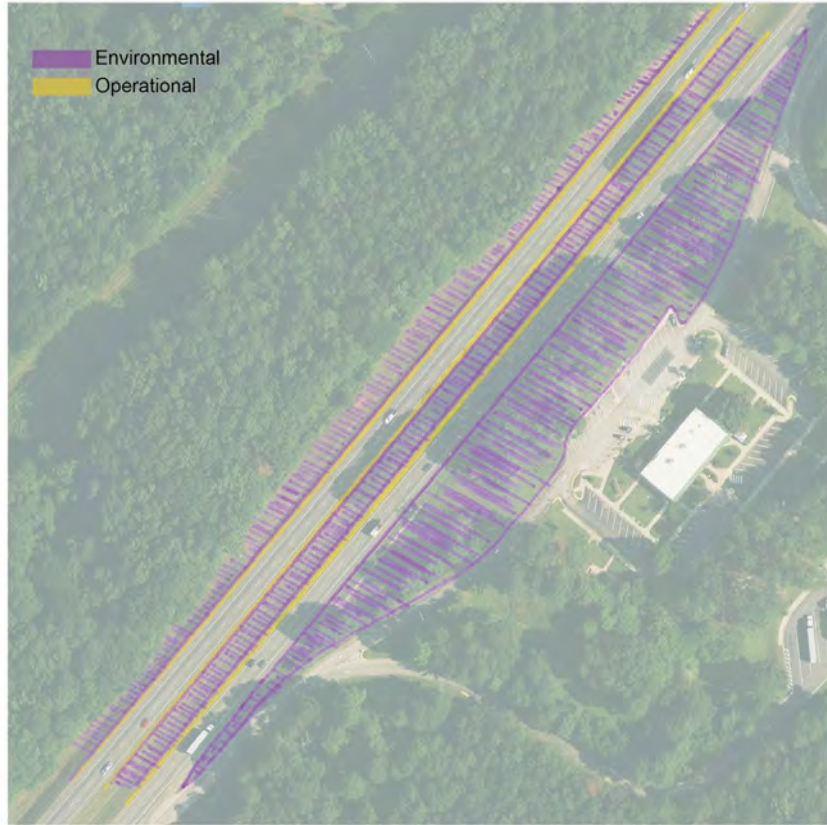
- Roadside Solar
- Drivable Solar / Wattway
- Solar powered car charging station
- Pollinator Gardens
- Bioswales

## Exit 6 Landscape Lab

- Kernza® Trial
- Perennial wildflower meadow research
- Slope Stabilization Research

# Roadside Landscape Typologies of The Ray

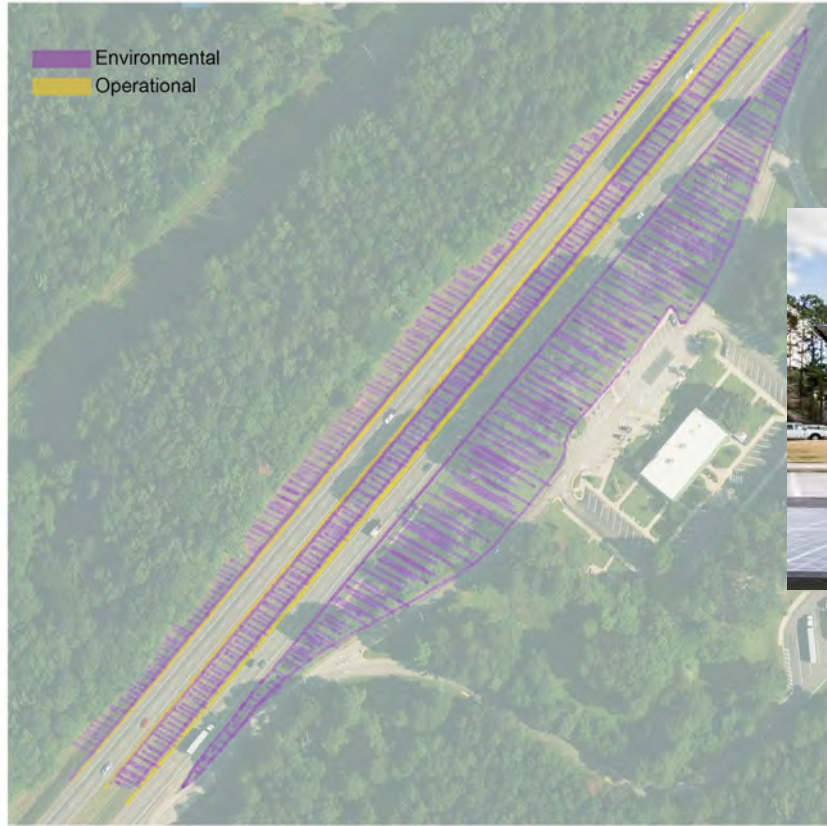




# Gateways

The main goal of the gateway typology is to showcase native plants of Georgia and create an inviting, beautiful, and sustainable landscape.

Gateways are found at the two ends of The Ray, at Exit 18, and at the Georgia Visitor Information Center.



