2025 NCDOT Research and Innovation Symposium



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2025 NCDOT Research and Innovation Symposium

FINAL REPORT

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16. Abstract

On February 11th and 12th, 2025, the Institute for Transportation Research and Education at North Carolina State University hosted the fifth annual NCDOT Research & Innovation Symposium. The Symposium was held at the University's McKimmon Center in a hybrid format and included multiple presentation sessions, poster presentations, a technology demonstration, a poster session, scholarship awards, and two off-site tours. This report summarizes the activities associated with the planning and execution of this event.

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1. Executive Summary

In February 2025, the Institute for Transportation Research and Education (ITRE) at NC State University hosted the fifth annual Research and Innovation Symposium for the North Carolina Department of Transportation (NCDOT). Held in a hybrid format, the two-day event featured 24 presentation sessions, two off-site demonstrations, two plenary sessions, one poster breakout session, a technology demonstration session, and four scholarship awards. Topics included connected and autonomous vehicles, traffic and safety, transportation planning, innovative technologies and processes, pavement and materials, operations and maintenance, environmental and hydraulics, unmanned aerial systems, structures and construction, geotechnical, rail, and updates from NCDOT Centers of Excellence. Of the 357 total registrants, 267 were non-students and 90 were students.

This report and its appendices document the planning and execution of the Symposium, including the call for presentations, session guidelines, agenda and abstracts, event website, and sign-up templates. Post-event activities included disseminating a survey, preparing session recordings for the website, compiling presenter materials, and drafting this summary report.

2. Introduction

In collaboration with ITRE at NC State University, NCDOT held its fifth annual Research and Innovation Symposium in February 2025. The event brought together a broad range of stakeholders—researchers, policymakers, engineers, planners, and other professionals—to share and discuss current and completed research projects relevant to NCDOT and the broader transportation community.

Like last year, the Symposium returned to a hybrid format. The majority of attendees participated in person, marking a successful transition from the fully virtual format of prior years. Over two days, the Symposium included 24 presentation sessions, one poster breakout, and two lab tours. A total of 357 participants attended—267 non-students and 90 students—representing a 13% overall increase in attendance, driven primarily by an 80% increase in student participation.

This report outlines planning activities and key deliverables, such as calls for presentations, guidelines, expanded abstracts, the agenda, and website content. It also describes post-event efforts, including video processing, presentation compilation, and report development. ITRE is proud to support NCDOT in promoting research implementation and technology transfer, and this report aims to support future Symposium planning efforts.

3. Presentation and Poster Selection

The first "Call for Presentations" was issued in September 2024 and allowed submissions through early January 2025, following a brief extension. The submission form (Appendix A) included options for both oral presentations and posters. Topics included:

- Environmental & Hydraulics
- Implemented Research Products

- Innovative Technologies, Projects, or Processes
- Integrated Mobility / Multi-Modal
- Pavement & Materials / Operations & Maintenance
- Planning & Policy
- Roadway Design
- Structures, Construction & Geotechnical
- Traffic & Safety
- Transportation Network Resilience
- Unmanned Aerial Systems
- Connected and Autonomous Vehicles
- Equity
- Other

ITRE conducted a preliminary categorization based on topic selections and abstract content. Titles and abstracts were compiled into PDF and Excel formats and sent to NCDOT for review. NCDOT rated each submission (1–5 scale) and provided review notes to inform the final selection process. Ultimately, 59 presentations and 62 posters were accepted.

Selected participants were notified by email (Appendix N), provided with a PowerPoint template, registration information, and told that their session details would be available later on the Symposium website. Those not selected received a separate thank-you email acknowledging their submission.

A draft agenda was created to minimize session conflicts and was updated regularly online based on presenter feedback and parallel session planning. This draft is presented in the following section.

4. Agenda

A draft agenda was first posted on the Symposium website in August 2024 and updated regularly leading up to the event in February 2025. Planning was initially done using a spreadsheet format to organize session "strands," which was later translated into a more user-friendly online version. The final online agenda, linked in Appendix E, included clickable presentation titles that directed users to the corresponding abstracts (Appendix F). Highlights this year included dedicated sessions for NCDOT Centers of Excellence and two lab tours on Centennial Campus.

Day 1 - Tuesday, February 11						
Time		Strand A - Equity, Planning, Policy, & Resilience (Room 1AB)	Planning, Policy, Innovation, ML/AI, Env., Structures, CAV, UAS Const., Pavement		Strand D - Int. Mobility / Multimodal (Room 5)	Strand E - Traffic, Safety, Rdwy Design (Room 6)
8:00 AM	9:00 AM		Registration	n / Breakfast / Netwo	rking	
9:00 AM	10:00 AM	General Ses	sion: Welcome, Sym	posium Logistics, Op	ening Plenary (R	oom 1AB)
10:00 AM	10:15 AM			Break		
		Session 1A	Session 1B	Session 1C	Session 1D	Session 1E
		Facilitator	Facilitator	Facilitator	Facilitator	Facilitator
10:15 AM	11:30 AM	Presentation 1	Presentation 1	Presentation 1	Presentation 1	Presentation 1
		Presentation 2	Presentation 2	Presentation 2		
		Presentation 3	Presentation 3	Presentation 3		
11:30 AM	1:00 PM		Lunch	w/ Keynote Speaker		
1:00 PM	2:15 PM	O	nsite Demos (w/ pote	ntial sponsored on-si	ite refreshments)	
		Session 2A	Session 2B	Session 2C	Session 2D	Session 2E
		Facilitator	Facilitator	Facilitator	Facilitator	Facilitator
2:15 PM	3:30 PM	Presentation 1	Presentation 1	Presentation 1	Presentation 1	Offsite 1
		Presentation 2	Presentation 2	Presentation 2	Presentation 2	Offsite 2
		Presentation 3	Presentation 3	Presentation 3	Presentation 3	
3:30 PM	3:45 PM	Break				
		Session 3A	Session 3B	Session3C	Session 3D	Session 3E
	5:00 PM	Facilitator	Facilitator	Facilitator	Facilitator	Facilitator
3:45 PM		Presentation 1	Presentation 1	Presentation 1	Presentation 1	Presentation 1
		Presentation 2	Presentation 2	Presentation 2	Presentation 2	Presentation 2
		Presentation 3	Presentation 3	Presentation 3	Presentation 3	Presentation 3

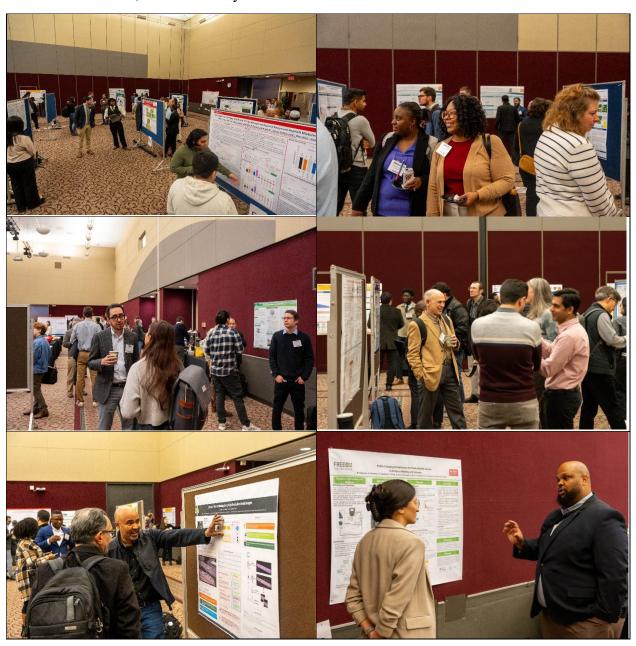
Day 2 - Wednesday, February 12							
Tir	Time Strand A Strand B Strand C Strand D Strand						
7:30 AM	8:30 AM		Registration / Breakfast / Poster Setup				
		Session 4A	Session 4B	Session 4C	Session 4D	Session 4E	
		Facilitator	Facilitator	Facilitator	Facilitator	Facilitator	
8:30 AM	9:45 AM	Presentation 1	Presentation 1	Presentation 1	Presentation 1	Presentation 1	
		Presentation 2	Presentation 2	Presentation 2	Presentation 2	Presentation 2	
		Presentation 3			Presentation 3		
		Presentation 4					
9:45 AM	11:00 AM		I	Poster Session			
11:00 AM	12:15 PM	Session 5A Session 5B Sessio		Session 5C	Session 5D	Session 5E	
		Facilitator	Facilitator	Facilitator	Facilitator	Facilitator	
		Presentation_COE	Presentation_COE	Presentation_COE	Presentation 1	Presentation 1	
					Presentation 2	Presentation 2	
					Presentation 3	Presentation 3	
12:15 PM	1:45 PM	Lunch w/ Keynote Speaker + Poster Awards					
1:45 PM	2:00 PM	Break					
2:00 PM	3:00 PM	Res. Dev. Unit	Committee Mtg				

5. Poster Gallery

A total of 62 student posters were submitted, representing a variety of universities. As shown in Appendix H, a dedicated room was available for poster display starting the morning of Day 1. Posters were mounted on wall space, and six rolling boards were marked for poster locations.

The room also included two refreshment tables and four small round tables for informal discussion.

Poster presenters received room setup guidance via email (Appendix C), which was also posted online. The website featured information on each poster, including the presenter's bio, title, location in the room, and a summary abstract.



6. Technical Demonstrations

A dedicated session showcasing cutting-edge technology applications was planned for the first day of the Symposium. This session featured participation from five universities: Elizabeth City State University, UNC Charlotte, NC State University, and North Carolina A&T.

In total, twelve demonstration stations were scheduled over a 75-minute period, with eleven located indoors and one planned for the outdoor parking area. However, due to inclement weather, the outdoor demonstration was canceled.

Indoor demonstration stations were equipped with an 8' table, two chairs, 120 V power, and wireless internet. Presenters were permitted to request additional space or materials as needed. Select demonstrations involving drones or full-sized vehicles were initially slated for outdoor presentation, contingent on weather and logistical considerations. Participants conducting unmanned aerial system (UAS) demonstrations were required to hold FAA Part 107 certification.



7. Offsite Tours

Two off-site tours were scheduled for the morning of Day 1, each limited to 25 participants.

- **Tour 1**: A walkaround at Gorman Street and Western Boulevard in Raleigh to examine pedestrian accessibility.
- Tour 2: A visit to Lake Johnson for a UAS bridge inspection demonstration.

Due to thunderstorms, both tours were converted to indoor presentations with Q&A sessions to ensure attendee safety.

8. Digital Collateral

Digital materials supporting the Symposium included:

- 1. The Call for Presentations (Appendix A)
- 2. Promotional emails (Appendix N)
- 3. The Symposium website hosted by ITRE (Appendix J)

9. Presenter and Moderator Guidelines

Session moderators were tasked with coordinating with their presenters before the event. Guidance was shared via email and online (Appendices B and D), covering:

- 1. Presentation upload instructions
- 2. Registration requirements
- 3. Presenter bios (Appendix G)
- 4. Assigned date and time
- 5. Presentation length (20–25 minutes + Q&A)
- 6. Room assignment
- 7. Campus map
- 8. Visual time cues (10, 5, and 1-minute warnings)

A PowerPoint template was provided, and instructions were given for last-minute changes on the day of the event.

10. Attendance

A total of 357 individuals registered for the Symposium: 328 attended in person and 29 joined virtually. This included 267 non-students and 90 students.

11. Documentation

ITRE documented the Symposium through video recordings and photographs, which can be downloaded at the following links:

- Videos:
 - https://drive.google.com/drive/folders/1HmFlVqkesO28nfLHhG13jFeRENdLDptS?usp=sharing
- Photographs: https://drive.google.com/file/d/1woPZ-237Z0J3MdpjG2s1j93BKgxtaHEj/view?usp=sharing

12. Post-Event Survey

A post-event survey (Appendix L) was sent to all attendees, with a three-week response window. Respondents who completed the survey received a PDH certificate for use with the NC Board of Engineers. The survey included 13 questions; summary results are in Appendix M.

Key Statistics:

- 123 responses (34.4% response rate)
 - o 107 in-person, 15 virtual, 1 hybrid
- 82% attended both days
- 64% were first-time attendees
- Nine sectors were represented, with engineering, private/government professionals, and students being the most common
- High interest areas included traffic and safety, CAVs, integrated mobility, bike/ped, and emerging technologies
- Most preferred in-person or hybrid formats
- Overall satisfaction was high

Positive Feedback:

- The McKimmon Center was appreciated for its location, accessibility, and parking
- Poster session encouraged meaningful one-on-one engagement
- AI and UAS presentations were consistently popular

Areas for Improvement:

- Lunch presentations lacked broad appeal specifically, the panels on AI were discussed on several occasions.
- Some sessions were too abstract or not practically applicable
- Presentations often suffered from poor delivery (reading slides, lack of clarity)
- Attendees suggested including clear takeaways for implementation

• Although there were improvements in this area, increased networking opportunities were requested

13. Continuing Education Units and Attendance Verification

Attendees were eligible for 9 PDH hours upon completing the post-event survey. ITRE provided an online certificate for attendees to submit to the NC Board of Engineers.

14. Recommendations

The 2025 Symposium was viewed positively, with strong participation and overall satisfaction noted across survey responses. The return to a hybrid format was well received, though in-person attendance remained dominant and preferred. Based on post-event survey data, participant feedback, and ITRE staff observations, several recommendations are offered to guide future Symposium planning:

Event Format and Planning

- Maintain in-person and hybrid availability, with continued emphasis on in-person programming as the preferred format for most attendees.
- **Avoid scheduling conflicts** with major transportation events such as the NCDOT Transportation Summit to reduce confusion and maximize attendance.
- Consider hosting the Symposium every two years, which may help increase attendance, expand the pool of presentation topics, and allow for more focused event planning across campuses.

Program Structure and Content Delivery

- **Strengthen the opening session** by featuring high-profile or motivational keynote speakers to establish energy and engagement early in the program.
- Allocate longer time blocks or dedicated panels for high-interest topics such as artificial intelligence, unmanned aerial systems, and innovative technologies that warrant deeper exploration than the standard 20–25 minute format allows.
- **Encourage clear takeaways** in all presentations, outlining how research can be implemented or translated into practice.
- **Promote effective presentation delivery**, discouraging excessive reading from slides or scripts, and encouraging more engaging and conversational approaches.

Engagement and Networking Opportunities

• Expand networking spaces and sessions, especially informal opportunities like those available during the poster gallery, which were cited as highly beneficial for one-on-one discussions.

- **Invite broader participation from the private sector**, including consultants and applied researchers who were underrepresented this year but expressed interest in future involvement. Their inclusion can enhance both attendance and content variety.
- Continue to support and grow student participation, which saw significant increases this year. Consider structured networking formats such as "meet and greet" tables, mentorship circles, or a "job dating" event modeled after speed dating, where students can interact with professionals from a range of transportation fields.

Logistics, Food Service, and Accessibility

- Improve consistency in meals and refreshments across both days. While individual meals were well received, attendees noted that breakfast or lunch was inconsistently provided.
- **Increase dietary accommodations**, ensuring that vegan, vegetarian, and gluten-free options are clearly labeled and readily available.
- Standardize event platforms and materials by assigning a consistent planning partner (e.g., ITRE, HSRC) to manage websites, templates, and collateral. With multiple universities involved, consolidating digital materials can reduce duplication and ease the burden of future planning.

15. Conclusion

The NCDOT Research & Development and ITRE collaborated to put on the fifth annual Research and Innovation Symposium. ITRE, with the assistance of NCDOT and past documented efforts, was able to plan, design, coordinate, and execute a successful event for NCDOT. It is our hope that we can assist NCDOT with its implementation and tech transfer activities again in the near future.

14. Appendices

Appendix A – Call for Presentations Form

R&I 2025 - Call for Presentations Form

Survey Flow

Block: Default Question Block (1 Question)

Standard: Block 2 (19 Questions) Standard: Block 1 (11 Questions)

Page Break

Start of Block: Default Question Block

Q1 NCDOT Research & Innovation Symposium 2025 • Fifth Edition February 11-12, 2025 McKimmon Conference & Training Center at NC State University 1101 Gorman St, Raleigh, NC 27606 Hosted by NCDOT | Organized by ITRE at NC State Abstracts for podium and poster presentations are now being accepted from university researchers, students, and transportation professionals working in public and private sectors. Submission deadline is November 17, 2024 at 11:59pm EST. Students presenting posters will be eligible to receive one or more scholarships up to \$2,500. Presentations are encouraged to include a meaningful focus on research and/or innovation. Presentations are welcomed even if not related to NCDOT-sponsored projects or specific to North Carolina. All abstracts are evaluated and selected for presentation by a Review Committee. Notification on abstract selection status will be emailed to the Presenter no later than December 20, 2024.

Potential topics include, but are not limited to: Connected and Automated Vehicles (CAVs), Environmental Equity Hydraulics Implemented Research Products Innovative Technologies, Projects or Processes Integrated Mobility / Multi-Modal MachineLearning/Artificial Intelligence Pavement & Materials / Operations & Maintenance Planning & Policy Roadway Design Structures, Construction & Geotech Traffic & Safety Transportation Network Resilience Vehicles (UAS/UAVs) Uncrewed Aerial Systems /

End of Block: Default Question Block
Start of Block: Block 2
Q2 Presenter Information Please enter the primary presenter's information below. You can add any additional presenter names later in the form.
Q3 First Name
Q4 Last Name

*	
Q5 Email Address	
_	_
*	
Q32 Confirm Email Address	
*	_
OC Disease Missels as	
Q6 Phone Number	
· · · · · · · · · · · · · · · · · · ·	
Q7 Position Title	
Q8 Organization	
Q11 City	
Q12 State	

Q9 Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact info on the next page.
○ Yes (1)
O No (2)
Display this question: If Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact inf = Yes
Q28 Submitter Information
Display this question: If Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact inf = Yes
Q10 Submitter's First Name
Display this question: If Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact inf = Yes
Q14 Submitter's Last Name
Display this question: If Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact inf = Yes
*
Q13 Submitter's Email Address

Display this question:
If Are you submitting this form on behalf of the Presenter(s)? If yes, please enter your contact inf = Yes
*
Q33 Confirm Submitter's Email Address
Page Break ————————————————————————————————————

Q15 What Business Sector does your organization represent?	
O Academia (1)	
O State Government (2)	
O Federal Government (3)	
○ City/County/Regional Government (4)	
O Private Industry (5)	
Other (please specify) (6)	
Q16 Is the Presenter a current student?	
○ Yes (1)	
O No (2)	
*	
Q17 Presenter Biography (100 word limit)	
End of Block: Block 2	

Start of Block: Block 1

Q18 Session Information
Q19 Presentation Title
Q20 Format
O Podium Presentation (up to 20 minutes; will be scheduled alongside 1-2 other presentations) (1)
O Poster Presentation (open only to current students) (2)
O Panel Discussion (up to 75 minutes) (3)
O Workshop or other format (up to 75 minutes) (4)
Display this question:
If Is the Presenter a current student? = Yes
And Format = Poster Presentation (open only to current students)
Q31 Would you like your submission to also be considered as a podium presentation?
○ Yes (1)
O No (2)

Q21 Topic Area(s) Connected and Autonomous Vehicles (CAVs) (14) Environmental (1) Equity (13) Hydraulics (15) Implemented Research Products (2) Innovative Technologies, Projects or Processes (3) Integrated Mobility / Multi-Modal (4) Machine Learning / Artificial Intelligence (16) Pavement & Materials / Operations & Maintenance (5) Planning & Policy (6) Roadway Design (7) Structures, Construction & Geotech (8) Traffic & Safety (9) Transportation Network Resilience (10) Uncrewed Aerial Systems / Vehicles (UAS/UAVs) (11) Other Topic (please specify) (12)

Q22	Abstract (250 word limit)	
-		
-		
-		
-		
-		
	Additional Presenters — list the names and organizations of any other speakers e presentation. Use a semicolon to separate each presenter's information.	appearing
-		
-		
_		
-		
-		
*		
Q24	What challenge or unmet need does this presentation address? (100 word limit)	
-		
-		
-		
-		
-		

Q25 Who is t	he audience for this presentation? (choose all that apply)		
	State Department of Transportation (1)		
	Federal Transportation Agencies (2)		
	Municipalities (3)		
	State Legislatures (4)		
	Private Industry (5)		
	Academia (6)		
	Other (please specify) (9)		
Q26 List up to five (5) keywords to describe the presentation. Use a semicolon to separate the keywords.			
responses a	nit your proposal, click "Next Page" below. You will receive a copy of your t the email address(es) provided.		
End of Block: Block 1			

Appendix B – Podium Presenter Guidelines

Podium Presenter Guidelines

On This Page

<u>Days Before Your Session</u> <u>Day of Your Session</u> <u>During Your Session</u>
After Your Session

Days Before Your Session

Review the email you received on **January 30** to find your session details (date, time, room number) and contact information for your session's Moderator.