# Gateways



# Interchanges

## Zone A / Operational Zone

- “Strip mowing” should take place along the first 5-15 feet adjacent to the roadway. Mowing height can be set at 4-8 inches depending on terrain and existing plant species.

### The Ray / Proposed Roadside Landscape Typologies

#### Interchanges



# Interchanges

## Zone B / Environmental Zone

Possible planting strategies include but are not limited to:

- Pollinator meadows
- Native plant seed production
- Canola or other biodiesel crops
- Plantings for carbon sequestration
- Crops for hay or other productive fiber production goals
- Roadside solar (outside of the designed clear zone with safety fencing)

### The Ray / Proposed Roadside Landscape Typologies

#### Interchanges

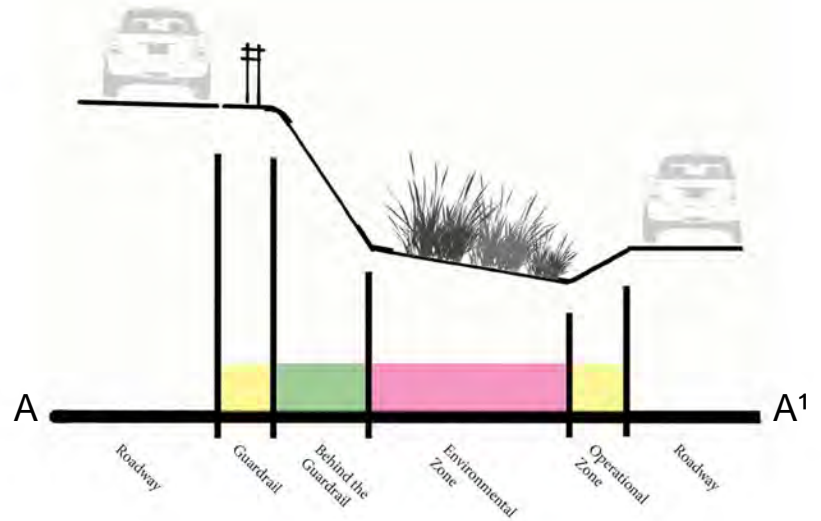
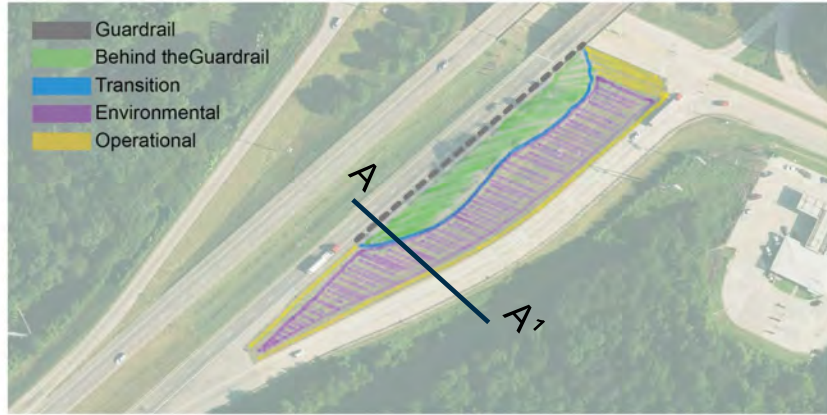




# Interchanges

## The Ray / Proposed Roadside Landscape Typologies

### Interchanges



# Medians

Along the 18-mile corridor of The Ray, the majority of the median is less than 50 feet wide. The goal of reducing mowing and improving ecological benefits can still take place in this typology but in different ways than in the ROW typology.

## Zone A / Operational Zone

- 5-15 feet “strip mowing”

But in this typology, a mown edge may not be necessary if planted with native grasses or forbs that do not grow taller than 18 inches.

The Ray / Proposed Roadside Landscape Typologies

Median



# Medians

## Zone B / Environmental Zone

Given the proximity to the roadway, this area cannot be planted with trees or shrubs because of safety concerns. But similar to the ROW, this typology can execute a number of possible project types:

- Pollinator meadows
- Native plant seed production
- Canola or other biodiesel crops
- Plantings for carbon sequestration
- Crops for hay or other productive fiber production goals