Review the Attendee Info page for additional information on venue location, parking, etc.

Your Moderator should reach out to you to become familiar with your topic and presentation.

Confirm with the Moderator how much time you have for your presentation. Sessions are scheduled for 75 minutes and —with some exceptions—each session has three (3) presenters. Plan to speak for **no more than 20 minutes plus ~5 minutes for Q&A** immediately following your presentation.

Provide your Moderator with one or two questions about your presentation. The Moderator will ask these questions, if needed, to encourage further discussion from the audience during Q&A.

Prepare your presentation file(s) — e.g., PowerPoint, PDF, Video — to be compatible with Windows PC format. Your presentation will be displayed on a laptop PC provided in the session room. Do not plan to use your own computer. The laptop will have a Wi-Fi internet connection; however, if web access is needed for your presentation, you are strongly encouraged to download and run web content locally from the laptop rather than accessing the content live via the wireless connection if at all possible.

We strongly recommend using a widescreen (16:9 ratio) PowerPoint template. For convenience and consistency, you can use the official R&I Symposium PPT Template—however, this is not required.

IMPORTANT: Please upload your file(s) to our online portal no later than 9am on Monday, February 10, 2025. Your file(s) will be pre-loaded on the podium laptop PC for you.

Upload presentation file(s)

Day of Your Session

If you've made any late changes to your presentation file(s) after upload, inform the Help Desk staff at Registration Check-in. They will copy your new files to our server and alert your Room Technician.

Arrive at your session room at least 10 minutes early to meet with your Moderator and the Room Technician.

The Technician will assist you with finding your presentation file(s) on the podium laptop. We strongly recommend bringing a copy of your file(s) on a USB flash drive as a back-up.

During Your Session

The Moderator will introduce you by your Name, Title and Organization only. Your and other presenter bios are posted on the Summit Attendee Info website for attendees to read.

Keep within your allotted time. The Moderator will hold up cue cards to alert you at 10-, 5- and 0-minutes remaining.

During Q&A, questions may come from both the in-person and virtual audience. Virtual attendees will post their questions/comments in Zoom, and the Room Technician will read them aloud for you.

Virtual attendees may be unable to hear questions from the in-person attendees. When you respond, please repeat the question before answering.

After Your Session

Your presentation file(s) will be archived by ITRE and NCDOT and become public record. If there are any concerns about copyright or confidentiality in your presentation content, please make sure these concerns are resolved with all involved parties before the event.

Appendix C – Poster Presenter Guidelines

Poster Guidelines

Poster sessions are a valuable opportunity for authors to present research and meet with interested attendees for in-depth technical discussions. Good planning can make your presentation clear, effective and rewarding.

On This Page

Poster design goals
What we provide
What you should bring

<u>Poster session rules</u> <u>Poster design guidelines</u>



We are excited to share that at least three scholarships between \$1000 and \$2500 will be awarded at the NCDOT Research and Innovation Symposium next month.

Want your poster to be eligible for a scholarship award?

Upload a PDF of your poster by 12pm on Feb.

3rd

Poster design goals

To provide a clear overview of your work

To provide enough content to explain the research without an oral explanation

To provide enough content to initiate discussion and questions without overwhelming the audience

The poster session is scheduled on **Wed**, **February 12 from 9:45 – 11 am** in Room 1AD at **NC State's McKimmon Conference and Training Center**. Several poster presentations will be taking place at once in the room. Poster presenters are encouraged to **set up early, starting at 7:30 am**, but should ensure setup is completed **no later than 9:45 am**

What we provide

The R&I Symposium provides a display surface that is four feet tall (4 ft. or 122 cm.) and six feet wide (6 ft. or 183 cm.). Posters are pinned to either side of a display board as well as on the walls around the room. Tacks and pins are provided for authors to use to attach posters. Each poster display area is numbered for easy identification by both authors and attendees.

No electrical outlets or cords will be provided. If your presentation requires a laptop computer or tablet, please come with your device charged! Please note, tables will not be available at the display boards, so any device you use will need to be handheld.

What you should bring

A single sheet poster made of heavyweight poster paper or similar material, a maximum of 4 ft. high x 6 ft. wide in size. Posters that are larger in either dimension may not be displayed or presented.

T-pins or tacks as back-up to the provided pins and tacks. **Tape or other kinds of fasteners are not permitted on the display boards or walls.**

Authors may bring additional written material of a non-commercial nature that supplements the content presented on the poster.

Poster session rules

Computers, tablets and other mobile devices *without audio* may be used to run demonstrations and display additional information or illustrations. Other audiovisual equipment is not allowed. Please note, tables will not be available at the display boards, so any device you use will need to be handheld.

Commercial advertising of products or services is not permitted.

Wireless internet is available at the conference center, but authors should be prepared in case the signal or speed are poor.

There are no provisions for making posters at the conference center, nor for receiving, storing or returning posters to authors.

Poster display boards are rented and cannot be written on or defaced.

Posters that are larger than 4 ft. high or 6 ft. wide may not be displayed or presented.

Poster design guidelines

Prepare poster on a SINGLE sheet of heavy-duty paper or similarly flexible material. The poster must be a maximum of 4 ft. high and 6 ft. wide. *Do not tack individual pages of a PowerPoint presentation or a text manuscript onto a poster board.*

Keep content SIMPLE. A poster is a visual communication tool, not a manuscript. The viewer should be able to easily identify the primary concepts of the project without wading through a lot of text or complex formulas. Identify 3 or 4 main

points or concepts to communicate.

Present text in bullets or small chunks broken up by subheadings. Use at least 28–36 point bold sans serif font (e.g., Arial or Helvetica) for headers and 18–24 point font for text.

Present information in columns. Arrange content in a logical sequence, from left top to bottom right. Three columns is a good target to shoot for.

Offer a balanced mix of text and graphics. Too many words will result in people glossing over or simply bypassing your poster. A good rule of thumb is 50% text, 50% graphics and photos.

Avoid acronyms and jargon. Simple language is best.

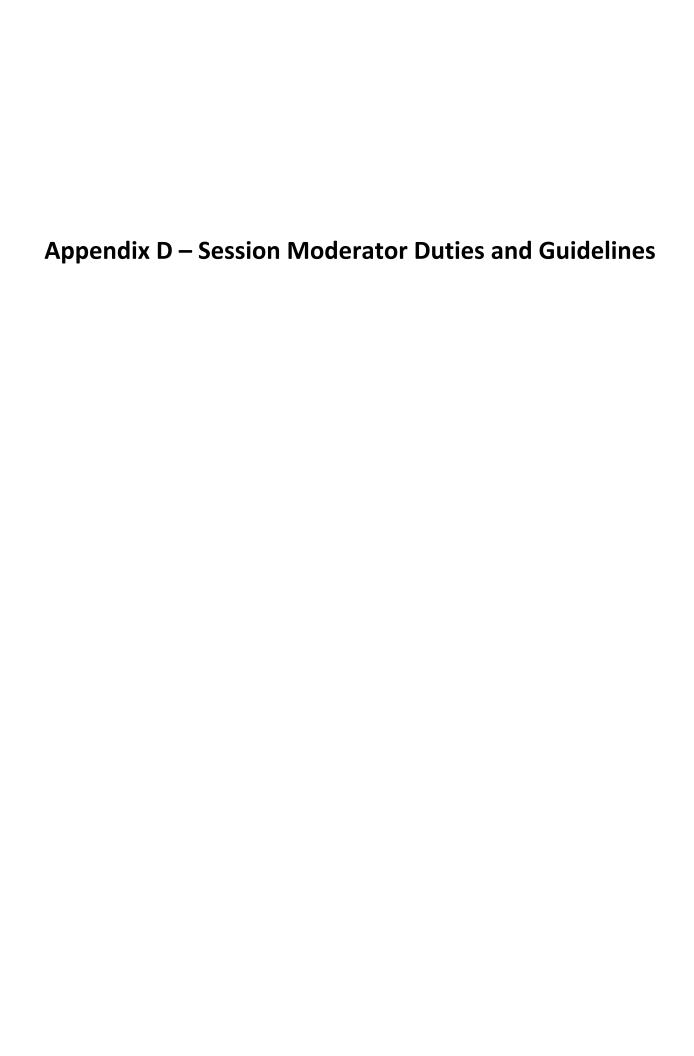
Avoid dark-colored backgrounds. Use light colored backgrounds with black or very dark colored text. Graphics should similarly provide a stark contrast to be readable.

Use simple graphics. Charts, drawings and illustrations should be limited to a 2-3 color palette at a resolution of at least 300 dpi. Visuals should be large enough to be comfortably read from 3 feet away.

Provide author name(s), organization logos and/or other acknowledgements to give credit to those who have done the work.

Prepare a brief (up to 5 minutes) oral presentation for delivering to small audiences gathered around the poster.

Adapted from TRB Annual Meeting Poster Session Guidelines



Moderator Duties and Guidelines

On This Page

<u>Days Before Your Session</u>
<u>Day of Your Session</u>
<u>Starting Your Session</u>

<u>During Your Session</u> <u>Ending Your Session</u>

Days Before Your Session

Review the session info you received by email on **January 24** to find your name, session details (date, time, room number) and contact information for your session presenters.

Review the Attendee Info page for additional information on venue location, parking, etc.

Familiarize yourself with your session's presenters and topics

Touch base with your presenters via email, phone, or Zoom and make sure they have the info they need. Presenters have been informed of the date and time of their presentation, but please confirm those details with them.

Draft one or two questions about each presentation. You'll use these, if needed, to encourage discussion from the audience during Q&A.

Day of Your Session

Arrive at your session room at least 10 minutes early to meet with your Room Technician and to make sure all the presenters have arrived.

The Technician will assist presenters with loading their presentation files on the podium laptop. They will also manage the Zoom webcast and questions/comments from the virtual attendees.

Inform the Technician about any missing presenters, audio/video issues, or concerns about the room temperature. They will contact the appropriate event staff, as needed, for additional assistance.

Starting Your Session

Start the session at the scheduled time.

Welcome attendees.

Remind attendees to turn cell phones to silent mode, and submit the online form to receive PDH credit. A URL and QR code will be provided.

Point out the nearest fire exits, and encourage any late arrivals to find seats.

Introduce each presenter by their Name, Title and Organization only. Please do not read their bios; instead, you may refer the audience to the Symposium website for this info.

During Your Session

Keep track of time. Each session is scheduled for 75 minutes.

Keep each presenter within their allotted time. With some exceptions, sessions have three (3) presenters who should speak for **no more than 20 minutes each plus ~5 minutes for Q&A** immediately following their presentation.

Alert presenters with time cues at 10-, 5- and 0-minutes remaining. Cue sheets to hold up will be provided for you at the podium.

Encourage and moderate discussion from the in-person and virtual audience. Virtual attendees will post their questions/comments in Zoom. Check with the Technician for any virtual responses; the Technician will read them aloud.

Virtual attendees may be unable to hear questions from the in-person attendees. Ask presenters to repeat the questions in their responses.

When all presenters have finished speaking, encourage additional audience discussion for any remaining time in the session.

Ending Your Session

End on time, or early when there's no more discussion from the audience or presenters.

Remind all attendees to submit the online form to receive PDH credit.

Thank the presenters and audience for coming.

Return your Cue sheets to the podium.

Appendix E – Expanded Agenda

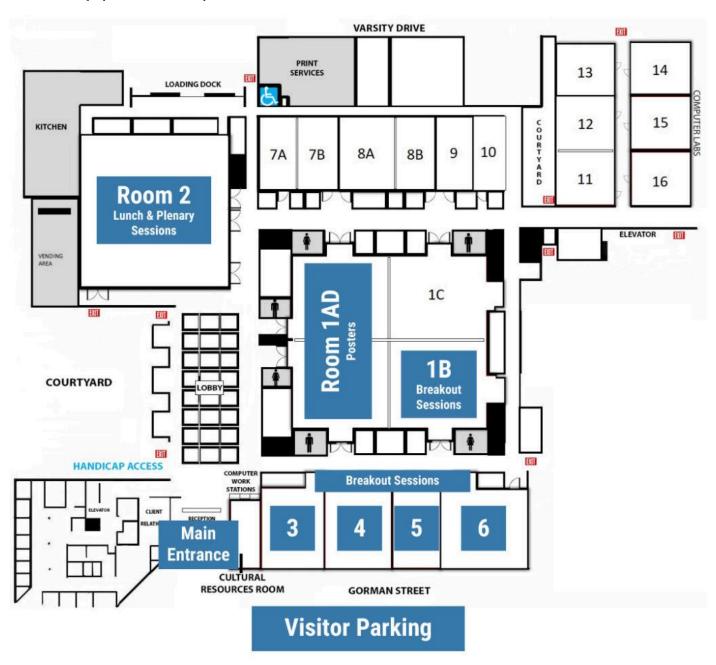
Agenda

Jump to a Section

Day 1 - February 11, 2025

<u>Day 2 - February 12, 2025</u>

Venue Map (click to view)



The agenda below is subject to change.

Send revision/update requests and questions to lctabor@ncsu.edul.

Day 1 – February 11, 2025

Registration, Breakfast, and Networking

8:00 am - 9:00 am

Welcome, Symposium Logistics, and Opening Plenary

Room 1AB

0-4	20		- 4		- 0	^		
9:1	u	am	-1	u	: 0	u	am	ı

Plenary topic: Data-Driven Discovery

Speaker:

Alyson Wilson Interim Vice Chancellor for Research and Innovation North Carolina State University

Data science, machine learning, and artificial intelligence are the hot buzzwords — and they are being touted as the solution for everything from curing cancer to self-driving cars. Data is driving discovery across disciplines at NC State; our motto is that "Data Science is for Everyone." But is data science just another name for "big data"? I will discuss what data science is (and is not), some of the key principles of data science practice, and give examples that illustrate how data is changing scientific discovery.

Break

10:00 am - 10:15 am

Breakout Session 1

Moderator: Nick Short

10:15 am - 11:30 am

Session 1, Strand A – Planning, Policy, and Resilience – Room 1AB

Moderator: Jessica Kuse

Ghosts of the Past: Restrictive Covenants and their Lasting Imprint on Raleigh's Urban Equity
Sneha Bora (UNC Chapel Hill)

Bridging Racial Wealth Gaps through Bridges
Weilin He (Syracuse University)

Addressing Accessibility Barriers in Rural and Disconnected Communities
Venktesh Pandey and Komal Gulati (NC A&T University); Abhay Lidbe (University of Alabama)

Session 1, Strand B – Innovation, ML/AI, CAV, and UAS – Room 3

Using New Technology to Count Airplane Traffic at Municipal Airports Chris Vaughan (NC State University) Collegiate Underrepresented Business and Engineering Drone Training Intensive Program (CUBED TIP) Laquanda Johnson, Oghenetejiri Ebakivie, and Rongfang Liu (NC A&T University Session 1, Strand C – Environmental, Structures/Construction, and Pavement – Room 4 Moderator: Kurt Golembesky Identifying optimal resilient transportation routes using visual data analytics, 2-D hydrodynamic modeling and high-resolution LiDAR data Barbara Doll, Jack Kurki-Fox, and Dan Line (NC State University) Validation of A Landslide Risk Predictor from Recent Hurricane Helene Sophia Lin, Shenen Chen, Wenwu Tang, Ryan Rasanen, Craig Allen, and Nicole Braxtan (UNC Charlotte) Hurricane Helene and the Wash-out of I-40: Observations From the Duke Great Smoky Mountains Rain **Gauge Network** Douglas Miller, Caitlin Crossett, and Christopher Godfrey (UNC Asheville) Onsite presentations for offsite sessions – Weather-related changes; expand for details Due to weather, the offsite sessions will not actually be held offsite. The second part of "Walk a Mile in Someone Else's Shoes" will now be held in Room 6 as a virtual walkthrough, and the second part of the UAS inspection demo has been canceled. Walk a Mile in Someone Else's Shoes – Accessibility Principles, Wayfinding, and Safety – Room 5 Bastian Schroeder (Kittelson & Associates), Sarah O'Brien (UNC Chapel Hill), and Alan Scott (Accessible Design for the Blind) **UAS Bridge / Structure Inspection Demo – Room 6** Ali Karimoddini (NC A&T University) and Tara Cavalline (UNC Charlotte) **Lunch and Panel Discussion** Room 2

Panel topic: Exploring Artificial Intelligence (AI) from Multiple Angles: Insights from

impacts of Artificial Intelligence (AI) for cybersecurity, workforce preparation, and systems engineering.

This dynamic roundtable brings together thought leaders and experts to discuss the challenges, opportunities, and

Cybersecurity, Workforce Preparation, and Systems Engineering

Efficient Traffic Monitoring Using High-Resolution Aerial Images

Tewodros Gebre and Leila Hashemi Beni (NC A&T University

Speakers:

11:30 am - 1:00 pm

Dasha Davies - President/CISO, Stealth-ISS Group Inc.

Collin F. Lynch – Associate Professor of Computer Science, Department of Computer Science & The Al Academy, North Carolina State University

Miles Thompson – Al Assurance Solutions Lead, MITRE Corporation

Moderator:

Caitlyn Mabry – Data & Information Branch Manager in the Office of Strategic Initiatives and Program Support (SIPS), NCDOT

Tech Demos

Room 1CD

1:00 pm - 2:15 pm

Breakout Session 2

2:15 pm - 3:30 pm

Collapse All – Expand All -
Session 2, Strand A – Planning, Policy, and Resilience – Room 1AB
Moderator: Kim Nguyen
A Multi-Objective based Network Optimization during Emergency Resource Distribution Nana Duah (NC A&T University)
Balancing the Transportation Needs of National Parks and Local Residents: A Case Study from North Carolina Rongfang Liu (NC A&T University)
When the Wheels Stop Turning: Impacts of School Bus Disruptions in Durham Samantha Pace (UNC Chapel Hill)
Session 2, Strand B – Innovation, ML/AI, CAV, and UAS – Room 3
Moderator: Sarah Searcy
Prediction of Retro-reflectivity of Traffic Signs Gurcan Comert, Denis Ruganuza, Methuselah Sulle, Paul Olukoye, Judith Mwakalonge, Saidi Siuhi, and Nana Kankam Gyimah (NC A&T University / South Carolina State University)
Analyzing Factors Influencing Driver Willingness to Accept Advanced Driver Assistance Systems Gurcan Comert, Hannah Musau, Judith Mwakalonge, Saidi Siuhi, Nana Kankam Gyimah (NC A&T University / South Carolina State University)
Reliable Vision-Based Perception for Control and Navigation of Automated Vehicle Tesfamichael Getahun and Ali Karimoddini (NC A&T University)
Session 2, Strand C – Environmental, Structures/Construction, and Pavement – Room 4
Moderator: Andrew Wargo

Asphalt mixture performance property variations within mixture categories

Nooralhuda Saleh (Continuum Infrastructure Solutions)

	Evaluation of High RAP Asphalt Mixtures and Binders with Recycling Agents Cassie Castorena (NC State University)
	Pavement Friction and Texture Performance Modeling B. Shane Underwood and Boris Goenga (NC State University); Paul Rogers (KPR Engineering)
	Session 2, Strand D – Integrated Mobility and Multimodal – Room 5
	Moderator: Brennon Fuqua
	Investigating Automated Shuttle Readiness for Rural Areas: A North Carolina Case Study Oladimeji Alaka and Venktesh Pandey (NC A&T University)
	Planning for connected and automated vehicles-more than engineering Tab Combs (UNC Chapel Hill); Elizabeth Shay (Appalachian State University)
	Pedestrian Crossing Treatment Hierarchy and Selection Guidance for Nevada DOT John Shaw (NC State University)
	Offsite Sessions – Weather-related changes; expand for details
	Due to weather, the offsite sessions will not actually be held offsite. The second part of "Walk a Mile in Someone Else's Shoes" will now be held in Room 6 as a virtual walkthrough, and the second part of the UAS inspection demo has been canceled.
	Walk a Mile in Someone Else's Shoes – Accessibility Principles, Wayfinding, and Safety – Room 6 Bastian Schroeder (Kittelson & Associates), Sarah O'Brien (UNC Chapel Hill), Alan Scott (Accessible Design for the Blind), and Chris Cunningham (NC State University)
	eak pm – 3:45 pm
Br	eakout Session 3
3:45	pm – 5:00 pm
	Session 3, Strand A – Planning, Policy, and Resilience – Room 1AB
	Moderator: Curtis Bradley
	The Economic Contribution of North Carolina's Supply Chain Steve Bert (NC State University)

The Past Meets the Future: Integrating Evolving Geospatial and UAV Technologies into Cemetery Mapping Timothy Mulrooney, Barron Allison, and Josue Millan (NC Central University)

Optimizing Freight Rail Networks for Decarbonization: A Comprehensive Approach Using A-STEP and Network Refinement Md Abdullah Al Hasan (NC State University)
Session 3, Strand B – Innovation, ML/AI, CAV, and UAS – Room 3
Moderator: Riley Beaman
Safe Advanced Air Mobility: From Risk Assessment to Autonomous Mitigation of Mid-Air Collisions Negasa Yahi (NC A&T University)
Urban Air Mobility Flight Operations Risk Assessment Based on Battery Energy Constraint Yonas Ayalew, Abdul-Rauf Nuhu, Lydia Zeleke, Vahid Hemmati, Abdollah Homaifar, and Edward Tunstel (NC A&T University)
Security Risks in Urban Air Mobility: Evaluating Trojan Attacks on Autonomous Landing Systems Reza Ahmari (NC A&T University)
Session 3, Strand C – Environmental, Structures/Construction, and Pavement – Room 4
Moderator: Nick Pierce
Strut-and-Tie Models for the Design of Bridge Bent Caps in North Carolina Giorgio Proestos and Vishnu Punithavel (NC State University)
Towards the design of disturbed regions in bridge structures utilizing FRP reinforcement Taylor Brodbeck, Ananna Sarker, Greg Lucier, Rudi Seracino, and Giorgio Proestos (NC State University)
Improved Live Load Distribution Factors for Load Rating of Slab and T-Beam Reinforced Concrete Bridges Ghadir Haikal (NC State University); Faezeh Ravazdezh, Seungwook Seok, and Julio Ramirez (Purdue University); Jeremy Hunter and Jennifer Hart (Indiana Department of Transportation)
Session 3, Strand D – Integrated Mobility and Multimodal – Room 5
Moderator: Joe Furstenberg
Multi Modal Trip Reductions Rates in Local Municipalities Daniel Coble (NC State University)
So close, yet so far: an automated method to identify missing links in pedestrian networks Matthew Bhagat-Conway (UNC Chapel Hill)
User's Preference for Trip Planner Interface and Factors Influencing Sustainable Transport Choices in Rura and Urban Areas Ridwan Tiamiyu and Venktesh Pandey (NC A&T University)
Session 3, Strand E – Traffic, Safety, and Roadway Design – Room 6
Moderator: Joe Hummer
Continuous Flow Intersection Safety Evaluation Christopher Cunningham (NC State University); Taha Saleem and Raghavan Srinivasan (UNC Chapel Hill)
An Estimate of the Potential Crash Savings from Optimizing the Design of Every Intersection Joe Hummer (NCDOT)

Safe System Implementation: Current Prospects and Opportunities in the United States Seth LaJeunesse (UNC Chapel Hill)

Day 2 – February 12, 2025

Registration, Breakfast, and Poster Setup

7:30 am - 8:30 am

Breakout Session 4

8:30 am - 9:45 am

Collapse All – Expand All - Session 4, Strand A – Planning, Policy, and Resilience – Room 1B
Moderator: Alyson Tamer
Resilient and Sustainable Transportation Session
The Rainfall, Intensity, Duration, and Return for Observations and Projections (RaInDROP) Tool for North Carolina Jared H. Bowden (NC State Climate Office)
Natural Hazards Vulnerability Assessment of the NCDOT Ferry Division Assets Tim Brock (NC State University) and Beth Sciaudone (Moffat & Nichol)
Topology and Resilience: A Geospatial Analysis of Transportation Network In North Carolina Trung Tran (Fayetteville State University)
A Review of Best Practices for Natural Disaster Infrastructure Recovery to Inform Hurricane Helene Recovery Strategy in Western North Carolina Mary Warren and Tim Brock (NC State University)
Session 4, Strand B – Innovation, ML/AI, CAV, and UAS – Room 3
Moderator: Sarah Searcy
UNC Charlotte Automated Shuttle Pilot Study: Perceptions, Operational Performance and Lessons Learned Srinivas Pulugurtha (University of Mississippi); Suzanna Leland, Amirhossein Ghasemi, Ninad Gore, Abhinav Grandhi, Mohammadnavid Golchin, Dil Samina Diba, and Rose Thomalen (UNC Charlotte)
Project OVAL (On-campus Vehicle Autonomous Launch) Jimin Yu, Cole Malinchock, Jack Elia, Pratik Thapa, and Suchir Madap (NC State University)
Session 4, Strand C – Environmental, Structures/Construction, and Pavement – Room 4
Moderator: Matt York
Mapping the Invisible: Predicting Stormwater Pipelines Using Artificial Intellegence Tianyang Chen (UNC Charlotte)
Deep Learning in Infrastructure Performance Monitoring Don Chen and Wenwu Tang (UNC Charlotte); Christopher Vaughan (NC State University)
Session 4, Strand D – Integrated Mobility and Multimodal – Room 5
Moderator: Darcy Downs

Investigation of Technology to allow the tracking of wait times and traffic points of origin for users of the Ferry System Daniel Coble (NC State University) A Multi-Objective Optimization based Single Truck-Multiple Drone Delivery Lidia Zewde (NC A&T University) Exploring Public Wi-Fi Log Data and Microtransit Data to Understand City-Level Travel Demand for **Enhancing Microtransit Services in North Carolina** Lei Zhu and Rachael (Yuqiu) Yuan (UNC Charlotte) Session 4, Strand E – Traffic, Safety, and Roadway Design – Room 6 Moderator: Daniel Carter **Camera-based Work Zone Intrusion Alert System** Erol Ozan (East Carolina University) Operational and Benefit-Cost Analysis of Intersections with Three-Phase Traffic Signals Hayden Edwards (VHB) Poster Presentations, Student and Professional Networking, and Refreshments Room 1AD 9:45 am - 11:00 am **Poster Titles and Abstracts Breakout Session 5** 11:00 am - 12:15 pm Collapse All - | Expand All + Session 5, Strand A – NCDOT Center of Excellence – Sustainable and Resilient **Transportation – Room 1B** Moderator: Nastasha Earle-Young NC Resilient and Sustainable Transportation COE (NC SuRe Center) NC SuRe Infrastructure Center of Excellence Overview Tim Brock (NC State University)

Creating More Climate Resilient Roads in North Carolina and COE Project 1 Update Shane Underwood (NC State University)

An Agent-Based Model for Assessing Electric Vehicle Charging Infrastructure Capacity and Performance along Critical Transportation Corridors and Project 2 Update

Alexander Yoshizumi and Heather Brutz (NC State University)

Cyber-Resilient Traffic Management Centers: Enhancing Security for Intelligent Transportation Systems Project 3 Update

	Shoaib Samandar (NC State University) and Sambit Bhattacharya (Fayetteville State University)
	Session 5, Strand B – NCDOT Center of Excellence – Advanced Air Mobility – Room 3
	Moderator: Jason Schronce
	North Carolina Advanced Air Mobility Center of Excellence
	Presenters TBA
	Session 5, Strand C – NCDOT Center of Excellence – Connected and Autonomous Vehicles – Room 4
	Moderator: Curtis Bradley
	NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV)
	Presenters TBA
	Session 5, Strand D – Integrated Mobility and Multimodal – Room 5
	Moderator: Hart Evans
	Got bikes? Traffic Gardens Grow Safe Road Users Ellen M. Walston (ECU Health Medical Center)
	Evolving Complete Streets into Smart(ER) Corridors Ashley Thompson (Stantec)
	Pedaling Toward the Future: Insights on North Carolinians' E-Bike Aspirations from the Ral-E-Bike Program Matthew Palm (UNC Chapel Hill)
	Session 5, Strand E – Traffic, Safety, and Roadway Design – Room 6
	Moderator: Daniel Carter
	Utilizing Emergency Medical Services (EMS), Emergency Department (ED), and Linked Crash-EMS and Crash-ED Data to Inform Local and State Traffic Injury Prevention Katherine Harmon and Yuni Tang (UNC Chapel Hill)
	Insights and opportunities for transportation and public health agency collaboration to improve road safety Elyse Keefe, Nandi Taylor, and Laura Sandt (UNC Chapel Hill)
	The Value of Proactive Safety: Revisiting High Injury Networks lan Hamilton and Lauren Blackburn (VHB)
Lu	nch, Poster Awards, and Plenary Presentation
Ro	om 2
12:1	5 pm – 1:45 pm
	Plenary topic: Hurricane Helene Impacts and Rebuild Efforts

Speaker:

Alyson Tamer
Program Support Manager
WNC STRONG
North Carolina Department of Transportation

Hurricane Helene caused extensive destruction in western North Carolina, including over 9,000 damage sites. Hear about NCDOT's comprehensive approach to statewide disaster recovery and the innovative delivery methods employed to rebuild the affected infrastructure.

Break

1:45 pm - 2:00 pm

Workshops

2:00 pm - 3:30 pm

Collapse All - | Expand All +

Keys to a Successful & Implementable Research Project – Room 1B

Curtis Bradley

Research Implementation Manager NCDOT

NCDOT manages between 60 – 80 research projects within its work program. The subjects of these projects range from Traffic & Safety, Pavement & Materials, Structures & Bridges, Environmental & Hydraulics as well as Planning & Multimodal. While the subjects of these projects may be diverse, there are common themes when it comes to the successful delivery of these research projects as well as key determining factors that lead to implementation. This session will highlight the importance of establishing a vision of the end product at the beginning of the research project, on-time delivery of deliverables, coordination with vested stakeholders, as well as follow-up methodologies that lead to the implementation of these research projects. The audience can expect to hear from multiple subject matter experts including (but not limited to), state / federal government, academic and private sector speakers.

Fully Autonomous Vehicle (FAV) Committee Meeting – Room 5

This committee meeting is open to attendance by interested attendees

Sarah Searcy

Emerging Technologies and Innovation Manager Office of Strategic Initiatives and Program Support (SIPS) North Carolina Department of Transportation

Appendix F – Session Abstracts

Full Session Session 1, Strand A Session 1, Strand A	Title Ghosts of the Past: Restrictive Covenants and their Lasting Imprint on Raleigh's Urban Equity Bridging Racial Wealth Gaps through Bridges	Abstract The legacy of racial segregation in American cities continues to shape urban landscapes and communities. Restrictive covenants, which historically barred non-white individuals from property ownership or rental, have left an indelible mark on contemporary urban equity. Despite being ruled unenforceable in 1948, the repercussions of these discriminatory practices persist, contributing to ongoing racial segregation and economic inequality. This research investigates the enduring impacts of restrictive covenants on the city of Raleigh, North Carolina, and proposes strategies for equitable urban development that address these historical injustices. Racial wealth disparities continue to be a significant challenge in the
		United States. Such disparities are not just a result of income differences; they are also influenced by historical and systemic factors that have limited opportunities for wealth accumulation for marginalized groups. Public infrastructure, especially bridge conditions, plays a crucial role in economic development. Deteriorating bridges lead to increased transportation costs, reduced economic activity, and fewer job opportunities. These conditions disproportionately affect marginalized communities, exacerbating wealth disparities. This research investigated the impact of bridge conditions on local economies, with a focus on wealth disparities. It developed a comprehensive framework for prioritizing bridge preservation activities that consider the economic implications on marginalized communities, aiming to provide more equitable bridge maintenance strategies to facilitate equal accessibility to infrastructure among communities with wealth disparities. The research quantitative analyzed bridge conditions and local economic census data, and developed a decision framework for bridge preservation prioritizing wealth equity. This includes geospatial analyses to examine the association between bridge conditions and wealth disparities, and a cost-benefit tradeoff model to guide preservation efforts. Preliminary analyses indicated a significant correlation between poor bridge conditions and lower median household incomes in marginalized communities. Addressing the link between infrastructure quality and wealth disparities offers a transformative insight into public policy and infrastructure management. The research findings highlight the need for a paradigm shift in how bridge preservation activities are prioritized, advocating for the integration of wealth equity into infrastructure planning and decision-making processes.

Session 1 Strand A	Addressing Accessibility Parriers in Purel and	Transportation accessibility is vital for connecting rural communities to
Session 1, Strand A	Addressing Accessibility Barriers in Rural and Disconnected Communities	Transportation accessibility is vital for connecting rural communities to essential opportunities such as employment, healthcare, and education. At its core, assessing accessibility involves two key factors: the availability of sufficient opportunities and the ability to reach these opportunities via diverse transportation modes, including driving, public transit, biking, or alternative means. Disparities in accessibility create "opportunity deserts," which hinder social and health outcomes. This presentation reviews accessibility barriers in rural areas, with a focus on the Southeastern United States. It examines trends in how our understanding of accessibility has evolved and highlights emerging modeling approaches for addressing accessibility gaps. Key methods discussed include integrating new datasets and socio-economic measures, modeling latent demand for more accurate forecasts, and evaluating the affordability of emerging transit solutions such as microtransit. The presentation is structured around two key themes of results: (a) By leveraging increasingly available disaggregate data at the building footprint level and employing scalable approaches for quantifying travel times, we quantitatively investigate discrepancies between macro-level (using census-tract centroids) and micro-level measures (using residential parcels) of healthcare access. (b) Using uncertainty in travel time evaluations, we explore how k-reliable shortest paths with limited overlap minimizing a weighted function of mean and variance have direct applications in assessing worst-case healthcare accessibility and finding that in rural areas, k-reliable paths exhibit high variance in travel times, signaling increased vulnerability. Broadly, this presentation contributes to understanding how accessibility barriers impact diverse populations and offers insights to inform the planning of equitable rural transportation systems.
Session 1, Strand B	Efficient Traffic Monitoring Using High-Resolution Aerial Images	Remote sensing technology has become increasingly important for real-time, effective monitoring approaches in transportation management. One of the prominent methods of remote data acquisition involves the utilization of drones, which provide high-resolution aerial imagery to enhance data collection and analysis. However, the processing of high-resolution images, a crucial component of remote sensing, poses significant computational challenges. The sheer size of these images, combined with the intense computational demands of object detection algorithms, can result in prolonged processing times and substantial computational costs, hindering the effectiveness of remote sensing in transportation applications. This study aims at processing high-resolution aerial images for traffic monitoring. We have developed an Adaptive Input Sampler (AIS) to optimize input data volume while maintaining detection performance in remote traffic sensing applications. The AIS utilizes pixel change monitoring and predictive algorithms based on historical object locations and speeds, enabling historical success-based object trajectory extrapolation. By detecting vehicles and selectively sampling image areas, the AIS reduces data input for downstream object detection systems, reducing computational load and improving inference speed. Our experiments demonstrate that the AIS achieves a 96.40% traffic counting accuracy and 95.60% classification accuracy while reducing data size for analysis by up to 79.00%. The AIS presents a promising solution for managing large datasets in traffic monitoring applications, enhancing computational efficiency, and speeding up inference results.

Session 1, Strand B	Using New Technology to Count Airplane Traffic at Municipal Airports	For two years, ITRE has been studying the accuracy of various tools for counting airplane and helicopter traffic at municipal airports. These tools, if accurate, are particularly useful to smaller airports in providing accurate air traffic volumes to government agencies for the proper allocation of funding, as the amount of funding depends on the air traffic volume. In the past, smaller airports typically estimated air traffic volumes, which was allowed. However, through the use of these technologies, many smaller airports have learned that they were likely underestimating, sometimes significantly, their air traffic. These tools have the potential to provide reliable counts, which is important to both the airports and the government agencies allocating these funds. Thereby, it is important to government agencies that these counting tools not overestimate air traffic and it is important to the airports that these tools not underestimate air traffic.
Session 1, Strand B	Collegiate Underrepresented Business and Engineering Drone Training Intensive Program (CUBED TIP)	The Collegiate Underrepresented Business and Engineering Drone Training Intensive Program (CUBED TIP) project is designed to expose undergraduate students from selected business majors (supply chain management and business analytics) and engineering majors (industrial engineering, civil engineering, electrical engineering and mechanical engineering) to drone operations and applications. This indepth training increases student marketability and better prepares them to secure drone technology positions in the supply chain and engineering fields. The CUBED TIP project is an important initiative as it helps to close the talent gap and increase the number of students entering fields where drone utilization is becoming an integral part of business operations. Students learn how drone implementation can positively impact both large corporations and medically vulnerable communities as well. The participants selected for this program take part in an 8-week drone intensive incubator with the principal investigator of this project. Upon completion of CUBED TIP, the inaugural cohort will be prepared to take and pass the FAA Remote Pilot Certification Exam. Securing this certification will enhance the career readiness of the participants of the CUBED TIP project as they plan to enter the workforce upon graduation. In addition, this initiative will help build a pipeline of students with drone operation skills who can pursue roles in the supply chain and engineering areas while also helping to ensure students excel in corporate roles related to drone technology.
Session 1, Strand C	Identifying optimal resilient transportation routes using visual data analytics, 2-D hydrodynamic modeling and high-resolution LiDAR data	Over the past 25 years, several major storms have hit North Carolina causing loss of life and billions of dollars in damage. A high frequency of flooded roadways and structure washouts temporarily crippled our transportation infrastructure. During Florence, Matthew and the 2020 extreme storms, most washouts occurred at undersized pipes with diameters < 72" located along secondary roads in small watersheds (<0.5 mi2). Fewer than 15% of the washouts were included in the existing HEC-RAS models developed by NC Emergency Management and used for mapping the NFIP floodplains. Therefore, more detailed two-dimensional hydraulic modeling is required to evaluate the flood resilience of transportation corridors. NC DOT does not have the resources to make all transportation routes resilient; therefore, a system-based approach that maximizes investments in transportation routes is needed. Our team developed Transportation Resilience Identification and Prioritization (TRIP), a prototype geospatial data visualization tool that combines hydraulics data with road, culvert and bridge data. Nine potential resilient routes were identified and evaluated in the Nahunta Swamp basin. A two-dimensional hydraulic model was built and used to generate water levels for the 25, 50, 100 and 500-year storm. Water levels were compared to the roadway elevation at hydraulic structures and at every 50-foot segment of roadway to determine depths of overtopping. Costing procedures for upgrading all structures and roadways were developed. Multiple routes were then compared to determine which route is most cost effective for upgrading to be resilient.

Session 1, Strand C	Validation of A Landslide Risk Predictor from Recent Hurricane Helene	To assess the multi-hazard risks to bridge infrastructure in North Carolina's mountainous regions, focusing on the interplay between landslide, flooding, wildfire, and earthquake risks. We approach the multi-hazard issue using landslide as the basic quantifier and investigate the nesting effect of earthquake and rainfall triggered landslides. Utilizing logistic regression (LR) and random forest (RF) models, this study develops predictive maps for landslide and wildfire susceptibility. The wildfire susceptibility map is then incorporated as an independent variable in predicting landslide occurrences, revealing critical interactions between wildfire and landslide risks. The result are two different high-resolution landslide susceptibility maps that represent different nested multi-hazards namely, wildfire-earthquake-flooding-landslide risk and earthquake-flooding-landslide risk, respectively. The resulting maps are then used to compare with landslides caused by the 2024 Hurricane Helene which resulted in widespread damage to life supporting infrastructures and roadways closures for the western mountain regions of North Carolina. We further identify the damaged bridge data from State reports to help evaluate the map predictions. The results indicate that the integration of multi-hazard data allows for a dynamic understanding of bridge vulnerability, resulting in a shift in risk probability for certain structures. These findings provide actionable insights for decision-makers, enabling proactive mitigation strategies tailored to bridges that face increased vulnerability from wildfiretriggered landslides. The results also indicated a need to address the complex interactions between environmental and anthropogenic factors and the urgency for future studies to advance our understanding of
		climate effects to our state highway infrastructure.
Session 1, Strand C	Hurricane Helene and the Wash-out of I-40: Observations From the Duke Great Smoky Mountains Rain Gauge Network	As Hurricane Helene strengthened in the southern Gulf of Mexico, a predecessor rain event (PRE) was impacting eastern Tennessee and western North Carolina with significant rainfall, saturating the soil of the region on 25-26 September 2024. After making landfall in Florida on 27 September as a major hurricane, Helene tracked almost due north and caused major devastation in western North Carolina due to flooding and landslides, along with uprooted trees and the resulting power outages. Rainfall associated with the PRE and Helene will be examined using observations from the Duke GSMRGN, located in the Pigeon River Basin (Haywood County, NC) and near the I-40 washout. Although the PRE and Helene events covered a broad area over eastern Tennessee and western North Carolina, rainfall observations of the gauge network indicates significant spatial variability that is a combination of convective systems embedded within the larger storm and of topographic relief.
	Walk a Mile in Someone Else's Shoes – Accessibility Principles, Wayfinding, and Safety	
Offsite 1 - Wayfinding	UAS Bridge / Structure Inspection Demo	
Offsite 2 - UAS/bridge		

Cossion 2 Strand A	A Multi Objective based Naturals Ontimization	Hurrisono Eleronos hit North Carolina an Cantambar 14, 2010, acusina
Session 2, Strand A	A Multi-Objective based Network Optimization during Emergency Resource Distribution	Hurricane Florence hit North Carolina on September 14, 2018, causing flooding and road closures across the transportation network. The affected area includes major distribution centers (DCs) for emergency supplies, emergency shelters requiring regular supply deliveries, multiple road closures due to flooding and debris, and limited road capacity on remaining routes due to emergency vehicle traffic. Based on the Florence data obtained from NCDOT, a multi-objective optimization model is formulated to optimize the distribution of emergency supplies from distribution centers to shelters while minimizing total travel time and maximizing network reliability. The data includes complete road networks with node_tuple_ids, current road conditions, whether it is open or closed, the capacity of each road segment during the hurricane, and historical road traffic data. When modeling, considerations are made for high-priority shelters to receive deliveries first; multiple trips daily may be necessary; and the routes must avoid flood-prone areas. Freight and Fuel transportation optimization tool (FTOT) is used to analyze the transport network resilience and determine alternate routes. Specific scenarios are generated using this tool, and then, for each specific scenario, network data is input to define the hurricane-affected area. Then, the optimization model is run, and its results are exported for use in FTOT. The optimization model is solved here using the weighted sum approach. Our model identifies traffic network flow volume and optimal routes between distribution centers and shelters to ensure reliable supply distribution, respond to changing road conditions, maintain emergency service levels, and adapt to network disruptions.
Session 2, Strand A	Balancing the Transportation Needs of National Parks and Local Residents: A Case Study from North Carolina	National parks located in urban areas differ from those in remote and rural areas not only because they often have limited spatial expansion opportunities, but also because of the integrated roadway/access with local transportation networks. The connection between the National park and the outside world is affected by urban traffic congestion, commuting patterns, and roadway capacities. This manuscript examines the potential applications of big data, crowd sourcing and AI to assist national parks, especially small urban parks to address challenges when attempting road closure. Using Guilford Courthouse National Military Park (GUCO) as a case study, the authors have demonstrated ways to gather traffic data via GPS/cell phone data, which may have the potential replace or reduce the expensive traffic data collection effort so proper evaluation is possible before a road closure is proposed. Local concerns and needs are addressed, which is essential for the mutual benefits of National Parks and local communities.
Session 2, Strand A	When the Wheels Stop Turning: Impacts of School Bus Disruptions in Durham	In January 2024 Durham Public Schools experienced significant disruptions in school bus service. This presentation reports on a survey of parents examining the role of household resources and infrastructure availability on families' ability to adapt to the unexpected loss of service. The survey also documented immediate impacts on children's school attendance, as well as broader consequences to households, such as parents missing work to unexpectedly drive their children to school. We analyze quantitative survey data in R, while qualitative openended responses are thematically coded using a grounded theory approach. We find that a significant number of families shifted to driving their children to school. Gaps in sidewalk and bicycle infrastructure, along with long public transit travel times, limited families' ability to turn to other modes of travel during the crisis, compounded negative impacts for some households. Findings suggest that school transportation reliability is critical to maintaining equitable access to education, especially for marginalized communities. The study emphasizes the importance of multi-disciplinary approaches that integrate transportation, land use, and housing strategies to enhance resilience and equity.