The Ray / Proposed Roadside Landscape Typologies

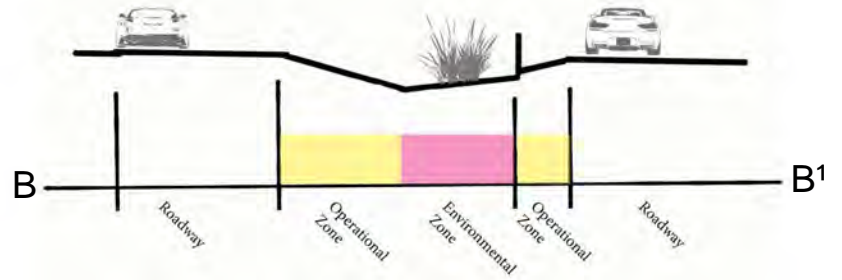
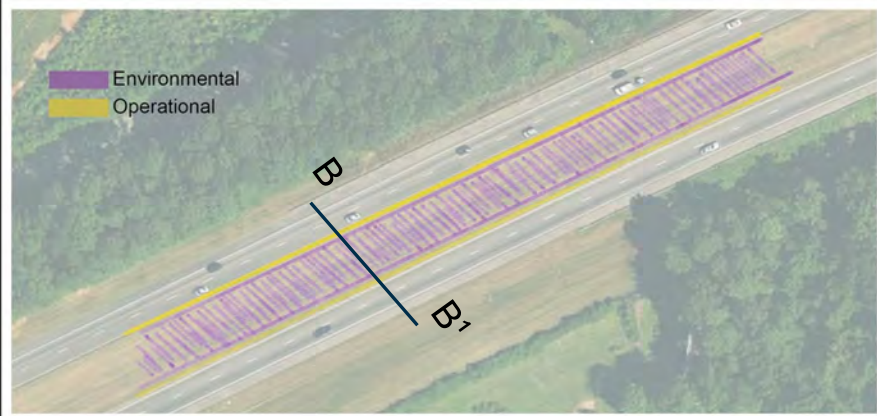
Median



# Medians

The Ray / Proposed Roadside Landscape Typologies

Median



# Roadside Pollinator Habitat Implementation Case Study

The background of the slide is a dark, starry space scene. It features numerous small white stars scattered across the field. Several bright, diagonal streaks of light, resembling meteor trails or comet tails, cut across the lower right portion of the image. These streaks are primarily yellow and white, with some green and blue highlights. The overall effect is a sense of dynamic movement and cosmic scale.

# James Hitchmough University of Sheffield

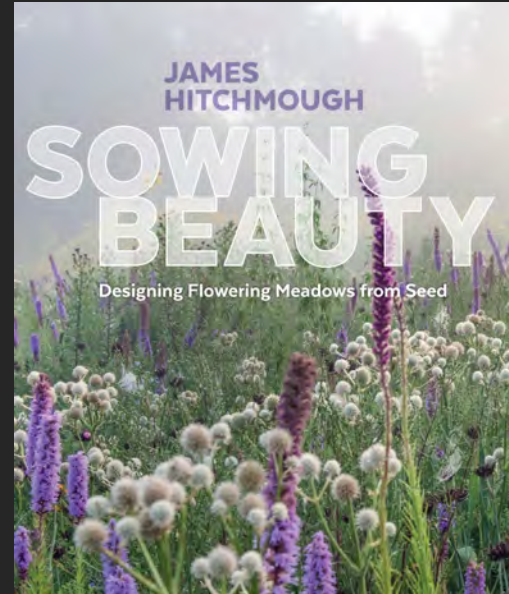
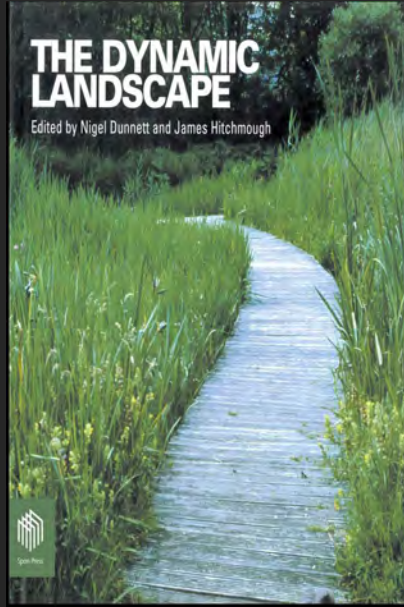












Figure 3A. Conventional lawn.



Figure 3B. Conventional lawn with native trees and shrubs.



Figure 3C. Replace 50% of the front lawn with prairie garden.



Figure 3D. Replace 75% of the front lawn with prairie grass.