Session 2, Strand B	Prediction of Retro-reflectivity of Traffic Signs	The retro-reflectivity of traffic signs is essential for road safety, particularly in low-light and adverse weather conditions, by ensuring signs remain visible and legible to road users. However, retro-reflective quality degrades over time due to environmental exposure, reducing sign effectiveness and increasing risks of road accidents and potential liabilities for road agencies. Accurate estimation of traffic signs' lifespan is thus critical for efficient maintenance and resource allocation. While prior studies have analysed factors affecting retro-reflectivity, such as sign age, color, orientation, and weather, few have utilized deep learning models with expanded input variables. This study addresses this gap by examining additional environmental factors, air temperature, relative humidity, and sign age through a deep learning model incorporating image detection. Data collection involved a hand-held reflectometer to capture retro-reflective readings alongside sign attributes and weather data. Model results yielded an R² value of 0.79, indicating that 79% of retro-reflectivity variance was explained, highlighting the model's capability to identify signs that fall below retro-reflectivity standards. The model's performance demonstrates a robust capability for automating the detection of road signs below required retro-reflectivity standards, reducing maintenance costs, and enhancing road safety through predictive monitoring.
Session 2, Strand B	Analyzing Factors Influencing Driver Willingness to Accept Advanced Driver Assistance Systems	Advanced driver assistance systems (ADAS) enhance highway safety by improving drivers' perception of the environment and reducing human errors. However, misconceptions and reservations among drivers about ADAS remain, with limited research addressing their understanding and information sources regarding these technologies. This study explores drivers' perceptions and usage patterns of ADAS in passenger vehicles through a comprehensive survey of a diverse sample across the United States. Data on demographics, driving habits, vehicle details, and ADAS usage patterns were collected through an online questionnaire, capturing insights into trust levels, factors influencing use, and information sources. Key ADAS technologies examined include Lane Departure Warning, Adaptive Cruise Control, Blind Spot Monitoring, and Automatic Emergency Braking. Results indicate that trust in ADAS, vehicle ownership, and socioeconomic factors such as income significantly influence ADAS adoption. Higher trust levels correlate with increased usage, while reliability concerns deter some drivers. Features like Forward Collision Warning and Driver Monitoring Systems notably impact adoption likelihood, highlighting drivers' prioritization of specific functionalities. Demographic factors (age, gender) and driving habits (frequency, experience) also contribute to adoption variations. These findings underscore the role of socioeconomic, demographic, and behavioral factors in shaping ADAS adoption and perceptions, offering automotive manufacturers, policymakers, and safety advocates insights for fostering public acceptance and optimizing ADAS for safer roads.

Session 2, Strand B	Reliable Vision-Based Perception for Control and	In autonomated driving, vision-based perception systems are crucial in
Session 2, Strand B	Reliable Vision-Based Perception for Control and Navigation of Automated Vehicle	In autonomated driving, vision-based perception systems are crucial in detecting and interpreting lane markings, lane centers, and road boundaries. These detection tasks are essential for accurate vehicle control and safe navigation. Accurate lane detection helps the vehicle establish its lane position, while identifying lane centers enables consistent lane alignment, especially when integrated with vision-based control. Detecting road boundaries and drivable areas further supports robust path planning and effective obstacle avoidance. However, achieving reliable visual perception is challenging due to real-world complexities. Factors such as faded lane markings, occlusions, variable lighting, adverse weather conditions, and diverse road structures often limit the accuracy of lane, boundary, and drivable area detection. This work addresses these challenges by exploring solutions from classical image processing to advanced deep learning models, particularly recent advances in segmentation methods designed to generalize across varied road environments while maintaining real-time performance. Furthermore, the integration of perception results with vehicle control systems is important. Reliable lane and drivable area detection, coupled with accurate road center estimation, strengthens accurate localization and smooth path planning. This integration with vehicle controllers enables effective autonomous navigation, driven mainly by visual perception data. By addressing both the challenges and the state-of-the-art solutions in visual perception, this research explores how these advancements support the development of more reliable,
Session 2, Strand C	Asphalt mixture performance property variations within mixture categories	perception-driven autonomous vehicles. The increasing use of recycled and modified materials in asphalt mixtures challenges the traditional volumetric design methods by introducing variability in performance outcomes. This study investigates the performance properties of asphalt mixtures designed under consistent volumetric specifications across multiple states—Indiana, Alabama, Maryland, and North Carolina. A total of 27 surface and intermediate mixtures were tested using the Asphalt Mixture Performance Tester (AMPT) for dynamic modulus, cyclic fatigue, and stress-sweep rutting (SSR) properties. Results revealed significant performance differences within the same design category, highlighting variations in rutting and fatigue resistance among mixtures. For example, Indiana surface mixtures demonstrated variability in fatigue performance, with higher binder content mixtures performing unexpectedly poorer. In contrast, Alabama's mixtures displayed notable differences in rutting due to gradation changes. Statistical analyses, including ANOVA and post-hoc tests, confirmed these differences, underscoring the limitations of using volumetric design alone to predict in-field performance.

Session 2, Strand C	Evaluation of High RAP Asphalt Mixtures and Binders with Recycling Agents	In recent years, several departments of transportation have introduced provisions to increase the use of reclaimed asphalt pavement (RAP) in asphalt mixtures. Although higher RAP content can lead to environmental benefits and economic savings, it may adversely affect the cracking performance of pavements due to the high stiffness and reduced ductility of the RAP binder. To address these performance challenges, national efforts have focused on developing new mix design procedures and/or products that enable the incorporation of high RAP content into asphalt mixtures without compromising long-term performance. The use of recycling agents (RAs) is one strategy aimed at mitigating the effects of oxidized binder on the rheology of the blended binder through physicochemical mechanisms related to RA's composition and dosage. This study evaluated the effect of various RAs on the performance characteristics of recycled asphalt systems in North Carolina and neighboring states. It benchmarks the rheological
		properties of recycled binder blends formulated using two dosage selection procedures against typical PG 64-22 binders used in the region, assessing the RAs' ability to restore the blended binder to a reference climatic grade. Both dosage selection procedures were successful in achieving rheological similarity at specific temperatures and for specific binder properties but might not necessarily yield similar properties at other temperatures. Additionally, mixture-level evaluations assessed the effects of RAs on mixture performance using Balanced Mix Design tests for cracking and rutting. The collective results indicate that RAs can improve the cracking performance of recycled mixtures without exceeding the limits for adequate rutting performance.
Session 2, Strand C	Pavement Friction and Texture Performance Modeling	When a tire rolls over pavement, various interaction components arise based on deformation and contact interface properties. Skid resistance at the tire-pavement interface depends on two main mechanisms: adhesion, related to aggregate mineralogy and shape, and hysteresis, which is linked to energy loss from tire deformation due to the texture profile. Research indicates that wet crash rates often increase after new asphalt wearing courses are placed, with initial decreases in friction and texture contributing to this trend. Thus, deriving expressions to predict long-term friction and texture performance is crucial. This study analyzed over 200 pavements with varying ages, traffic levels, and climates to propose general functional forms for friction and texture performance models, calibrated using continuous friction measurements and high-speed texture observations. A random effects model was chosen to account for variations in pavement performance, and the results showed that including random effects improves prediction accuracy. Texture performance models were found to be more accurate than friction models, as mean profile depth (MPD) displays more stable variations, while friction is influenced by factors like temperature and precipitation. Model validation confirmed that the proposed models effectively capture individual performance trends. Although the random effect in the intercept accounted for significant performance variation, some pavements deviated from the general trend. Over time, friction tends to decrease due to aggregate polishing, but it may increase in the presence of moderate to severe raveling typical of older surfaces.

Session 2, Strand D Investigating Automated Shuttle Readiness for Recent decades have seen the potential of automated shuttles in Rural Areas: A North Carolina Case Study addressing transportation needs for vulnerable communities; however, the infrastructure and community readiness in urban and rural underserved communities for the deployment of these shuttles remains This research evaluates the level of readiness of rural counties in North Carolina for implementing autonomous vehicle (AV) technology, focusing on physical infrastructure, digital infrastructure, and social vulnerability using a range of indicators derived from secondary data sources, including road quality, bridge conditions, broadband availability, and socio-economic factors. The geospatial analysis reveals a diverse landscape of readiness across the counties, with variations in physical and digital infrastructure and social vulnerability indices. Despite being rural and located in coastal regions, Camden County emerged as a leading candidate for AV deployment due to the better availability of the internet, good road conditions, and a population in need of autonomous shuttles. This was followed by Halifax, Chatham, and Bladen counties. To further understand regional differences, we used clustering analysis to identify distinct clusters within census tracts that reflect varying readiness levels. While some clusters are well-positioned for early AV deployment, others require infrastructural improvement. Conversely, counties with higher social vulnerabilities indicate a potential need for autonomous shuttle interventions to enhance the livelihood of the population in need of these services. The study findings emphasize the importance of a multiweighted analysis for readiness assessments that can guide investments and strategic interventions and the potential of data-driven approaches that can be generalized to other states for determining readiness. Session 2, Strand D Planning for connected and automated vehicles--The rise of connected and automated vehicles (CAVs) is widely more than engineering discussed among transportation professionals and public officials. Yet massive uncertainties remain regarding how a transition to a CAVdominated transportation system will unfold: What infrastructure and regulatory tools will be needed to manage large fleets of CAVs? How might the widespread presence of CAVs on public roads impact other road users? What role should planners play in shaping what may be an inevitable shift to CAV-dominant transport systems? We explored these questions through interviews with 55 senior-level transportation professionals, including 19 in North Carolina. Thematic analysis of the interview transcripts suggests interviewees expect transformative CAV impacts but lack defined strategies for transitioning to CAV-adapted systems while protecting other road users. Most noted CAVs' need for predictability in the roadway environment and have concerns over the need to upgrade infrastructure, services and policies to ensure safe, efficient operations. Many also worry about the subordination of the convenience and safety of non-car road users. particularly if infrastructure is retooled without deliberate prioritization of their specific needs. There is currently no cohesive policy framework regulating the rollout of CAVs on U.S. streets, leaving industry in charge of setting public policy de facto. Transportation professionals are urgently seeking actionable guidance on appropriate next steps to meet the CAV challenge. Planners—partially sidelined during the heat of the technology-driven CAV campaign—are well positioned to lead a more inclusive, stakeholder-centered public debate over what modes, travelers, and supporting technologies should be prioritized within such guidance.

Session 2, Strand D	Pedestrian Crossing Treatment Hierarchy and Selection Guidance for Nevada DOT	Pedestrian safety has been a major concern throughout the 140-year history the automobile. Over the years, numerous options have been devised for improving safety at mid-block pedestrian crossings. These range from simple marked crosswalks to sophisticated pedestrian signal systems and costly grade separations. Some of these devices simply alert motorists to pedestrian presence, while others make it mandatory for motorists to stop and allow pedestrians to cross. The per capita pedestrian fatality rate in the State of Nevada is 36% above the national average, with notable concentrations in the Las Vegas metro area. As in many parts of the country, inconsistent device selection has resulted in undertreatment of some pedestrian crossings and overtreatment of others. To improve consistency, the project team developed a clear hierarchy of pedestrian treatments, a spreadsheet to help match treatment type with site characteristics, a method for estimating the financial benefits of using a specific treatment at a specific site, and guidelines on the most appropriate uses of each treatment type.
Offsite 1 - Wayfinding	Walk a Mile in Someone Else's Shoes – Accessibility Principles, Wayfinding, and Safety	
Offsite 2 - UAS/bridge	UAS Bridge / Structure Inspection Demo	
Session 2, Strand E		
Session 3, Strand A	The Economic Contribution of North Carolina's Supply Chain	As North Carolina continues to carve out its competitive advantage among states, there are several strategic decisions and investments that can be made to strengthen its status as an international leader in business. This presentation aims to spotlight North Carolina's competitive advantages as well as demonstrate opportunities for targeted business growth within the state. The presentation will focus on 14 of North Carolina's highest-producing sectors within its supply chain. It will feature content from an economic contribution analysis, which demonstrates how North Carolina's supply chain impacts the state's economy. Additionally, the presentation will highlight the essential factors of production for North Carolina's industries with a look behind the curtain for which supply chain inputs are produced in-state and which are produced out-of-state. Employment hotspots will also be discussed to show areas of concentrated economic activity within each sector. The presentation will close with North Carolina's emerging industries and the value of North Carolina's transportation network.

Session 3, Strand A	The Past Meets the Future: Integrating Evolving Geospatial and UAV Technologies into Cemetery Mapping	The creation, collection and cataloging of high-quality cemetery data is a patchwork and circuitous process that involves the accumulation of existing cemetery records, death notices and census information with tacit knowledge of church elders and family members who will not be around forever. Further complicating matters are headstones which are now gone, those who were buried in unmarked graves or have no markers to begin with and the forest reclamation of cemeteries. There exists a need to record this information in digital format as well as understand where unmarked graves may exist without disrupting these sacred grounds. In this work, the Department of Environmental, Earth and Geospatial Science (DEEGS) is teaming with the Department of History at North Carolina Central University (NCCU) to develop comprehensive maps and spatial data of cemeteries. The integration of geospatial technologies such as GIS (Geographic Information Systems), GPS (Global Position System), GPR (Ground Penetrating Radar) and UAV (Uncrewed Aerial Systems) in the high-scale mapping of cemeteries is still being realized. The creation of high-quality spatial products such as in-situ true color and infrared imagery as well as imagery collected from ground penetrating radar to detect potential unmarked burial sites with their coordinates linked to cemetery records on a map not only have obvious applications in the field of history as persistent markers of the past, but also with transportation planning, planning, environmental justice and cadastral mapping.
Session 3, Strand A	Optimizing Freight Rail Networks for Decarbonization: A Comprehensive Approach Using A-STEP and Network Refinement	Achieving Sustainable Train Energy Pathways (A-STEP) is a software tool designed to support decision-making for decarbonizing freight rail networks. It offers simulations of energy consumption, environmental impact, and cost across various locomotive technologies and network configurations. This study enhances A-STEP by refining and optimizing the Federal Railroad Administration (FRA) network for efficient freight operations. The FRA network, initially comprising 302,794 links and 250,413 nodes, was distilled to 16,343 links. This process involved removing abandoned links, industrial complexes, redundant yard tracks, and passenger-only networks. Rail segments with insignificant energy-related variations were concatenated, while nodes were preserved based on specific criteria, such as connections, state boundaries, freight origins/destinations, and yard locations. Elevation data was obtained from the U.S. Geological Survey (USGS) to quantify rail grades, and ArcGIS was employed to create vertices and estimate curvature for each link. Quality control checks against track charts ensured accuracy, and methods were developed to address unique cases where track elevation and curvature deviated from actual alignments. This work provides a methodological framework for refining rail networks, quantifying rail grades, and curvatures. The refined dataset enables A-STEP to more precisely evaluate energy consumption and environmental impacts, offering valuable insights for advancing decarbonization strategies within the freight rail industry.

Session 3, Strand B Safe Advanced Air Mobility: From Risk Assessment This work develops novel risk assessment and on-the-fly mitigation to Autonomous Mitigation of Mid-Air Collisions techniques essential for ensuring the separation of UAM aircraft. By integrating advanced simulation and analytical methods, this research enhances safety in dense airspace, focusing on collisions involving Loss of Control In-flight (LOC-I) scenarios. The comprehensive risk assessment evaluates separation loss encounters between LOC-I and UAM aircraft trajectories using high-fidelity simulation software designed for traffic management purposes, specifically targeting flights at low altitudes in metropolitan areas. The collision risk is quantitatively assessed by calculating probabilities of mid-air collisions, near mid-air collisions, and well-clear violations through Probabilistic Risk Assessment (PRA) methods. The findings reveal that UAM aircraft in congested environments face significant risks from LOC-I trajectories, underscoring the urgent need for effective mitigation strategies. The centerpiece of this work is an on-the-fly decision-making framework designed to mitigate collision risks triggered by LOC-I. Recognizing that LOC-I often results in cascading separation losses. where one aircraft's maneuver to avoid another can create further risks, a behavior-tree-based decentralized decision-making approach is presented to address a sequence of separation losses. This framework enables UAM aircraft to execute separation assurance tasks assigned by the central service provider and select mitigation maneuvers while incorporating Federal Aviation Administration (FAA) "See and Avoid" concepts or right-of-way rules. The significance of this framework is validated through simulations of LOC-I scenarios, demonstrating its effectiveness in real-time conflict detection, tasking, and maneuver planning. By leveraging this cutting-edge research, UAM vehicles can operate safely in busy airspaces, significantly reducing mid-air collision risks. Urban Air Mobility Flight Operations Risk Session 3, Strand B As cities become increasingly congested and environmentally Assessment Based on Battery Energy Constraint conscious, the need for innovative solutions to address transportation challenges has never been more pressing. Urban Air Mobility (UAM) envisions a future where electric Vertical Takeoff and Landing (eVTOL) aircraft, and other aerial vehicles seamlessly integrate into existing transportation networks, offering efficient, safe, and sustainable alternatives to traditional modes. In this research study, risk assessment of UAM operations and routes considering separation automation and mission structure sensitivity based on energy demand is presented. Identified UAM potential routes in major US metropolitan areas are simulated using agent-based simulation considering level flight conflict management. We evaluated the energy consumption of a hexacopter eVTOL vehicle for all the routes with a mission parameter sensitivity study for operational flexibility and assessed the associated risk level of the vehicle's overall flight energy consumption using statistical metrics. Our results demonstrate that the feasibility and energy demand of the flights can be affected greatly by the vehicle, range of operational routes, conflicts, and different parameter values of the mission structure. This study highlights that a mission parameter-based sensitivity study, that respects the minimum operational and performance regulations, can provide information about possible safety degradation in response to the choice of different airspace structures. Additionally, the statistical approaches reveal the level of risk associated with high energy-demanding flights for the potential routes in two metropolitan regions. These findings provide air transportation modelers with crucial insights for enhancing strategies aimed at accelerating the implementation of advanced mobility and mitigating their operational hazards.

Session 3, Strand B	Security Risks in Urban Air Mobility: Evaluating	In this study, we explored the vulnerabilities of autonomous landing
Session S, Straind B	Trojan Attacks on Autonomous Landing Systems	systems in Urban Air Mobility (UAM) vehicles, specifically examining the risks posed by Trojan attacks on deep learning models used for navigation. Trojan attacks are a significant cybersecurity concern, as it inserts hidden triggers within Convolutional Neural Networks (CNNs), leading to misclassifications under specific conditions while maintaining normal functionality under typical operations. We focused on assessing the susceptibility of Urban Autonomous Aerial Vehicles (UAAVs) to these attacks, using models like DroNet, which are widely employed for real-time obstacle avoidance. To investigate this, we collected a custom dataset of over 5,000 images of landing pads, simulating both clean and Trojan-triggered conditions. Our deep learning model was trained on this dataset, and its performance was evaluated under both normal and triggered scenarios. The results revealed a substantial drop in accuracy, from 96.4% on clean data to 73.3% on Trojan-infected data, illustrating the severe impact of Trojan attacks on model reliability, particularly during critical phases like landing. These findings highlight the pressing need for robust defense mechanisms to mitigate Trojan-induced vulnerabilities and stress the importance of further research into enhancing the security of autonomous systems in UAM applications. These applications include navigation during takeoff and landing, obstacle avoidance, and communication with ground control. UAM vehicles have the potential to revolutionize passenger transport, emergency services, cargo delivery, and surveillance. Ensuring the security of these systems is essential, as any vulnerability could endanger lives, sensitive data, or critical infrastructure.
Session 3, Strand C	Strut-and-Tie Models for the Design of Bridge Bent Caps in North Carolina	Strut-and-tie models (STMs) can be used to design deep beams or disturbed regions in concrete members where plane sections do not remain plane such as near concentrated loads or supports. Bridge bent caps often behave as deep beams. In these regions, STMs better capture the flow of forces and the member behavior compared to sectional methods. While most current design codes incorporate the strut-and-tie method for the design of concrete structures, they offer limited guidance on selecting the layout and dimensions of strut-and-tie models in practice. There are practical challenges as they relate to the design of bent caps in bridge structures including how to consider multiple loading cases, column moments, load combinations, and other design considerations. This presentation describes the development of STM templates and their underlying assumptions for use in the design of bridge bent caps in North Carolina. The templates discussed are for typical typologies commonly encountered in the state. A process for creating an efficient template for strut-and-tie models following AASHTO is outlined. The STM designs are then evaluated using nonlinear finite element analyses. The presentation also provides a summary of large-scale deep beam experiments representative of typical bent caps with different reinforcement ratios and shear span-to-depth ratios. The results from the testing program provide insights into crack widths at service loads and performance throughout loading. The experimental results are compared to STMs and nonlinear finite element models.

Session 3, Strand C	Towards the design of disturbed regions in bridge structures utilizing FRP reinforcement	With the recent adoption of fiber reinforced polymer (FRP) bars as the main reinforcement for particular North Carolina bridges such as the Harkers Island Bridge and the Alligator River Bridge replacement, it is becoming increasingly important to develop design methods for members reinforced with FRP reinforcement. While sectional flexure and shear design is well understood, there is limited research on the shear design of disturbed regions utilizing FRP reinforcement. For conventional steel reinforced disturbed regions, sectional methods have proven to be overly conservative, and as a result, strut-and-tie methods are often utilized to design the disturbed regions and more accurately capture the flow of forces in the member. This presentation discusses the ongoing efforts to develop methods for the design of disturbed regions utilizing FRP. A current research project for NCDOT is investigating common bridge elements that would classify as disturbed regions to provide insights to improving their designs. This research builds on recent studies for the ACI CRC Foundation which investigated the use of the strut-and-tie method for FRP reinforced deep beams and assessed existing ACI code provisions. Along with nonlinear finite element modelling, large-scale experiments were conducted wherein deep beams were tested to failure. The results of the completed experiments will be discussed in this presentation, exploring the impact of various design parameters and detailing requirements. This research explores the significant changes in the performance and behavior of these members, and will ultimately influence future design methods for the safe and efficient design of disturbed regions.
Session 3, Strand C	Improved Live Load Distribution Factors for Load Rating of Slab and T-Beam Reinforced Concrete Bridges	More than 30% of existing bridges in US have exceeded their 50-year design life. Therefore, the accurate and reliable live load-carrying capacity evaluation of bridges is of critical importance to state and local government agencies. The Conventional Load Rating (CLR) methodology adopted in the American Association of State Highway and Transportation Officials (AASHTO) specifications relies on a two-dimensional (2D) analysis to estimate bridge demands. CLR approximates the transverse load distribution using live load Distribution Factor (DF) formulations that do not explicitly consider edge components such as railings and end-diaphragms. Recent studies have shown that this approach may produce overly conservative rating factors, potentially causing excessive bridge postings and/or closures. This presentation discusses the results of a recent study funded by the Indiana Department of Transportation (INDOT) investigating potential improvements in load rating standards for older reinforced concrete slab and girder bridges. Three-Dimensional (3D) Finite Element (FE) models of T-beam and flat-slab bridges were used to conduct refined analyses that explicitly incorporate non-structural elements in superstructure modeling. Results showed that bridge geometry and the presence of edge-elements such as railings and end-diaphragms significantly changed the distribution of loads over the bridge width. Consequently, 3D assessments of bridge demands differ significantly from CLR estimates and exhibit a significant improvement in load rating performance. Modification Factors (MF) for live load DF were proposed based on a statistical study of FE bridge analysis results under standard truck load configurations. The outcome is an improved standard methodology for load rating of reinforced concrete bridges.

Session 3, Strand D	Multi Modal Trip Reductions Rates in Local	NCDOT requires a Traffic Impact Analysis (TIA) for some
·	Municipalities	developments based on the site trip generation estimates, site context,
		or at the discretion of the NCDOT District Engineer. Many aspects of
		the TIA build on the trip generation estimates, which means the trip
		generation process of a TIA is a critical component and receives
		substantial attention and review from both NCDOT and the developer.
		As a result, vehicle trips may be impacted by developments in locations
		with multimodal options. Recent TIAs in these locations commonly
		include vehicle trip reductions. However, a thorough documentation and
		examination of reasonable vehicle trip reduction rates is not available in
		North Carolina. This research will assist NCDOT by developing a better
		understanding of the application of vehicle trip reduction rates for sites with probable multimodal usage in the context of Traffic Impact
		Analysis (TIA). Using data from North Carolina sites, the research will
		provide estimates of vehicle trip reduction rates for sites with probable
		multimodal usage (based on common location types with expected trip
		reduction requests in TIAs). The research will also provide
		recommendations for the application of vehicle trip reduction rates for
		NCDOT in the review of TIAs. This information will be useful for
		NCDOT in the review of TIAs, but can also be useful for developers and
		municipalities who may be intentionally focused on designs and
		developments that encourage multimodal transportation uses and
		options.
Session 3, Strand D	So close, yet so far: an automated method to	Post-war suburban development is often characterized by a
·	identify missing links in pedestrian networks	disconnected pod-and-collector street pattern. This creates significant
		barriers to active travel, forcing even short trips to take roundabout
		routes on busy arterial roads. However, it also creates a network of low-
		stress neighborhood streets. We hypothesize that there are many
		opportunities to add short, low-cost pedestrian and bicycle links to
		these street networks to increase connectivity.
		A key challenge is identifying these links. While planners have a good
		idea of where major infrastructure investments are beneficial, they are
		unlikely to be familiar with every neighborhood street and potential
		connections between them. We introduce an algorithm to automatically
		and efficiently identify potential new links based only on existing
		network topology, with no need to prespecify potential projects. We
		score these links based on their contribution to accessibility. We apply
		this algorithm to the pedestrian network of Charlotte, North Carolina,
		USA, and find opportunities to improve connectivity through new links
		and safe crossings of major roads.

Session 3, Strand D	User's Preference for Trip Planner Interface and	Promoting sustainable transportation modes requires understanding
	Factors Influencing Sustainable Transport Choices in Rural and Urban Areas	the factors influencing user behavior and preferences. The study aims to examine the determinants of transportation choices in rural and urban areas, focusing on behavioral and infrastructural factors, and assesses user preferences for trip planner interfaces. To achieve this, a survey was conducted to identify key insights into what influences individuals' choices for sustainable transportation. Results highlight strong support for trip chaining features, with 40% of respondents favoring the ability to plan multiple destinations and 41% preferring to select different modes for trip segments. Cost and travel time information emerged as top priorities, with 66% and over 50% of respondents, respectively, ranking them as essential criteria. The findings reveal significant disparities between urban and rural respondents. Urban participants were more receptive to sustainable transportation modes, while rural respondents identified poor infrastructure, limited public transit options, and longer travel distances as primary barriers. Across all demographics, practical information like avoiding congestion, road safety, and amenities such as gas stations and medical facilities were highly valued, while environmental data, such as carbon footprint, ranked lower in importance. The study emphasizes the importance of user-centric trip planner interfaces that prioritize cost, convenience, and safety to foster broader adoption of sustainable transportation. These insights emphasize the need for targeted infrastructure improvements, enhanced public awareness, and user-friendly digital tools to bridge the gap between urban and rural transportation needs and preferences. By addressing these challenges, this research provides actionable recommendations for promoting sustainable travel behavior.
Session 3, Strand E	Continuous Flow Intersection Safety Evaluation	The CFI is an alternative intersection form that is known for efficiency; however, there is conflicting evidence on whether CFIs are safe. This effort looked at CFIs across the US and determined under what conditions they are most suited for design.
Session 3, Strand E	An Estimate of the Potential Crash Savings from Optimizing the Design of Every Intersection	This presentation describes an effort to estimate the potential crash savings from converting every intersection in a population to its optimum from a safety perspective. The sample was from a population of the meeting of two state-owned roads. After verifying and adding to data from an inventory we were able to compute expected crashes as is and with a conversion to the feasible design that minimized crashes. The analysis showed that NCDOT could convert about 21 percent of the intersections in the population of 98,000 to an optimum concept to achieve savings of about 7,000 crashes per year. Most conversions would be from minor-street stop to all-way stop; these would be inexpensive conversions that would almost certainly bring a positive return on investment. The next most-promising conversions are large signalized intersections into median u-turns, with about 1,600 such feasible conversions yielding an estimated savings of about 2,400 crashes per year. There is some potential for conversions into reduced conflict intersections, roundabouts, and right-in right-out as well. Overall, the results were humbling for those in the intersection design business. About 80 percent of intersections in the population have small demands or unusual geometries that mean no obvious conversion potential. This means that about two-thirds of the crashes experienced in the population would not be prevented even if every intersection was converted into its safest feasible design. Any serious vision zero effort also has to involve large scale vehicle or driver behavior changes.

Session 3, Strand E	Safe System Implementation: Current Prospects and Opportunities in the United States	Fostering a Safe System in the United States and in North Carolina is a worthwhile, yet complex and strategic endeavor. Through the process of developing Safe System Implementation guidance for a National Cooperative Highway Research Program effort, a multi-disciplinary research team led by UNC's Highway Safety Research Center learned about what 400 transportation, policy, and public health professionals perceived as impactful and feasible to implement toward greatly enhancing road users' safety and stepping toward a Safe System which reliably protects everyone. There professionals were presented with 75 safety practices, many of which have never been implemented in the U.S., and asked to appraise their safety impact and political/social/financial feasibility. Several of these professionals also participated in focus groups to further explore the reasonableness and nuances associated with instituting robust safety practice. This session will present the findings from this unique research endeavor, provide insight into promising pathways toward implementing a truly Safe System, and invite participants to share their experiences with advancing Safe System practices.
Session 4, Strand A	Resilient and Sustainable Transportation - Session I	The Rainfall, Intensity, Duration, and Return for Observations and Projections (RaInDROP) Tool for North Carolina; Jared H. Bowden (NC State Climate Office) – 15 min presentation Natural Hazards Vulnerability Assessment of the NCDOT Ferry Division Assets; Tim Brock (ITRE, NCSU) and Beth Sciaudone (Moffat & Nichol) – 15 min presentation Topology and Resilience: A Geospatial Analysis of Transportation Network In North Carolina; Trung Tran (Fayetteville State University) – 15 Min Presentation A Review of Best Practices for Natural Disaster Infrastructure Recovery to Inform Hurricane Helene Recovery Strategy in Western North Carolina; Mary Warren (ITRE, NCSU) and Tim Brock (ITRE, NCSU) – 15 Min Presentation
Session 4, Strand A		
Session 4, Strand A		

Session 4, Strand B	UNC Charlotte Automated Shuttle Pilot Study:	This presentation session will focus on an evaluation of an automated
	Perceptions, Operational Performance and Lessons Learned	
Session 4, Strand B		
Session 4, Strand B		
Session 4, Strand C	Mapping the Invisible: Predicting Stormwater Pipelines Using Artificial Intellegence	Knowing the locations of underground stormwater pipeline is crucial for transportation infrastructure resilience and effective stormwater management. However, this information is commonly poorly documented or inaccessible. This presentation covers the preliminary development of deep learning method for the DeepPipe project, funded by NCDOT, which aims to detect underground stormwater pipelines leveraging cutting-edge Al solutions. Our approach leverages advanced graphic neural networks, trained on spatial and environmental data, to predict pipeline locations across North Carolina. By applying deep learning techniques to this unique spatial challenge, we aim to bridge gaps in existing data and support future transportation planning efforts. This presentation will showcase our preliminary results, offering insights into the model performance in terms of the capability of detecting stormwater pipelines.
Session 4, Strand C	Deep Learning in Infrastructure Performance Monitoring	The NCDOT manages the second largest state-maintained highway network in the United States. To assist the Department in making appropriate pavement maintenance decisions, we evaluated primary and secondary roadway pavement conditions using deep learning, a state-of-the-art artificial intelligence technique. In this study, raw roadway surface images were labelled at a very fine resolution to develop high quality datasets for training, testing, and validation. Deep learning algorithms, including U-Net, Vision Transformer, and ResNet, were then developed to classify, segment, and quantify roadway surface distresses. Our approach consistently achieves outstanding performance, with various performance ratings greater than 95%. This study could significantly improve the efficiency of the pavement condition assessment process, enhancing the safety, durability, and efficiency of the roadway network in North Carolina.

Session 4, Strand C		
Coolin I, Chand O		
Session 4, Strand D	Investigation of Technology to allow the tracking of wait times and traffic points of origin for users of the Ferry System	The North Carolina Ferry Division operates vessels on seven routes along the eastern coast of North Carolina. The routes serve diverse populations, ranging from routes with substantial tourist/visitor customers to routes with primarily daily commuters. Wait times and queue lengths are important considerations of customers. However, measuring and communicating wait times and queues is not simple and not currently available to customers. The NCDOT Ferry Division would like to implement technology that would measure and track wait times. This project tested various technology solutions to measure and track wait times. The objectives of the proposed project were 1) to review and test options for measuring wait times and 2) recommend the implementation of a system to measure and track wait times for installation at ferry terminals. The options tested to track vehicles' wait times are security cameras, bluetooth counters, and license plate reading cameras. The security cameras and bluetooth units were used in tandem so that the cameras could validate the bluetooth devices. Custom bluetooth devices developed from Raspberry Pi technology and tested as a possibility as well as upgraded commercial bluetooth devices from SMATS. The license plate reading cameras were tested iteratively as more ideal configurations were determined. Along with the license plate reading cameras, a python code was developed and continued to be refined that automatically matches the license plate data to deduce wait times.
Session 4, Strand D	A Multi-Objective Optimization based Single Truck-Multiple Drone Delivery	In a coordinated truck-drone delivery system where trucks and drones integrate to deliver goods to customers, one of the challenges of drones is the duration of their battery capability. Trucks can be used as depots, and drones can be used as delivery tools in such a coordination system. The drone's route must end before its battery reaches the maximum operational discharging rate. This can be done by minimizing the maximum travel distance of each drone. However, at the same time, to increase operational efficiency, the workload must be distributed among all drones. Our problem will consider these two somehow conflicting objective functions and try to find a set of Pareto-optimal solutions. The goal is to avoid any drone's mid-air low battery problem and ensure the drone arrives on the ground before the minimum threshold amount of state of charge of its battery is reached. Our model considers the placement of meeting points between the truck's and the customer's location to involve two or more drones exchanging packages for more than last-mile delivery. The meeting points are placed within the drone's travel range. This consideration helps to speed up service time and minimize service costs. Our model is formulated using a multiple objective function based a mixed integer linear programming approach, then solved using Gurobi software. The outcome of the model results in a coordinated and safe truck-drone delivery with workloads efficiently balanced between existing drones and an increased drone delivery range.

Session 4, Strand D	Exploring Public Wi-Fi Log Data and Microtransit Data to Understand City-Level Travel Demand for Enhancing Microtransit Services in North Carolina	Microtransit services are being embraced by North Carolina cities, serving as a first-and-last-mile (FLM) transit connection or replacing traditional fixed-route transit systems due to their advantages in accessibility, flexibility and affordability. In Wilson, NC, an on-demand, dynamically routed, mobile-app-powered microtransit service (RIDE) entirely replaced the existing fixed-route bus system in 2020. Though the rider survey has confirmed that RIDE is a critical and essential service to low-income, transit-dependent riders, it can be further improved in terms of travel efficiency and service quality by understanding the city-level travel demand, which includes microtransit and general traffic. However, understanding the city-level general travel demand is challenging. Traditional travel data collection approaches like surveys collect low-sampling data with minimal information. Recently, the city of Wilson offered a public free Wi-Fi service across the city, which provides an opportunity to track the Wi-Fi users' travel and imply the city-level general travel demand. This study was intended to synergize digital and transportation equity in Wilson by analyzing its city-level Wi-Fi and microtransit data. After data processing, similarity and dissimilarity between microtransit and Wi-Fi user travel patterns can be analyzed by using a density-based spatial clustering approach and a graph comparison model. The common Wi-Fi and RIDE users were identified and analyzed to determine user profiles and trip purposes. The differences between Wi-Fi and RIDE travel demand patterns were used to identify potential microtransit riders who use public Wi-Fi to increase the microtransit ridership and deploy more Wi-Fi network access points to enhance digital equity.
Session 4, Strand E	Factors associated with vulnerable road user crashes on freeways in North Carolina	A vulnerable road user (VRU) is a nonmotorist, such as a pedestrian and bicyclist. In recent years, VRUs have accounted for a growing share of U.S. roadway fatalities. VRU safety assessment is a critical component of the Strategic Highway Safety Plan in North Carolina (NC). Over the past decade, NC has experienced a substantial number of VRU crashes, with 22,057 pedestrian crashes and 8,927 bicycle crashes between 2012 and 2021. More importantly, A significant number of fatalities and serious injuries involve VRUs on freeways in NC, although VRUs are generally prohibited from freeways. While much research has focused on VRU fatalities on urban roads, little is known about VRU fatalities and serious injuries on freeways. To fill in this gap, this paper will investigate the VRU crash data from
		2010 to 2022, obtained from the NC Pedestrian and Bicycle Crash Data Tool. Hotspots of VRU fatalities and serious injuries on freeways will be identified using Geographic Information System and spatial point pattern mining. Then, to evaluate the impact of various risk factors on VRU crashes, considering freeway versus non-freeway locations and crash severity, we will conduct an exploratory comparative analysis and employ regression models to statistically infer the impact of the risk factors (e.g., land use and number of lanes) on VRU crashes on freeways. The findings of this paper will provide critical insights into geographical distribution of freeway-specific VRU crashes and the underlying risk factors.
Session 4, Strand E	Camera-based Work Zone Intrusion Alert System	This presentation provides an account of the stages that are involved in developing a camera-based work zone intrusion detection technology at East Carolina University. The presentation describes the research and development journey starting from the idea inception phase at East Carolina University and going through various stages including proof-of-concept, prototype development, field tests and finally technology licensing and the commercialization of the technology. A part of those effort involved NCDOT sponsored projects. The presentation aims to inspire researchers to successfully license and commercialize their inventions and designs to maximize societal impacts in the field of transportation technologies. It also illustrates the impact of NCDOT research grants in the creation of innovative safety products in the marketplace.