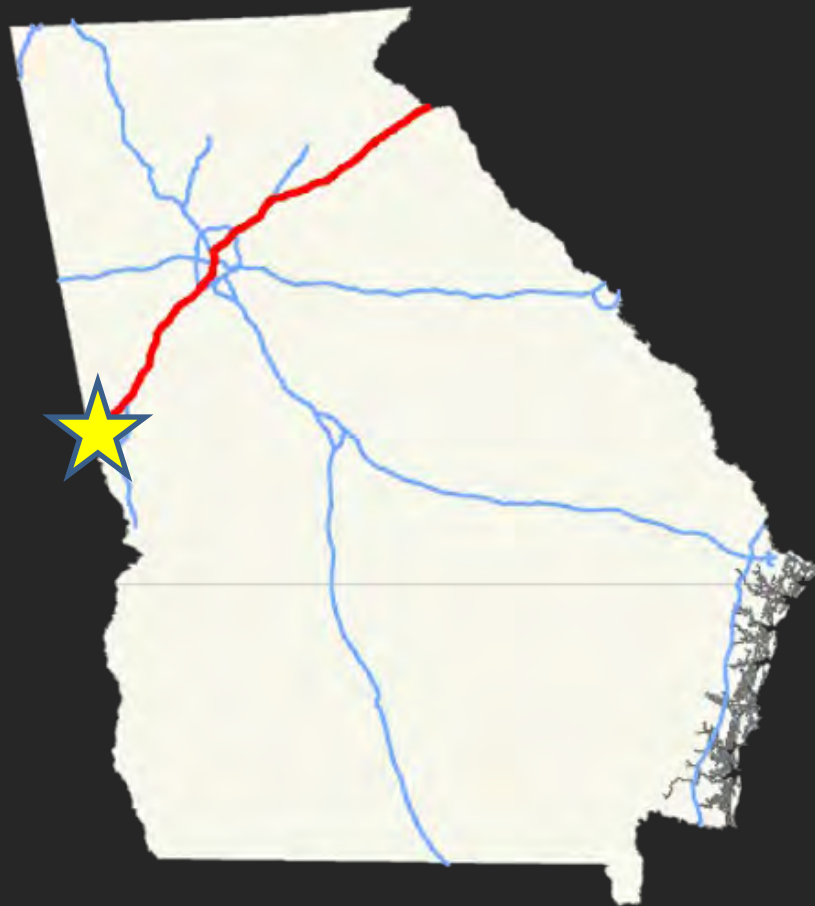
Figure 3E. Replace 50% of the front lawn with oak savanna shrubs.



Figure 3F. Replace 75% of the front lawn with prairie garden and woody shrubs.

"Messy  
Ecosystems,  
Orderly Frames"  
- Joan Nassauer

LaGrange, GA  
I-85, Exit 6



## Exit 6 Outdoor Lab

- Site 1
- Site 2
- Site 3
- Site 4
- Kernza Plots



## Site 1

-  Jelitto - Fines
-  Jelitto - Clay
-  GDOT - Fines
-  GDOT - Clay
-  Roundstone - Fines
-  Roundstone - Clay