Session 4, Strand E	Operational and Benefit-Cost Analysis of	At four-phase conventional intersections where traffic demand is near
	Intersections with Three-Phase Traffic Signals	or above capacity, alternative intersections may perform better. Alternative designs with two-phase traffic signals such as reduced conflict intersections (RCI, also called RCUT, J-turn, and superstreet) result in shorter travel times, fewer crashes, and better pedestrian service in North Carolina. However, retrofits to designs with two-phase signals may be impactful and unpopular. On the other hand, intersections with three-phase signals might provide some of the two-phase design advantages while also providing more direct movements and alleviating some public concerns.
		This research sought to add new insights regarding the benefits and drawbacks of using alternative intersections with three-phase traffic signals compared to other intersection designs. Nine (9) intersections with three-phase traffic signals, including reverse RCI, thru-cut, redirect 2L&T (two left and a through), redirect L&T (one left and one through from a minor leg), partial CFI (continuous flow intersection), seven-phase, two new concepts of MUT (with three-phase signals), and a CFI/MUT combination were compared to conventional, RCI, and two-phase MUT intersection designs.
		To identify the benefits and drawbacks of three-phase intersections, the research team evaluated these designs for their travel time performance using TransModeler. These travel times were also used to perform a cost-benefit analysis of the three-phase designs. Overall, designs with a CFI component (partial CFI, CFI/MUT combination, and redirect 2L&T) showed the greatest benefits in travel time savings but required the most right-of-way to construct.
Session 5, Strand A	NC SuRe Center of Excellence / Resilient and Sustainable Transportation - Session II	NC SuRe Infrastructure Center of Excellence Overview; Tim Brock (ITRE, NCSU) – 10 mins Creating More Climate Resilient Roads in North Carolina and COE Project 1 Update; Shane Underwood (CCEE, NCSU) – 20 mins An Agent-Based Model for Assessing Electric Vehicle Charging Infrastructure Capacity and Performance along Critical Transportation Corridors and Project 2 Update; Alexander Yoshizumi (NCCTEC, NCSU), Heather Brutz (NCCTEC, NCSU) – 20 mins Cyber-Resilient Traffic Management Centers: Enhancing Security for Intelligent Transportation Systems Project 3 Update; Shoaib Samandar(ITRE, NCSU) and Sambit Bhattacharya (Fayetteville State University) – 15 min presentation
Session 5, Strand A		
Session 5, Strand A		
Session 5, Strand B	North Carolina Advanced Air Mobility Center-of- Excellence	Introduction of the multi-university Center of Excellence to explore innovative research and applications in the fields of advanced air mobility (AAM) and unmanned aircraft systems (UAS). The goal of this effort is to further understand and plan for long-term trends in advanced mobility transportation infrastructure across the state.
Session 5, Strand B		
Session 5, Strand B		

Session 5, Strand C	NCDOT Center of Excellence - NC-CAV	Connected Autonomous Vehicles (CAVs) are expected to create new opportunities by enhancing the mobility, safety, efficiency, reliability, affordability, and sustainability of transportation systems while rapidly disrupting traditional transportation technologies. The NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV) investigates the adoption, utilization,
		and deployment of CAVs and their impacts on the transportation system in North Carolina and the nation. In this talk, NC-CAV researchers will briefly discuss the findings on (1) Assessing the Impact of Connected and Automated Vehicles on Work Zones, (2) Evaluating Connected and Secure Edge Infrastructure for Scalable Hardware-in-the-Loop North CAV Testbeds, and (3) Defining and Implementing Potential Use Cases for the Deployment of CAVs.
Session 5, Strand C		
Session 5, Strand C		
Session 5, Strand D	Got bikes? Traffic Gardens Grow Safe Road Users	The Town of Winterville was chosen by the Bike Walk NC organization to receive a permanent traffic safety garden as a gift for hosting the 2022 Bike Walk NC Summit. This legacy gift was made possible through funding from the AARP Community Grant Program. Many hours of staff time were donated by the Eastern Carolina Injury Prevention Program, Pitt County Schools and Recreation Program, and Bike Walk NC to bring this project to fruition in 11 months. The traffic safety garden is one of the first in the state and will be utilized by many children and families in eastern NC. This presentation will review the details of the entire project including site selection, partnership building, budget, contractor selection, ribbon cutting event, conference presentations and future educational plans for the garden. Access to funding for traffic garden projects will be shared. Design templates, educational resources, and pop-up props will be reviewed. The role of public input for site selection and design selection will be discussed. Participants will learn all aspects of traffic safety garden implementation, maintenance, and replication for their own communities. They will be motivated to seek a project for the community through the energy and passion that was a direct by product of this successful quick build project. The value of relationships with key stakeholders to achieve a Vision Zero mission will be shared. The role of non- traditional safety advocates and the contributions of local businesses to foster meaningful collaborative partnerships will be shared.

Session 5, Strand D	Evolving Complete Streets into Smart(ER)	Roadway design best practices once were focused on moving vehicles
Session 5, Strand D	Corridors Corridors	as efficiently as possible. In the last couple of decades, cities and states have come to realize roadways are more complex. Now the foundational best practices put multi-modal integration forward with a focus on safety for all roadway users, including transit riders, cyclists, and pedestrians. The industry dubbed this approach Complete Streets. With advancements in technology and a shift in social norms, we've come to another decision point as transportation planners, designers, and policymakers. Networks have become even more complex, there are more modes than ever to accommodate, users expect convenience and efficiency without sacrificing safety or cost, and we all want more options to plan the best trip to fit our personal needs. To do this well, Complete Streets are evolving into Smart Corridors. There are many design aspects to consider and tools to support analysis and solutions. This presentation will explore how to evolve a Complete Street into a Smart Corridor – best practices for space allocation for emerging modes such as e-scooters and microtransit, EV infrastructure integration, creating dynamic curbsides, shared and smart parking opportunities, innovative ITS, as well as AI and data analytics for safety, equity, and resilience. The presentation will include case studies from recent projects to illustrate these best practices and recommendations around policy and planning to manage this evolution.
Session 5, Strand D	Pedaling Toward the Future: Insights on North Carolinians' E-Bike Aspirations from the Ral-E-Bike Program	E-bikes offer a sustainable and accessible transportation option that mitigates barriers such as distance, hills, and carrying capacity, enabling broader integration of cycling into daily life. However, their high cost remains a significant barrier to adoption. To address this, cities and states across North America are piloting programs to reduce financial hurdles. The City of Raleigh's Ral-E-Bike program exemplifies this effort, offering \$1,500 vouchers to residents earning 80% or less of the Area Median Income (AMI) and \$500 vouchers to higher-income participants. This study investigates the characteristics and motivations of those who signed up for the program, providing a snapshot of the population interested in e-bikes. Using first-wave survey data, this research explores participants' comfort with various types of cycling infrastructure, current biking behavior, demographic profiles, and intended trip purposes with an e-bike. By comparing participant demographics to the broader Raleigh population, the study examines how such incentive programs might address equity and accessibility gaps in transportation. These insights contribute to the growing understanding of how e-bike incentives can expand access to sustainable mobility solutions and inform policies to ensure equitable program design and outreach.

Session 5, Strand E	Utilizing Emergency Medical Services (EMS), Emergency Department (ED), and Linked Crash- EMS and Crash-ED Data to Inform Local and State Traffic Injury Prevention	According to the North Carolina (NC) Vision Zero Safety Dashboard, 112,460 persons were injured or killed in police-reported MVCs in 2022. While the numbers of traffic injuries reported in NC EMS (n= 111,997) and ED data (n=112,842) were similar, there were key subgroup differences. For example, higher numbers of pedestrians (n=2,983) and bicyclists (n=1,652) were reported injured in NC ED data as compared to the numbers reported in the NC MVC data (n=2,486 and n=617, respectively). Similar disparities exist for other active transportation modes, as well as for selected demographic groups, with female and Black road users being overrepresented in the healthcare data. Furthermore, MVC data lack accurate and complete health outcomes information. For example, a previous study of linked NC MVC-ED data, determined that 37% of injured road users treated in NC EDs were classified as uninjured in the MVC data. While MVC data provides unparalleled information on crash location and circumstances, healthcare data provides critical information regarding injury outcomes. This presentation will highlight the value of health outcomes data for traffic safety planning and decision-making, as well as describe historical, ongoing, and future NC Governor's Highway Safety Programfunded efforts to utilize NC ED and EMS to enhance local and state traffic injury surveillance activities. These include preliminary data integration efforts, the development and testing of a public-facing Health Outcomes Data Dashboard, and collaboration with local and state traffic safety stakeholders to build an effective, sustainable data integration and traffic injury surveillance program.
Session 5, Strand E	Insights and opportunities for transportation and public health agency collaboration to improve road safety	We used a mixed methods approach of key informant interviews (n = 7) with transportation leaders representing different regions of the U.S., combined with a systematic analysis of all state highway safety plans for the year 2023 (n = 57). The key informant interviews revealed three key thematic areas for increased public health and transportation agency collaboration: 1) collaborative strategic planning and holistic problem identification with an equity foundation, 2) data sharing and integration of health and transportation-related sources to improve burden assessment and prioritize action, and 3) innovative, joint program development, implementation, and evaluation. Analyses of highway safety plans indicated that more than three-quarters of plans noted state public health partner involvement in plan development; however, very few plans mentioned taking a public health approach or integrating public health frameworks in plan development (<20%). Moreover, while states generally used traditional transportation data sources to assess burden and develop performance measures, less than a third of states utilized health data sources (e.g., emergency medical services, hospital discharge, or emergency department data). Finally, nearly all plans included some proposed collaboration between health and transportation partners in terms of programmatic activities; however, many of the activities fell into a few traditional buckets (e.g., child passenger safety seat distribution). While public health partners have some presence in state transportation safety efforts, current transportation safety programming often fails to fully leverage public health concepts and partners in designing, implementing, and evaluating programs and utilizing and advancing diverse safety data systems.

Session 5, Strand E	The Value of Proactive Safety: Revisiting High Injury Networks	The Safe System Approach emphasizes a proactive approach to roadway safety, but the most common approach to safety in transportation planning and project prioritization is highly reactive. Crash rates and High Injury Networks (HINs) are the most common way for local agencies to plan potential improvements; however, this ignores the potential for a severe crash to occur (i.e., risk), and "regression to the mean" (i.e., the notion that high crash locations will experience years with relatively few crashes and vice versa) is unaccounted for in these methods. The purpose of this presentation is to demonstrate a risk-based approach to safety in several North Carolina Safe Streets and Roads for All (SS4A) plans and compare it to traditional HINs and reactive approaches. In many cases, the proactive, risk-based approach performs better at "capturing" future crashes and reliably identifying locations where risk is highest. The goal of the presentation is not to totally discourage the use of HIN and other reactive tools, but to underscore that a balanced approach produces more effective plans for State, regional, and local agencies.
Opening Plenary	Data-Driven Discovery	Data science, machine learning, and artificial intelligence are the hot buzzwords and they are being touted as the solution for everything from curing cancer to self-driving cars. Data is driving discovery across disciplines at NC State; our motto is that "Data Science is for Everyone." But is data science just another name for "big data"? I will discuss what data science is (and is not), some of the key principles of data science practice, and give examples that illustrate how data is changing scientific discovery.
Day 1 Lunch Plenary	Exploring Artificial Intelligence (AI) from Multiple Angles: Insights from Cybersecurity, Workforce Preparation, and Systems Engineering	This dynamic roundtable brings together thought leaders and experts to discuss the challenges, opportunities, and impacts of Artificial Intelligence (AI) for cybersecurity, workforce preparation, and systems engineering. Speakers: Dasha Davies - President/CISO, Stealth-ISS Group Inc. Collin F. Lynch - Associate Professor of Computer Science, Department of Computer Science & The AI Academy, North Carolina State University Miles Thompson - AI Assurance Solutions Lead, MITRE Corporation Moderator: Caitlyn Mabry - Data & Information Branch Manager in the Office of Strategic Initiatives and Program Support (SIPS), NCDOT
Day 2 Lunch Plenary	Highly Automated Safety Systems Center of Excellence (HASS COE)	Ashley Nylen will provide an introduction of the HASS COE, an office under the Principal Deputy Assistant Secretary for Research and Technology at the United States Department of Transportation. The plenary will feature the work of the HASS COE with a focus on collaborative efforts in automation with fellow operating administrations with focus on state and local engagement, artificial intelligence assurance, distributed testing and air and advanced mobility initiatives.

Appendix G – Speaker Bios

Speaker Bios

Sneha Bora (UNC Chapel Hill)

I am currently a second-year international graduate student in the City & Regional Planning department. My long-term goal is to bridge the gap between academic research and professional practice, focusing on inclusive and sustainable communities. I aim to integrate innovative planning techniques to address urban inequalities and empower marginalized communities, advancing equitable urban development that reflects the diverse needs of all residents and contributes to resilient, thriving cities. I want to use this opportunity to present my Master's project on the legacy of racial segregation in Raleigh and how historically racial practices had/continues to shape urban landscapes and communities.

Weilin He (Syracuse University)

Weilin He is a Ph.D. student in the Dept. of Civil and Environmental Engineering at the Syracuse University (SU). Before joining SU, Weilin obtained MS degree in Civil Engineering from the Shen Zhen University in China. Since joining SU in 2023, Weilin has been working in the area of using Large Language Model and Ontology approaches to improve infrastructure project performance.

Venktesh Pandey and Komal Gulati (NC A&T University); Abhay Lidbe (University of Alabama)

Venktesh Pandey is an Assistant Professor in the Department of Civil, Architectural, and Environmental Engineering at the North Carolina Agricultural and Technical State University. His research integrates intelligent transportation systems (ITS) and emerging mobility services in traffic operations, congestion pricing, and transportation planning models with a focus on sustainability.

Tewodros Gebre and Leila Hashemi Beni (NC A&T University

A Ph.D. candidate in the Applied Science and Technology program, his area of focus is the integration of Artificial Intelligence and Remote Sensing Technologies with Road Transportation Systems to uncover innovative solutions for transportation-related applications.

Chris Vaughan (NC State University)

Chris Vaughan is a Research Scholar at the Institute for Transportation Research and Education at North Carolina State University with almost 16 years of experience. He specializes in traditional and non-traditional data collection of all modes of travel. He also annually teaches continuing education courses to full-time employees of various state agencies and private engineering firms, with topics ranging from Highway Design to Engineering Economics. Chris has participated in research sponsored by FHWA, NCHRP, NCDOT, GHSP, and various local agencies, among others.

Laquanda Johnson, Oghenetejiri Ebakivie, and Rongfang Liu (NC A&T University

Dr. Laquanda Leaven Johnson is an Associate Professor of Supply Chain Management at North Carolina A&T State University. Her research interests include exploring strategies to optimize healthcare access, transportation equity, and drone technology. She has secured ~\$1m in research grants from the United States Department of Transportation, North Carolina Department of Transportation, Boeing, Medtronic, and the Thurgood Marshall College Fund.

Barbara Doll, Jack Kurki-Fox, and Dan Line (NC State University)

Barbara Doll, PhD, PE, is an Associate Extension Professor at NC State University's Department of Biological & Agricultural Engineering Dept and an Extension Specialist with the NC Sea Grant Program. She teaches both professional development workshops and academic courses in fluvial geomorphology and stream restoration. She has secured and managed more than \$12 million in external funding for water quality and restoration research and demonstration projects. She leads a team of engineers and students that focus on evaluating the performance of stream restoration efforts, developing new techniques for ecological restoration and assisting communities with flooding and water quality challenges.

Sophia Lin, Shenen Chen, Wenwu Tang, Ryan Rasanen, Craig Allen, and Nicole Braxtan (UNC Charlotte)

Sophia Lin is a PhD candidate for the Infrastructure and Environmental Systems (INES) program at UNC Charlotte. Sophia received her BA and MS degree from the National Sun Yat Sen University, Taiwan. Specialized in geospatial information systems, her current research interest is in the application of GIS to investigate the effects of climate related disasters to transportation infrastructure.

Douglas Miller, Caitlin Crossett, and Christopher Godfrey (UNC Asheville)

Ph.D., Atmospheric Science, 1996, Purdue University, West Lafayette, Indiana

The focus of my research is working to better understand situations when mountains influence the weather to make it have a high impact on humans compared to other situations when mountains diminish the chances of high weather impacts on humans. Our field research focuses on observations of wintertime precipitation, primarily precipitation-type issues, in the cold season (SEMPE) and on variability of rainfall from individual storm scales to inter-annual scales for the Pigeon River Basin during the warm season (Duke GSMRGN, Mountain Raingers).

Nana Duah (NC A&T University)

Rongfang Liu (NC A&T University)

Samantha Pace (UNC Chapel Hill)

Samantha Pace is a third year dual master's student in City and Regional Planning at UNC Chapel Hill and Environmental Management at Duke University. After receiving her undergraduate degree in Industrial Design from North Carolina State University, she worked at a biotechnology start-up in Research Triangle Park for 3 years. She is passionate about resilient infrastructure, urban design, and public space.

Gurcan Comert, Denis Ruganuza, Methuselah Sulle, Paul Olukoye, Judith Mwakalonge, Saidi Siuhi, and Nana Kankam Gyimah (NC A&T University / South Carolina State University)

Gurcan Comert received a Ph.D. in civil engineering from the University of South Carolina, Columbia, SC, USA, in 2008. He is an associate professor with the Computational Data Science and Engineering Department at North Carolina A&T State University, Greensboro, NC. He was an associate director with the Center for Connected Multimodal Mobility and National Center for Transportation Cybersecurity and Resiliency led by Clemson University and a researcher with the Information Trust Institute at the University of Illinois Urbana-Champaign. His research interests include applications of statistical models to problems in different fields, real-time parameter prediction, and stochastic models.

Gurcan Comert, Hannah Musau, Judith Mwakalonge, Saidi Siuhi, Nana Kankam Gyimah (NC A&T University / South Carolina State

University)

Gurcan Comert received a Ph.D. in civil engineering from the University of South Carolina, Columbia, SC, USA, in 2008. He is an associate professor with the Computational Data Science and Engineering Department at North Carolina A&T State University, Greensboro, NC. He was an associate director with the Center for Connected Multimodal Mobility and National Center for Transportation Cybersecurity and Resiliency led by Clemson University and a researcher with the Information Trust Institute at the University of Illinois Urbana-Champaign. His research interests include applications of statistical models to problems in different fields, real-time parameter prediction, and stochastic models.

Tesfamichael Getahun and Ali Karimoddini (NC A&T University)

Tesfamichael Getahun is a Postdoc researcher at the Autonomous Cooperative Control of Emergent Systems of Systems (ACCESS)Laboratory at North Carolina A&T State University, Department of Electrical and Computer Engineering. His research interests include visual perception, sensor fusion, planning, and control for autonomous vehicles.

Nooralhuda Saleh (Continuum Infrastructure Solutions)

Dr. Saleh has over 7+ years of experience in improving asphalt mixture performance tests, balanced mixture design, performance indexes, quality assurance, performance specifications, long-term aging procedures of asphalt mixtures, and innovative pavement technologies. She has also contributed to the development of specialized software tools and provided comprehensive training and implementation support. She has made significant contributions to the FHWA's research efforts and has collaborated with numerous national and international highway agencies and industry partners, including the NCHRP, AASHTO, CFLHD, Caltrans, NCAT, Heritage Research Group, and Qatar Foundation.

Cassie Castorena (NC State University)

Dr. Cassie Castorena is a Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. She is interested in multi-scale characterization of asphalt materials, asphalt binder modification, asphalt pavement design, and asphalt pavement distress mechanisms.

B. Shane Underwood and Boris Goenga (NC State University); Paul Rogers (KPR Engineering)

Dr. Shane Underwood is a Professor and Associate Head for Undergraduate Programs in the Department of Civil, Construction, and Environmental Engineering. Prior to this appointment, he was an Assistant Professor in the School of Sustainable Engineering and the Built Environment within the Ira A. Fulton Schools of Engineering at Arizona State University. He received his doctorate degree in Civil Engineering from North Carolina State University in December of 2011. Dr. Underwood teaches courses on pavement engineering and infrastructure materials and has received multiple awards for teaching and service.

Oladimeji Alaka and Dr. Venktesh Pandey (NC A&T University)

Oladimeji Alaka is a Civil Engineering graduate student and research assistant at the Transportation Modeling Lab at North Carolina A&T State University, set to graduate in May 2025. His research focuses on transportation planning, with a recent emphasis on rural autonomous shuttle readiness using geospatial analysis, employing data-driven methods to assess infrastructure needs and optimize planning for rural areas.

Tab Combs (UNC Chapel Hill); Elizabeth Shay (Appalachian State University)

Dr. Tab Combs is a planner, educator, and social scientist focused on building and disseminating knowledge on sustainable, resilient, and socially just transportation systems and planning practices. Her research and teaching interrogates the pivotal role of transportation systems in building resilience for individuals, communities, and society in the face of uncertainty.

John Shaw (NC State University)

John Shaw is a multidisciplinary road safety professional with qualifications in civil engineering and urban planning. Shaw has more than 30 years of experience, including 18 years at Wisconsin DOT and more than a decade of academic research experience. With this dual background, Shaw brings a practitioner's eye to research, and a researcher's eye to practice.

Steve Bert (NC State University)

Steve Bert is a Senior Economist at ITRE where he works with clients within supply chain and multi-modal transport disciplines. His responsibilities include managing ITRE's Economic & Policy Assessment Group, executing a portfolio of 6-8 ongoing research projects, and generating new work through existing relationships and research proposals. His professional career has included both academic and consultative services in the areas of economic impact analysis, economic development, data analysis and visualization, policy evaluation and implementation, urban and rural planning, communications, and graphic design.

Timothy Mulrooney, Barron Allison, and Josue Millan (NC Central University)

Tim Mulrooney is a professor and graduate coordinator in the Department of Environmental, Earth and Geospatial Science at North Carolina Central University in Durham, North Carolina.

Md Abdullah Al Hasan (NC State University)

Md. Abdullah Al Hasan completed his Bachelor's degree from Bangladesh University of Engineering and Technology (BUET) and is currently serving as a Graduate Research Assistant in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. His primary area of focus is transportation systems.

Negasa Yahi (NC A&T University)

Negasa Yahi is a PhD student at the North Carolina Agricultural and Technical State University. He is a member of Autonomous Cooperative Control of Emergent Systems of Systems (ACCESS)Laboratory. His research interests include urban air mobility, motion planning and control of multi-agent vehicles, robotics and flight control systems.

Yonas Ayalew, Abdul-Rauf Nuhu, Lydia Zeleke, Vahid Hemmati, Abdollah Homaifar, and Edward Tunstel (NC A&T University)

Yonas Ayalew is a PhD student in Electrical and Computer Engineering at North Carolina A&T State University since 2021. He is currently a research assistant in Autonomous Control and Information Technology (ACIT) Institute. His research area focuses on Urban Air Mobility solutions for safe flight operation of eVTOL aircraft, risk assessment of autonomous systems, and AI applications on emergent transportation technologies.

Reza Ahmari (NC A&T University)

Reza Ahmari earned his Bachelor of Science in Engineering in Computer Network Technology Engineering from Shamsipour Technical College, Tehran, in 2021, and is pursuing a Master of Science in Computer Science at North Carolina A&T State University. He has over six years of experience as a Python Developer and Software Engineer, working as a freelancer and with institutions such as Mazandaran's Digital Cultural Complex. His expertise includes software development, mentoring, and technical support. His research focuses on reinforcement learning, UAVs, computer vision, deep learning, and autonomous vehicles, emphasizing machine learning optimization and advancing AI technologies.

Giorgio Proestos and Vishnu Punithavel (NC State University)

Giorgio T. Proestos is an Assistant Professor at North Carolina State University, Raleigh, NC. He received his BASc in Engineering Science, his MASc, and his PhD from the University of Toronto, Toronto, ON, Canada, in 2012, 2014, and 2018, respectively. He is the Secretary of Joint ACI-ASCE Committee 445, Shear and Torsion, and chair of Joint ACI-ASCE Subcommittee 445-F, Interface Shear. He received the ACI Chester Paul Seiss Award in 2018 and the ACI Design Award in 2017. His research focus is on the design and analysis of concrete structures subjected to shear and torsion.

Taylor Brodbeck, Ananna Sarker, Greg Lucier, Rudi Seracino, and Giorgio T. Proestos (NC State University)

Taylor Brodbeck is a Postdoctoral Fellow in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University, Raleigh, NC. She received her BS in Civil Engineering, her MCE, and her PhD from North Carolina State University, Raleigh, NC, in 2019, 2022, and 2024, respectively. Her research focus is on the behavior of concrete structures.

Ghadir Haikal (NC State University); Faezeh Ravazdezh, Seungwook Seok, and Julio Ramirez (Purdue University); Jeremy Hunter and Jennifer Hart (Indiana Department of Transportation)

Ghadir Haikal is an Associate Professor in Structural Engineering and Mechanics in the Department of Civil, Construction and Environmental Engineering at North Carolina State University. She holds a Bachelor's degree from Tishreen University, Syria and M.S. and Ph.D degrees from the University of Illinois at Urbana-Champaign, all in Civil Engineering. Before her current position, Dr. Haikal led the Computational Materials Integrity group at Southwest Research Institute and was an Assistant Professor of Civil Engineering at Purdue University. Dr. Haikal's research focuses on developing advanced computational models for structures and materials with applications in improved design specifications and life cycle assessment.

Daniel Coble (NC State University)

Daniel Coble has been with the Institute for Transportation Research and Education at NC State for 10 years, starting full-time over 6 years ago. He recently earned his Master's of Science in Civil Engineering specializing in transportation systems. He has assisted in leading data collection efforts in operation and safety studies in various transportation modes including ferry, rail, bike/pedestrian and highways. A few examples of those studies are noise studies on rumble strips and sound walls, effectiveness of radar vehicle-detection systems at rail crossings, and plane-tracking technology for airports.

Matthew Bhagat-Conway (UNC Chapel Hill)

Matt Bhagat-Conway is an Assistant Professor of City and Regional Planning at the University of North Carolina at Chapel Hill. His research interests focus on computational methods in transportation planning, particularly planning for public and active transport. He holds a BA in Geography from the University of California, Santa Barbara, and an MA and PhD in Geography from Arizona State University.

Ridwan Tiamiyu and Dr. Venktesh Pandey (NC A&T University)

Research Assistant

Christopher Cunningham (NC State University); Taha Saleem and Raghavan Srinivasan (UNC Chapel Hill)

CHRIS CUNNINGHAM is currently Director of the Highway Systems Group at ITRE – an Institute of North Carolina State University. Mr. Cunningham's areas of expertise traffic operations and safety, with specific focus on alternative intersections.

Joe Hummer (NCDOT)

Joseph E. Hummer, Ph.D., P.E., is the State Traffic Management Engineer with the North Carolina DOT Mobility and Safety Division. He specializes in alternative intersection and interchange designs. Joe began researching the designs in 1990, has published numerous articles about them, has invented several new designs. His two-part series in the ITE Journal in 1998 helped create momentum in this area. He has a B.S. and an M.S. in civil engineering from Michigan State University and a Ph.D. in civil engineering from Purdue University.

Seth LaJeunesse (UNC Chapel Hill)

Seth LaJeunesse is a Senior Research Associate with the University of North Carolina Highway Safety Research Center. He designs studies that draw from social and systems sciences to advance road user safety and access. For the past decade, Seth has developed guidance on safe, accessible pedestrian and bicycle access, and Vision Zero and Safe System implementation. Seth has served as principal investigator (PI) on several cross-disciplinary teams toward instituting a Safe System for the North Carolina Governor's Highway Safety Program, National Cooperative Highway Research Program, United States Department of Transportation, the AAA Foundation for Traffic Safety.

Srinivas Pulugurtha (University of Mississippi); Suzanna Leland, Amirhossein Ghasemi, Ninad Gore, Abhinav Grandhi, Mohammadnavid Golchin, Dil Samina Diba, and Rose Thomalen (UNC Charlotte)

Dr. Srinivas S. Pulugurtha is currently working as the Chair & Professor of the Department of Civil Engineering at the University of Mississippi. Prior to his appointments at the University of Mississippi, Dr. Pulugurtha worked as a faculty in the Department of Civil & Environmental Engineering at the University of North Carolina at Charlotte from 2005 to 2024 and as an Assistant Director and Assistant Research Professor of the University of Nevada, Las Vegas – Transportation Research Center (UNLV-TRC) from September 1998 to August of 2005.

Tianyang Chen (UNC Charlotte)

Dr. Tianyang Chen is a Postdoctoral Fellow at the Center for Applied GIScience at the University of North Carolina at Charlotte, specializing in Geospatial Artificial Intelligence (GeoAl), High-Performance Computing (HPC), and Geographic Information Science (GIS). His research spans spatial analytics, environmental conservation, and infrastructure resilience, with an emphasis on practical applications of GeoAl and spatial decision support.

Don Chen and Wenwu Tang (UNC Charlotte); Christopher Vaughan (NC State University)

Dr. Don Chen is a Professor in the Department of Engineering Technology and Construction Management at the College of Engineering at the University of North Carolina at Charlotte. His research primarily focuses on improving pavement performance and developing parametric modeling and visualization techniques in design and construction. Two research projects led by Dr. Chen were recognized by the AASHTO Value of Research Task Force as providing "Transportation Excellence through Research." Additionally, Dr. Chen has served on journal editorial boards and as the Lead Proceedings Editor for international conferences.

Daniel Coble (NC State University)

Daniel Coble has been with the Institute for Transportation Research and Education at NC State for 10 years, starting full-time over 6 years ago. He recently earned his Master's of Science in Civil Engineering specializing in transportation systems. He has assisted in leading data collection efforts in operation and safety studies in various transportation modes including ferry, rail, bike/pedestrian and highways. A few examples of those studies are noise studies on rumble strips and sound walls, effectiveness of radar vehicle-detection systems at rail crossings, and plane-tracking technology for airports.

Lidia Zewde (NC A&T University)

I am a third year PhD student in the Electrical and Computer Engineering department of North Carolina Agricultural and Technical State University. I received my master's degree from Addis Ababa University in Electrical (Control) Engineering in 2017. My BSc degree is also in Electrical Engineering. I have an MA in leadership and management. I have profound work experience in engineering project management and higher education teaching. My research focus is smart transportation, specifically urban air mobility and its involvement in multimodal transport operation.

Lei Zhu and Rachael (Yuqiu) Yuan (UNC Charlotte)

Assistant Professor of Industrial and Systems Engineering (ISE) at UNC Charlotte. Dr. Zhu's research focuses on microtransit, micromobility, and advanced mobility systems modeling and simulation.

Yuting (Tina) Chen and Youngseob Eum (UNC Charlotte)

Dr. Chen is an assistant professor at UNC Charlotte. Her research focuses on construction safety and health, railroad trespassing and transportation safety.

Erol Ozan (East Carolina University)

Dr. Erol Ozan is an information technology professor at East Carolina University in Greenville, North Carolina. He has degrees in electrical engineering, applied physics, and engineering management. Ozan's research and teaching interests include: artificial intelligence; information technology risk management; IoT applications; work zone intrusion detection technologies; web application development. Ozan's research projects have been sponsored by NASA, NSF, DoD, NCDOT, and CMII.

Hayden Edwards (VHB)

Hayden Edwards graduated from the US Naval Academy in 2015 with a Bachelor of Science in naval architecture. Following graduation, he was commissioned as an officer in the US Navy and served for seven years. In 2024, he received his Master of Science in civil engineering with a focus on transportation systems from North Carolina State University. As a graduate student, he worked on an NCDOT-funded research project focused on evaluating intersections with three signal phases and interned with the congestion management unit at NCDOT. Since graduating from NC State, he has worked as a highway safety analyst at VHB.

Ellen M. Walston (ECU Health Medical Center)

2026-Injury prevention program coordinator for the ECIPP at ECU Health Medical Center. Coalition coordinator for Safe Kids Pitt County. NC Coalition Coordinator of the Year in 2013 and 2022 NC Coalition of the Year in 2011 and 2021. Safe Kids NC 2023 Excellence in Injury Prevention by an Individual Award. Presentations- Lifesavers, Safe States, GHSP, NC Bike Walk, Safe Kids Worldwide PREVCON, Governor's Highway Safety Association's, NC DOT Research and NC SITE, Tennessee Lifesavers, and Safe Kids North Carolina conferences. Managed over 2 million dollars grants. Publications-Evolving Perspectives Journal & International Association of Chiefs of Police.

Ashley Thompson (Stantec)

Ashley is Stantec's Smart(ER) Mobility Practice Lead for the Southeast and national Mobility Hub subject matter expert. Through her work as an urban designer and transportation planner, she discovered Smart(ER) Mobility and a passion for empowering communities through innovative mobility and design solutions that focus on [E]quity and [R]esilience. Working on traditional projects, such as comprehensive plans, vision plans, and corridor studies, allows her to bring a unique, community-based perspective to all of her projects. She has experience with AV feasibility studies, conceptual design, and transit planning, as well as planning complete streets, smart parking, and technology assessments.

Matthew Palm (UNC Chapel Hill)

Matthew Palm is an Assistant Professor in the Department of City and Regional Planning at UNC Chapel Hill. His research examines transportation planning impacts people and society, including how those impacts are distributed

across the population. Matthew's work also examines how the removal of mobility barriers can increase residents' social and economic participation.

Katherine Harmon and Yuni Tang (UNC HSRC)

Dr. Harmon is a Research Associate at the UNC Highway Safety Research Center, Faculty in the UNC Injury Prevention Research Center, and Adjunct Faculty in the UNC Department of Emergency Medicine. She holds a PhD in Epidemiology from UNC Chapel Hill.

Elyse Keefe and Nandi Taylor (UNC Chapel Hill); Laura Sandt (HSRC)

Ms. Keefe is a project manager at the UNC Injury Prevention Research Center and holds master's degrees in Public Health and Social Work from UNC-Chapel Hill. Ms. Keefe works on several projects and programs focused on advancing Safe Systems approaches to road safety using a public health framework. Currently she provides technical assistance and leadership development efforts for road safety professionals and has extensive experience using applied research methods in injury prevention.

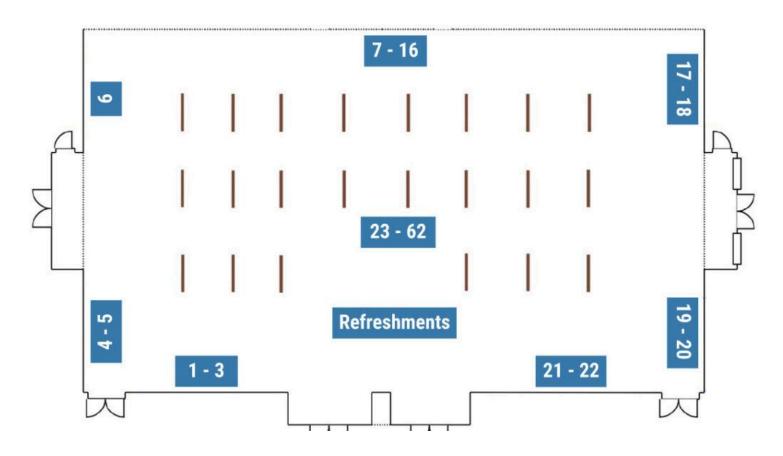
Ian Hamilton and Lauren Blackburn (VHB)

lan is a Transportation Planner who specializes in GIS applications for transportation safety analysis and data management. He has a master's degree in city and regional planning from the University of North Carolina at Chapel Hill, as well as a B.S. in geography from the University of Georgia. His experience includes both public and private sector GIS analysis and transportation planning.

Appendix H – Poster Presentations

Poster Presentations

Room Layout



Collapse All - | Expand All +

1 – Improving the Magnetic Permeability of Composite Materials to Enhance Wireless Power Transfer System Performance for Transportation

Xiuhu Sun (UNC Charlotte)

Wireless power transfer (WPT) enables charging without human intervention and serves as critical infrastructure for electric vehicles in the transportation sector. In the transportation WPT system, magnetic composite materials, such as magnetic concrete consisting of magnetic particles and cement, can significantly improve the efficiency and overall performance of the system by enhancing electromagnetic induction. However, the high cost of these materials poses a challenge, particularly for large-scale applications like charging highways and rails, which affects their economic feasibility. This study aims to optimize the geometry of magnetic concrete to improve its coupling coefficient while reducing material usage. Additionally, by applying electromagnetic pulses, the magnetic material can be redistributed to increase its effective magnetic permeability. Ultimately, these approaches will improve the efficiency and performance of WPT systems while saving materials and enhancing economic viability.

2 – Variability of Plant-produced High Recycled Content Asphalt Mixtures within North Carolina

Gabriel Macedo Duarte (NC State University)

The incorporation of recycled asphalt material (RAM) into asphalt mixtures is a widely adopted technique in the asphalt paving industry as it reduces the demand for raw materials such as virgin aggregate and asphalt binder, thereby preserving natural resources, decreasing landfill waste from construction debris, and lowering costs. State agencies limit the quantity of recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS) in asphalt mixtures owing in part to concerns about variability in performance. The variability of RAM stockpile properties within a state can lead to inconsistencies in the properties and performance of asphalt mixtures. This study aimed to characterize the properties of RAM materials within stockpiles over time and across multiple asphalt plants in North Carolina. It also evaluated the variability in performance of plant-produced high recycled content mixtures in the state and investigated the potential causes for this variability. Asphalt mixtures and their constituent materials were acquired and characterized from four asphalt plants on two different dates. The results showed that while RAM properties were generally consistent within stockpiles over time, significant variations in binder properties and asphalt content were found across different plants within the state. The majority of the mixtures evaluated showed consistent rutting and cracking performance. Variability in cracking performance across plants could be linked to the properties of the recycled and virgin binders. The differences in cracking and rutting performance between the first and second samples acquired from a given plant closely mirrored asphalt content differences.

3 – Characterize Shared E-scooter Travel Patterns using Comprehensive Travel Data: A Case Study in Charlotte, NC

Yuqiu Yuan (UNC Charlotte)

Shared e-scooters have gained popularity as a micro-mobility option in urban areas and have the potential to improve transportation convenience and efficiency by replacing walking, and to enhance energy and environmental benefit by saving car driving trips. This study aims to process and analyze the e-scooter data collected from Charlotte, NC, to understand the detailed e-scooter user travel and trip-level activity through a series of descriptive and temporal-spatial analyses. With that, Charlotte's micromobility travel patterns and insights can be identified. Furthermore, e-scooter data has been spatially aligned and analyzed with a variety of travel-related data, such as land use, demographic census block groups, and public transit data at different resolution levels (e.g., micro- and macro-levels) to further explore the e-scooter use cases and the role of e-scooters in first-and-last-mile (FLM) transport in Charlotte. The micro-level analysis focuses on the ride pickup or drop-off (PUDO) points, transit accessibility, and land use characteristics. The micro-level e-scooter trips were further aggregated into the census block groups in a macro-level analysis, which provides insights into e-scooter's travel demand patterns, such as origin-destination matrix, production-attraction of census block groups, and accessibility to e-scooter pickup and drop-off locations. The analyses offer unique sociodemographic perspectives on the intricate dynamics of e-scooter mobility in the Charlotte metropolitan area, which have the potential to be applied to enhance urban transportation services, such as transit accessibility, operations of microtransit and e-bikes. The study was supported by NCDOT Technical Assistance Request Project: TA-2024-06 Charlotte Scooter Data Processing and Travel Pattern Analysis.

4 – A Comparative Analysis of Machine Learning-Based Intrusion Detection Systems for Intra-Vehicle Communications in Connected and Autonomous Vehicles (CAVs) in Rural Areas

Mahsa Tavasoli (NC A&T University)

This paper presents an in-depth comparative analysis of ML-based Intrusion Detection Systems (IDS) for securing CAN bus communications in CAVs operating in rural environments. We evaluated models including Random Forest, SVM, Decision Tree, and LSTM for their ability to detect and classify anomalies within CAN bus communications by utilizing both historical data and real-time inputs. Each model exhibited distinct strengths and limitations in addressing the unique cybersecurity needs of rural CAV systems. The LSTM model achieved the highest detection accuracy at 98.14%, making it particularly effective for identifying time-dependent anomalies, such as repeated communication disruptions. However, the model's extended training duration (36.33 seconds) limits its practicality for real-time applications. In contrast, the Decision Tree model demonstrated the fastest training time (0.02 seconds) and the smallest model size (0.02 MB), making it well-suited for resource-constrained settings where rapid deployment is crucial. Random Forest provided a balanced approach with an accuracy of 97.44% and moderate computational demand, while SVM presented a compromise between complexity and accuracy, ideal for environments with moderate detection needs. Further optimization of the Random Forest model through hyperparameter tuning enhanced its accuracy to 98.94% and reduced the model size from 1.29 MB to 0.52 MB, making it more efficient for resource-limited rural deployments. Our findings underscore the feasibility of deploying ML-based IDS for strengthening CAV cybersecurity in rural regions. Each model's performance in terms of accuracy,

training time, and model size supports the development of adaptable IDS frameworks tailored to the unique challenges of rural vehicular communication networks. 5 – Modified T-FAST Test for Quantifying the Risk of ASR in Hardened Concrete Aline Cristiane Kumpfer Nascimento (NC State University) The alkali-silica reaction (ASR) is a significant durability issue in concrete structures. It occurs when alkali-rich pore solutions react with reactive siliceous aggregates, leading to extensive cracking, which often necessitates costly repairs or complete replacement of the affected structures. The most reliable ASR testing method, ASTM C1293-20a (the Concrete Prism Test, CPT), can take up to two years to produce results. To accelerate ASR assessment, faster methods like ASTM C1260 (the Mortar Bar Test) are commonly used but often produce unreliable results. As a response, the Turner-Fairbank Alkali-Silica Reactivity Test (T-FAST) has shown potential as a faster and more accurate ASR testing method, delivering results within 21 days. Unlike traditional methods that rely on expansion measurements, T-FAST assesses aggregate chemical reactivity by measuring ion leaching in sodium hydroxide solutions. T-FAST has demonstrated good agreement with both ASTM C1293-20a and field expansion data. However, a reliable test for concrete samples is still needed. This study aimed to modify the T-FAST protocol to evaluate concrete mixtures, not just aggregates. It investigated variables like temperature (55°C and 80°C), immersion solution composition, and test duration, assessing their influence on the Reactivity Index (RI) of crushed concrete samples. Results from five aggregates tested with the modified T-FAST protocol were compared with 1year ASTM C1293-20a expansion data. The findings showed a good correlation with the 0.45 RI threshold, indicating suitability for use with crushed concrete samples. 6 – Using Color Measurements to Assess Reclaimed Asphalt Pavement (RAP) Degree of **Activity** Rafaella Fonseca da Costa (NC State University) High content Reclaimed Asphalt Pavement (RAP) mixtures pose a challenge due to uncertainty regarding the activity level of RAP binder during production. This activity level, termed Degree of Activity (DoA), influences the integration of RAP binder into the virgin binder matrix of asphalt mixtures. This study proposes a practical method for measuring DoA using Light Intensity (LI) measurements obtained from the Asphalt Compatibility Tester (ACT). Since darker colors reflect less light, it is hypothesized that LI decreases as the activation level of RAP increases. Thus, LI can provide a quantitative measure associated with DoA for RAP samples. Furthermore, this study compares DoA measurements obtained using the ACT with those obtained using a method associating DoA with Indirect Tensile Strength (ITS) of 100 percent RAP specimens. The two methods showed similar trends, but their measurements

occasionally diverged. Both methods demonstrated an increase in DoA as temperatures rose from 100°C to 155°C, with DoA values exceeding 70% at standard production temperatures (140°C-155°C) for hot asphalt mixtures. The ACT-based DoA measurement approach holds promise for improving material selection and the design of recycled asphalt mixtures. However, further validation with a broader range of RAP sources is required to confirm its reliability and applicability across varying material sources.