Site 1 – Planting Day – January 28th, 2020



Monitoring Visit 1 - June 2nd, 2020



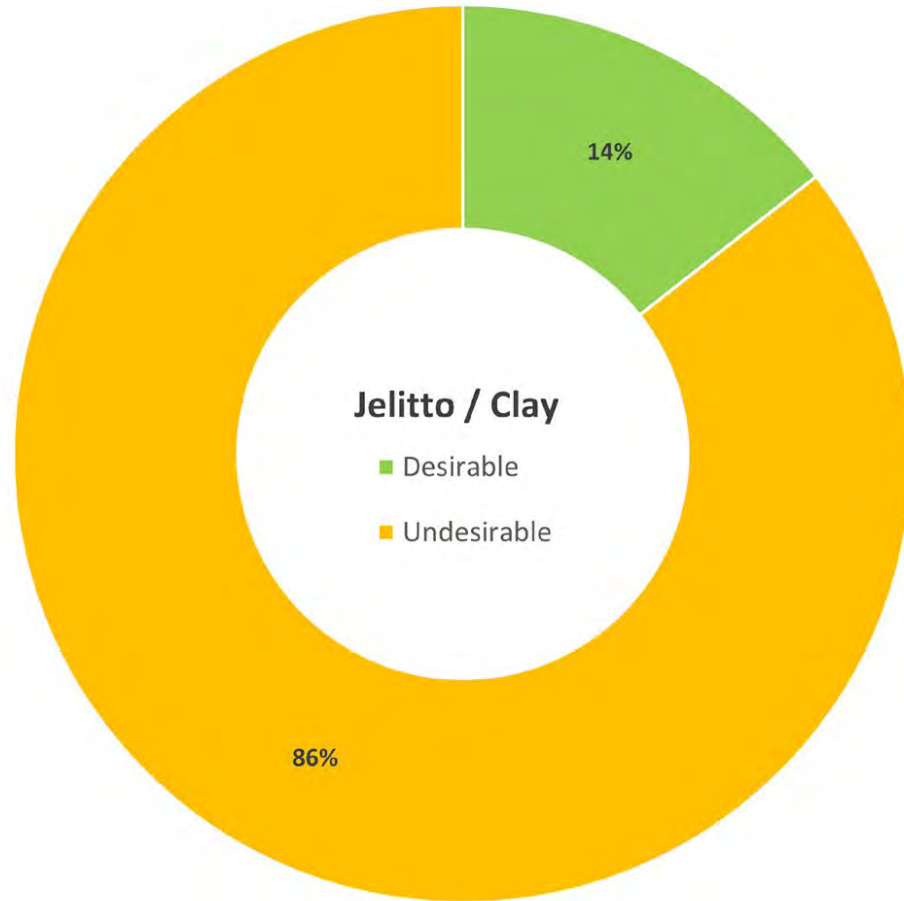
Monitoring Visit 2 – August 11th, 2020





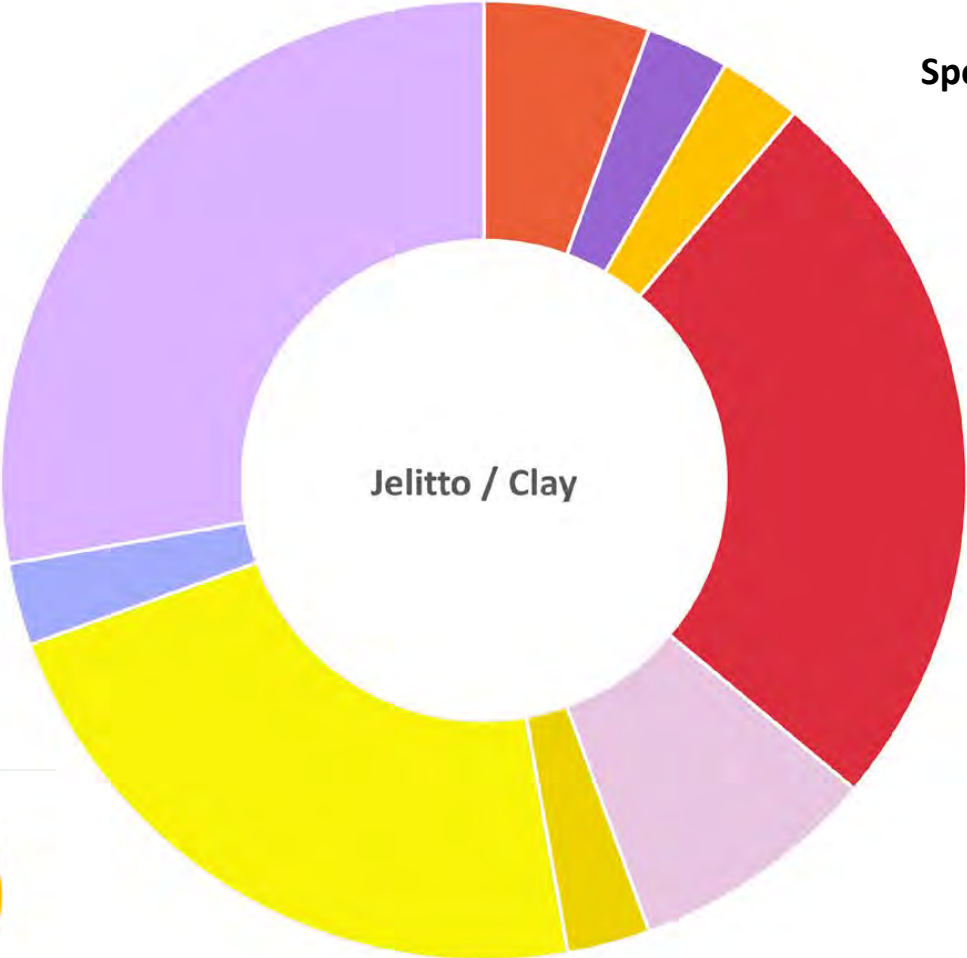
Monitoring Visit 3 – September 28th, 2020





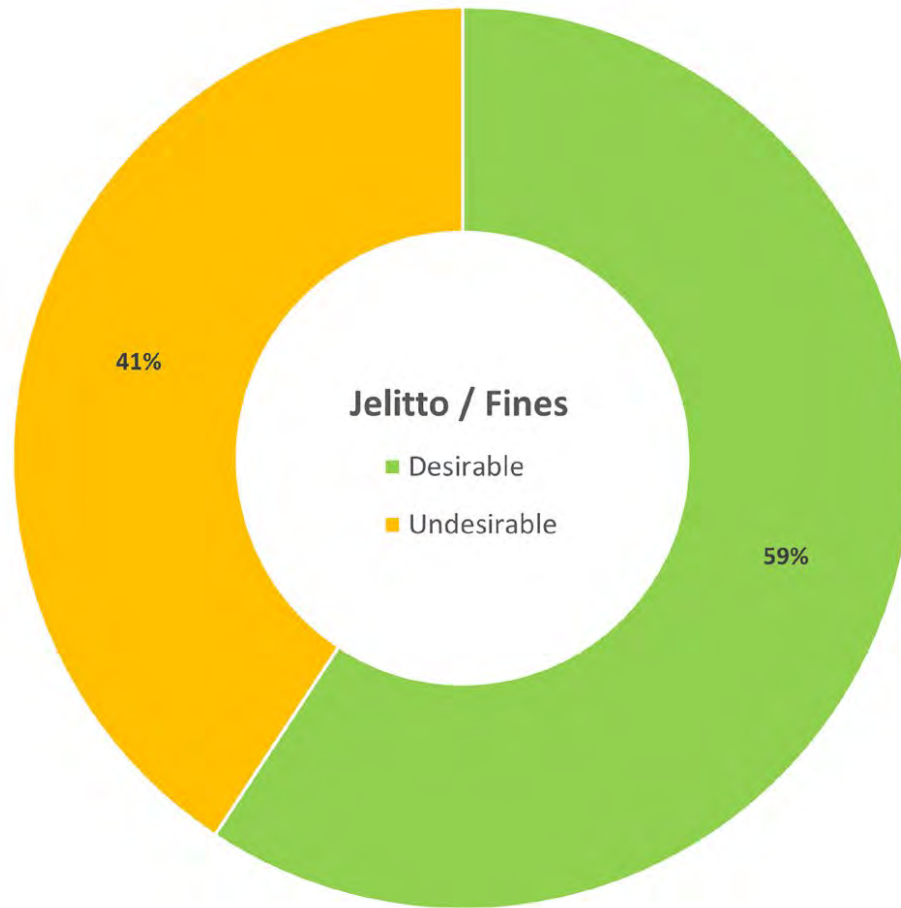


### Species Breakdown – Desirables (14%)



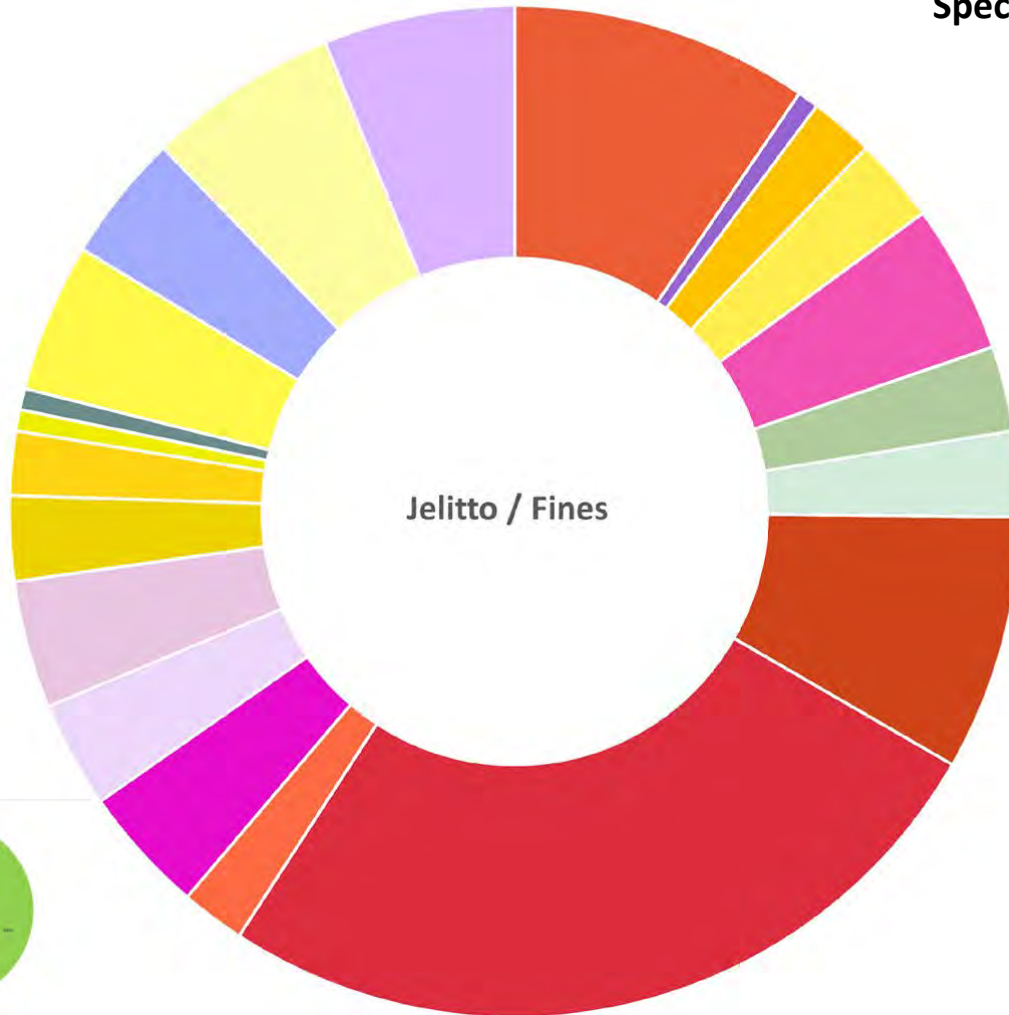
- Aesclepias tuberosa (5.6%)
- Baptisia australis (2.8%)
- Coreopsis lanceolata (2.8%)
- Gaillardia pulchella (25%)
- Oenothera speciosa (8.3%)
- Rudbeckia hirta (2.8%)
- Solidago speciosa (22.2%)
- Symphotrichum laeve (2.8%)
- Verbena spp. (27.8%)







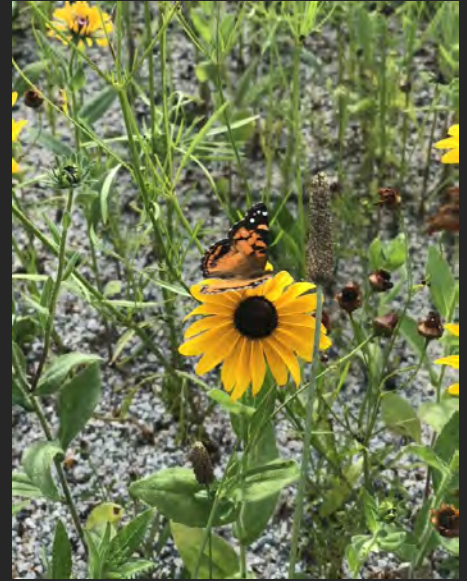
## Species Breakdown – Desirables (59%)



- Aesclapias tuberosa (9.5%)
- Baptisia australis (0.7%)
- Coreopsis lanceolata (2%)
- Coreopsis spp. (2.7%)
- Echinacea spp. (4.8%)
- Eragrostis pectinacea (2.7%)
- Eryngium yuccifolium (2.7%)
- Gaillardia aristata (8.2%)
- Gaillardia pulchella (25.9%)
- Kniphofia uvaria (2%)
- Liatris spicata (4.1%)
- Monarda fistulosa (3.4%)
- Oenothera speciosa (4.1%)
- Rudbeckia hirta (2.7%)
- Rudbeckia maxima (2%)
- Rudbeckia triloba (0.7%)
- Schizachyrium scoparium (0.7%)
- Silphium terebinthinaceum (4.8%)
- Symphotrichum laeve (2%)
- Verbascum olympicum (6.1%)
- Verbena spp. (6.1%)







What's Next for Exit 6?



Phase III: Terraseeding



# Monarch Butterfly Caterpillar Sighting at Exit 6 May 18, 2021



The background is a dark, starry space scene. It features numerous small white stars and several prominent, bright, diagonal streaks of light in shades of yellow, orange, and white, suggesting high-speed motion or light trails. The overall aesthetic is futuristic and technological.

# Green Highway and EV Technologies for Roadside Design and Management



# EV Charging



- First public PV4EV in the Southeast
- Interstate EV charging gap – connects Atlanta & Montgomery



# WheelRight tire safety station

- Drive-through system analyzes tread depth, tire pressure & sidewall damage within seconds
- In U.S., under-inflated tires waste 2B gal. fuel/yr. & increase tail pipe emissions
- WheelRight (UK) installation on The Ray 1<sup>st</sup> in U.S. – only sidewall monitoring in the world



GEAR



Powered by

WheelRight  
tire pressure management







# Wattway on The Ray

- World's first **DRIVABLE** solar road surface
- Pilot on The Ray 1<sup>st</sup> in world outside of France
- Exceeds state average for road surface safety (.98 friction number = 70 skid number)
- Nearly 6 MWh generated / 12 months







## Right-of-Way Solar

- 1 MW DC on 4 acres -- 2,600 solar panels
- Online 2019 -- public project, power to grid
- 1<sup>st</sup> pollinator-friendly ROW solar in U.S.
- 2019 Analysis of Highway Solar Economics: The Ray & Webber Energy at UT Austin
- 2021 Esri solar mapping tool





ZERO WASTE. ZERO CARBON. ZERO DEATHS.

*Before*



*After*





# The Smart Ray – CV & AV Ready

- Connected Vehicle project partners:  
Panasonic + Georgia DOT + freight + The Ray
- Autonomous Vehicle project partners:  
3M + Georgia DOT + The Ray

***Goal: Hardware, software to enable interstate testing***





## Project Partners



## Technology Partners



## Research Partners



Webber Energy Group

College of Environment + Design  
UNIVERSITY OF GEORGIA



RESILIENT  
ANALYTICS

## Contact:

Matthew Quirey

Landscape Design & Research Fellow

[matthew@theray.org](mailto:matthew@theray.org)

Facebook / Twitter / Insta / LinkedIn:

@TheRayHighway

#RideTheRay

#DriveTheFuture



# Research & Development

- **Rubber-Modified Asphalt State of Knowledge**

Partner: US Tire Manufacturers Association

July 2021 publication

What is it? Best data & analysis of beneficial aspects of rubberized asphalt highways

- **ROW Solar Mapping**

Partner: Esri

Current users: TxDOT, COA, CDOT, PA Turnpike, MnDOT, MdDOT, Charleston SC

- **Next Generation Highways**

Partner: NGI Consulting; McKnight Fnd.; Energy Fnd.; Southwire

Current users: MnDOT

What is it? Co-located transmission & communications in the ROW

# Research & Development

- **Smart Road Dot**

Partner: 3M

What is it? The Ray holds IP on a solar-powered, LED-lit, smart & connected RPM

- **Tech Roadmap for The Ray 2020-2025**

Partner: Innovia Technology

September 2021 publication

What's next?                      Hydrogen refueling

platooning

Freight

Micro-wind  
Microgrids



# Research & Development

- **In-lane Inductive Charging**

Partner: ASPIRE Center, an NSF ERC

What is it? Energized loops embedded in roadbed, 50kW +

- **Connected Freight**

Partners: GDOT, Panasonic, HATCI, Kia Georgia  
July 2021 - Phase Two

What is it? Thirteen dual-mode, dual-active V2X radios; 14 C-V2X fleet vehicles; critical highway use cases: freight priority, crash warning, weather warning, work zone warning



# Operations & Growth

- **Five-year strategic operating plan**

Partner: Fox Advancement

- **Accelerator Fund**



Raising philanthropy to facilitate projects in 50 states

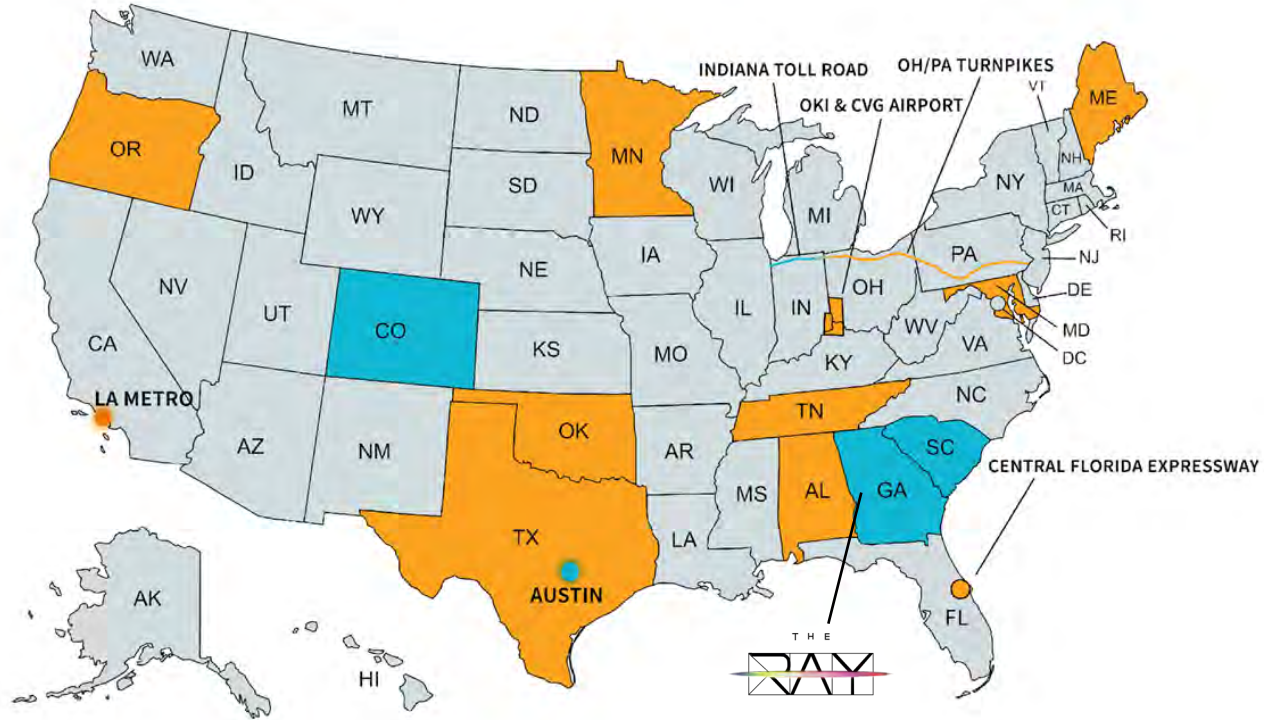
- **Tax-exempt bonding**

Facilitate large infrastructure projects + lower cost of borrowing & financing



# PARTNERSHIPS

-  The Ray Partners
-  Friends of The Ray



# WHO WE ARE

## Ray C. Anderson (1934-2011)

- “America’s Green Industrialist”
- Global pioneer of corporate sustainability
- Circular economy now mainstream

## The Ray Highway

- A publicly accessible living laboratory
- A proving ground for the transportation infrastructure of the future





Q & A Moderator  
Scott Lucas, MBA, CPM  
ADK40 Chair

ISA Certified Arborist OH-6674A  
Assistant Administrator  
ODOT Office of Maintenance Operations

# Today's Presenters



**Moderator: Scott Lucas,**  
Ohio DOT



**Matthew Quirey,**  
The Ray

# *TRB Weekly*

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*A new look for a classic newsletter!*

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- Even previous subscribers must resubscribe!

<https://bit.ly/ResubscribeTRBWeekly>

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#TRBExplorers



# Get involved with TRB

- Receive emails about upcoming webinars:

<https://mailchi.mp/nas.edu/trbwebinars>

- Find upcoming conferences:

<http://www.trb.org/Calendar>

#TRBWebinars



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# Get Involved with TRB

## #TRBwebinar

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 Transportation  
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*Getting involved is free!*

**Be a Friend of a Committee** [bit.ly/TRBcommittees](http://bit.ly/TRBcommittees)

- Networking opportunities
- May provide a path to Standing Committee membership

**Join a Standing Committee** [bit.ly/TRBstandingcommittee](http://bit.ly/TRBstandingcommittee)

**Work with CRP** <https://bit.ly/TRB-crp>

**Update your information** [www.mytrb.org](http://www.mytrb.org)