7 – Identification and Prioritization of Vulnerable Roadway Segments for Proactive **Resilience Planning and Response**

Matheus Jesus Ribeiro Araújo (NC State University)

Flooding caused by tropical storms, hurricanes, and other weather events can significantly damage pavement infrastructure. Some of the most common issues reported by the North Carolina Department of Transportation are usually associated with immediate damage or long-term effects including failures caused by erosion and weakened bases and subgrade. In addition, infrastructure issues related to these events, such as embankment failures, landslides, and damaged bridges and culverts, significantly impact mobility. It can require substantial resources for rebuilding or rehabilitating the road network and recovering the lost mobility. The main objective of this project is to identify the characteristics that contribute to the vulnerability of roads due to flooding and to identify features that may play a role in improving pavement resilience due to repeated or more severe inundation. Initially, sections expected to be recurrently flooded will be identified through data sources such as the Roadway Inundation Tool (RIT, software that uses LiDAR data to predict riverine and coastal flooding within different recurrence time intervals), official reports, division information, and road closure records. Subsequently, 1) sites reported as damaged after hurricanes, tropical storms, and other weather events and 2) sections predicted to be frequently flooded will be inspected to evaluate the main factors associated with the damage and possible continued effects. Ultimately, the

project aims to analyze the relationship between flood-induced pavement deterioration and the common features and characteristics of pavements and roadway infrastructure that contribute to less resilient roadway segments, providing recommendations to support the development of more durable pavement infrastructure.

8 – Designing Artificial Intelligence Tools for Human-Like Automated Driving

Michael Azage (NC A&T University)

Recent advancements in autonomous driving aim to replicate human decision-making, promising enhancements in safety and user acceptance. Accurately modeling the intricate and adaptive nature of human road navigation remains a significant challenge. This research introduces a practical control system designed and implemented to learn from expert human driving behavior using LSTM networks for predictive tasks. The system processes historice

Recent advancements in autonomous driving aim to replicate human decision-making, promising enhancements in safety and user acceptance. Accurately modeling the intricate and adaptive nature of human road navigation remains a significant challenge. This research introduces a practical control system designed and implemented to learn from expert human driving behavior using LSTM networks for predictive tasks. The system processes historical buffered data, and current sensor to estimate axle torque and deceleration values. Experimental validation results based on sensor data from an automated Chevy Bolt EUV have shown the system's predictive accuracy aligns well with ground truth measurements. Furthermore, the system effectively filters out additive noise with zero mean from both current and predicted chunked pitch values, enhancing its noise resistance. Statistical analyses, including measures of central tendency, coefficient of correlation, mean absolute error, and probability density plots, confirm the system's capability to emulate human-like driving decisions. This approach improves the predictive accuracy and noise resilience of autonomous driving systems, enhancing overall driving safety, comfort, and efficiency by closely mimicking human responsiveness on the road. Additionally, the system enables practical application in real road scenarios with steep inclines or declines by predicting pitch values ahead and adjusting torque and braking accordingly. This behavior correlates with human driver responses, ensuring the autonomous vehicle maintains appropriate propulsion and braking for varying road conditions, ultimately advancing the practicality and reliability of autonomous driving.

9 – Evalute Lane Centering Assist System in Work Zones

Abhinav Sharma (NC State University)

Lane Centering Assist (LCA) systems rely significantly on clear and well-maintained lane markings for reliable operation. In work zones, where inconsistent or worn markings are common, LCA is very likely to malfunction, leading to potential safety hazards. The objective of this research is to capture the potential malfunctions of LCA in work zones and evaluate its safety impacts. To this end, we equip an LCA-enabled vehicle with a multi-sensor system and drive it through work zones with potentially confusing markings to test the LCA performance. The multi-sensor system consists of a centimeter-level GPS, a LiDAR, and three cameras, which produce four datasets, including the subject vehicle's trajectory, trajectories of surrounding vehicles, a 3D representation of the site environment (including geometrics, lane markings, cones), and video footage of the driving environment. With the data collected, we evaluate the LCA performance. The performance metrics include vehicle's lateral deviation, yaw rate, and maximum acceleration, which will collectively capture any drift or steering deviations in response to confusing markings. The research outcomes will help government agencies to understand the effects of LCA malfunctions and develop safety enhancement strategies, such as new methods to remove unwanted markings in work zones.

10 – Project OVAL (On-campus Vehicle Autonomous Launch)

Jimin Yu, Cole Malinchock, Jack Elia, Pratik Thapa, and Suchir Madap (NC State University)

Project OVAL aims to deliver a versatile autonomous service for university and business campuses across the United States. OVAL is a compact, self-driving vehicle measuring approximately 2 feet in height, 3 feet in length, and 1.5 feet in width, designed specifically for campus environments. It is capable of multiple functionalities. This includes campus navigation and additional accommodations to provide student safety and assist those with disabilities. Additionally, OVAL can transport packages, food, books, etc. To provide these functions it is equipped with a locker system that can only be opened through QR code scans or a unique numeric code, a camera with an emergency button for security personnel to monitor during emergencies, an on-board first aid/CPR kit, and a touchscreen display and speaker to assist users with directions or other campus information. With its flexible design and accessible technology, OVAL has limitless potential to enhance campus life and meet the needs of students, faculty, and staff. Image segmentation is utilized to identify traversable paths and avoid any obstacles to perform autonomous navigation. This, along with GPS data, allows the vehicle to find the correct path to its desired destination. Large Language Models are also employed in human-computer interaction to enable real-time

conversation and clear communication, helping to effectively address users' needs. This could include warning about oncoming traffic when crossing a road and providing directions to a lost student.
11 – Navigating the Truck Parking Challenge: A Comprehensive Review of Strategies, Emerging Technologies, and Future Directions
Nana Duah (NC A&T University)
Freight transportation systems play a vital role in the economy of the United States, making adequate truck parking essential for safe and efficient operations. However, a significant gap between truck parking demand and supply has led to challenges including road safety risks, regulatory non-compliance, operational inefficiencies, and environmental impacts. Despite their importance, comprehensive reviews of potential solutions for truck parking are limited. This study addresses this knowledge gap by reviewing the current truck parking management approaches, focusing on intelligent truck parking information systems, data prediction models, and truck pattern analysis. The analysis encompasses various technological solutions, including the sensing infrastructure, GPS technology, and information dissemination methods. The review also examines emerging solutions in smart parking systems and the potential adoption of these solutions to address truck parking challenges. Furthermore, the current challenges in the truck parking problem, the possible solutions, and future scopes in its implementation are also presented.
12 – A Hierarchical Deep Reinforcement Learning Based Approach for Robust Decision- Making of Autonomous Vehicles at Unsignalized Intersections in Rural Communities
Miressa Mamo (NC A&T University)
In rural and suburban areas, unsignalized intersections are frequently encountered, and maneuvering at these intersections poses a significant challenge for autonomous vehicles due to the complex interactions among traffic participants and the associated risks. This informs the need for robust decision-making system which can ensure the safety of autonomous vehicles. Traditional rule-based methods have been investigated to address the problem. These methods provide reliable decision-making at intersections in simple scenarios. However, in complex intersections with numerous participants, accounting for all possible rules becomes nearly impossible. In contrast, deep reinforcement learning techniques outperform rule-based methods by covering large observation spaces and eliminating the need for complete knowledge of the environment. In this works, a hierarchical reinforcement learning-based decision-making architecture based on Gated Recurrent Unit (GRU) and Double Deep Q-Networks (DDQN) is proposed for robust intersection crossing. The proposed technique consists of high-level layer for making decisions and low-level layer for determining an optimal steering to traverse a desired route while considering other traffic users. This approach reduces computational complexity by using a hybrid-reward mechanism and decomposing tasks into two subtasks for more efficient learning. A GRU is used at the input to capture and retain history of observations over time, enabling the network to recognize and mitigate the effects of observation noise. The proposed method is tested in the high-fidelity CARLA simulator, utilizing realistic driving environments and vehicle dynamics to evaluate the robustness of our approach.
13 – A robust Al-enabled information fusion for object detection and scene understanding in rural communities
Tekalign Mengistu (NC A&T University)
Abstract: This work presents a robust fusion approach integrating camera and radar data aimed at enhancing scene understanding of automated driving. The proposed method leverages the complementary strengths of both sensing modalities while addressing the challenges of computational efficiency and performance during adverse weather conditions. By combining high-resolution visual data from cameras with precise depth and velocity information from radar, this approach enables a robust understanding of both static and dynamic objects within the environment. Furthermore, the method presents an attention-based fusion architecture aimed at reducing computational overhead by automatically identifying and selecting sparse features from radar data. Focusing in rural areas, experimental results demonstrate the proposed methods effectiveness and efficiency, showcasing its potential for understanding

challenging scenes caused by adverse weather, thus enabling safe and efficient navigation.

Comparative Analysis of Meta-Heuristics

14 - Mobile Health Clinic Routing Optimization Using Synchronization Constraints and

Sam Jotham Sutharson (NC A&T University)

Mobile health clinics (MHCs) bridge the gap between traditional hospital visits and home-based healthcare delivery for underserved communities and populations in remote areas. This paper proposes a routing strategy that incorporates synchronization constraints to increase the efficiency of MHC routing by utilizing a high-capacity resupply vehicle. Seven meta-heuristic methods (ALNS, Simulated Annealing, Ant Colony Optimization, Particle Swarm Optimization, Genetic Algorithm, Tabu Search) were developed to solve this complex combinatorial problem and a comparative study of them was conducted. The results obtained show that the synchronized routing model is more efficient in routing the MHCs and the comparative analysis serves as a framework for obtaining good solutions in shorter time periods. Analysis of Meta-Heuristics

15 – Network-theory based Approach to Assessment of Bidding Competition in Design Bid Build Highway Projects

Muhammad Ali Moriyani (UNC Charlotte)

Design-bid-build (DBB) is the predominant method of public highway procurement due to its potential to minimize costs, optimize project outcomes, and maintain procedural transparency. However, the intended benefits of DBB are contingent upon the adequacy of competition among bidders. Previous studies have indicated that higher or lower levels of competition can lead to unfavorable project outcomes, including monopoly or winner's curse. Yet the primary indicator of competition employed by State Highway Agencies (SHAs) is the number of bidders, which overlooks the complex competitive dynamics, particularly the competitiveness of certain bidders. Recently, researchers have explored the potential of network theory to model competition among bidders. However, the application has been limited to collaboration networks rather than measuring competition at the contract level. This study addresses this gap by introducing a novel data-driven framework utilizing network theory to model competition that facilitates owners' evaluation of competition adequacy at the contract level beyond the number of bidders. In the proposed approach, competition is modeled as a bidirected network of interconnected bidders, with edges representing their historical frequency of wins and losses. Various centrality measures in the proposed network provide distinct insights into bidder competitiveness. The proposed centrality measures are validated using Spearman's rank correlation coefficient with bidding performance. The results indicate that these proposed measures exhibit stronger correlations with bidding performance than the number of bidders. This approach enables SHAs to obtain a more detailed assessment of contractor competitiveness and competition levels during project letting, thereby ensuring effective competitive bidding practices.

16 – Detecting Red-Flag Bidding Patterns in Low-Bid Procurement for Highway Projects with Pattern Mining

Muhammad Ali Moriyani (UNC Charlotte)

Collusive bid arrangement is among the most prevalent anti-competitive practices in design-bid-build projects, significantly impacting bid prices, which have largely remained undetected proactively by State highway agencies. The primary reason for the ineffectiveness of current practices and state-of-the-art methods in bid collusion detection is their substantial reliance on engineers' estimates. There are various concerns regarding the use of engineers' estimates, including inaccuracy and bid manipulative techniques employed by experienced collusive bidders, such as submitting bids with similar cost structures. This study proposes a novel data-driven collusion red-flag detection framework (CRFD) that utilizes pattern mining techniques and statistical tests to proactively identify contractors exhibiting red-flag patterns without relying on engineers' estimates. The red-flag bidding pattern is defined as a significant difference in the winning rates of a contractor with and without the co-occurrence of other particular contractors. Additionally, a mechanism is proposed to incorporate potential influential factors into the CRFD to enhance detection power or examine possible collusion across different scenarios, such as spatiotemporal factors. The proposed method is anticipated to assist project owners in detecting early signs of bid collusion and ultimately aid in significantly improving their award decision-making processes.

18 – Mechanistic-Based Evaluation of Performance Thresholds for Balanced Mix Design
 Asphalt Surface Mixtures

Omar Othman (NC State University)

Balanced Mix Design (BMD) is an approach to design asphalt mixtures using performance tests seeking to balance the resistance to cracking and rutting. However, BMD is often decoupled from structural design considerations, leading to potential deficiencies in long-term payement durability and increased costs due to premature failures. To address these issues, it is important to define BMD tests thresholds that are based upon performance under the intended conditions. The Virginia Department of Transportation (VDOT) has implemented BMD strategies for lowand moderate-traffic dense-graded asphalt mixtures. Their BMD specification relies on three empirical, yet practical tests: the Cantabro test, with a maximum mass loss of 7.5%, the Indirect Tensile Cracking test, with a minimum Cracking Tolerance Index (CTIndex) of 70, and the Asphalt Pavement Analyzer test, with a maximum rut depth of 8.0 mm. These thresholds were established through a benchmarking study completed in 2018 and are independent of the structure or intended traffic. The objective of this study is to refine the thresholds through the addition of fundamental testing paired with mechanistic performance predictions. For this effort, 18 Virginia-produced surface mixtures were evaluated using VDOT's BMD tests as well as Dynamic Modulus (DM), Cyclic Fatigue (CF), and Stress-Sweep Rutting tests. Additionally, eight of these mixtures underwent DM and CF testing after long-term ovenaging, following NCHRP Project 09-54 protocols. The results helped calibrate the NCHRP Project 09-54 aging models for Virginia materials, which were incorporated into FlexPAVE™ simulations to establish traffic-based BMD thresholds aimed to enhance asphalt mixture durability and performance.

19 – Adversarial Attack towards Car-following Trajectory Prediction and Planning

Zijun He (NC State University)

Car following (CF) is a critical dynamics in traffic flow, which describes longitudinal movement of a vehicle stimulated by its preceding vehicle. To better understand CF dynamics, many CF models have been developed for traffic flow analysis and vehicle control. Motivated by the successful application of Artificial-Intelligence (AI) techniques across different fields, various AI-based CF models have been proposed to learn the CF behavior in the real traffic environment. Based on historical CF state, AI-based CF models can predict the future CF state of target vehicles. In a vehicle platoon mixed with autonomous vehicles (AVs), AVs will plan their trajectories based on historical and predicted movement of other vehicles to achieve driving efficiency and safety. However, AI-based CF models are vulnerable to adversarial attack. The attackers can apply carefully designed disturbance to malicious vehicles which might mislead the AI-based CF models to produce inaccurate predictions. Fed with such problematic prediction results, AVs may plan trajectories representing inefficient and unsafe maneuvers. In this work, we develop an attack framework targeting the AI-based CF models. The disturbance and its allocation will be carefully designed to optimize the attack outcome. We find that with the same attack budget, distributed attack can outperform centralized attack, i.e., allocating disturbance to multiple vehicles getting greater outcome.

20 – Optimizing the Mixture Design of Biochar-Fly Ash Concrete for Low-Carbon Construction

Jonathan Culpepper (Appalachian State University)

With global industrialization continuing to become more prevalent, the atmospheric CO2 content continues to increase. Concrete construction is a key part of development with cement production contributing 7% of the emissions related to the concrete industry. Studies have been done looking at using Supplementary Cementitious Materials (SCM) such as steel slag, silicon fume, and fly ash. Particle size, metal oxide content, and absorption capacity contribute to selection. Cement has long been supplemented with a type of SCM known as a Pozzolan, such as volcanic ash by the ancient romans. More attainable materials like fly ash produce a similar product and have been used as early as the 1930s. Class F fly ash obtained from a local source will be one of the SCMs used in this study. Other materials such as biochar, a carbon rich material derived from biomass undergoing pyrolysis with carbon sequestering properties, has been investigated as an SCM when certain biomasses are used. Arundo donax grass is the biomass of choice for this study due to its high regeneration rate, local availability, and the opportunity to repurpose a plant species with potential to harm other species. Additionally, the biochar used was produced by other graduate students at Appalachian State University. This study aims to investigate and determine the optimal cement replacement ratio of Class F fly ash and Arundo donax biochar by performing various tests (compressive strength, flexural strength), workability, slump, setting time, and flexural strength).

21 - Q-Loc: Visual Cue-Based Ground Vehicle Localization Using Long Short-Tern
Memory

Cole Malinchock (NC State University)

Q-Loc: Visual Cue-Based Ground Vehicle Localization Using Long Short-Term Memory, is a proposed method of utilizing pretrained neural networks to predict the location of an autonomous vehicle. It is a rapid and cost-effective localization method using a sensor ubiquitous in autonomous systems: cameras. We introduce a system that uses vision-based machine learning techniques to detect common landmarks in camera streams and subsequently predict location. The system employs a Faster-RCNN object detection model for landmark identification and a custom Long Short-Term Memory neural network architecture for vehicle localization based on the bounding boxes of the detected landmarks. A Kalman Filter, commonly used in localization, is incorporated to enhance prediction accuracy. To assess Q-Loc's feasibility and effectiveness, we implemented a prototype on a small-scale autonomous vehicle platform equipped with an NVIDIA Jetson Orin and a Zed2i camera, conducting trials on North Carolina State University's Centennial Campus. The campus's complex and varied landscape allows us to evaluate the system's robustness, accuracy, and real-world application potential. Across the 750 meter path, the prototype's results reveal that Q-Loc achieves a mean localization error of 16.57 meters, with a standard deviation of 18.79 meters, demonstrating consistent accuracy across tests. The localization error ranges from as low as 0.11 meters, showing the method's high precision in optimal conditions with low tree cover and more than one landmark identifiable, to a maximum error of 102.49 meters under challenging scenarios with little to no landmarks detected and high tree coverage, highlighting areas for future refinement.

22 – Public Charging Infrastructure for Power Mobility Devices to Enhance Mobility and Inclusion

shokoufeh Valadkhani (NC State University)

In the U.S., 12.1% of the population experiences a mobility disability, with Power Mobility Device (PMD) users traveling 73% less than an average American walks, highlighting significant mobility challenges and barriers to social inclusion. Developing public charging infrastructure for PMDs is essential to enhance mobility and promote community engagement. The researchers at NCSU developed the charging infrastructure for PMD units consisting of an IoT-integrated universal charger for PMD batteries, a connected battery- and PMD-data acquisition and monitoring system, and a mobile app with Al-driven energy consumption estimators. This integrated system aims to empower PMD users, improving their daily mobility, social interaction, and community engagement. Intended for both 120-V and 220-V grids, this charger features a lightweight design, high efficiency, a programmable output range of 50–330W, and robust safety characteristics. An optional Data Acquisition and Sensing System (DASS) monitors critical parameters, including battery voltage, current, and temperature, as well as GPS-based location and environmental parameters, which can be uploaded to a dedicated database for customizing Al-based energy estimators. The mobile app assists wheelchair users by locating accessible public charging stations, planning optimal routes, displaying real-time battery levels, and monitoring the charging process. The app provides real-time battery status and charging cycles when connected to DASS. The App route planner estimates distance, travel time, and battery energy needed based on user-specific data via DASS, enhancing accuracy compared to a generic estimator. The app adheres to the strict recommendations of the Web Content Accessibility Guideline (WCAG) 2.1 AA standard for accessible design.

23 – Pumped Concrete Point of Placement Air System Evaluation

Sunday Akanji (UNC Charlotte)

Specifications regarding the point at which concrete is sampled and tested for air content vary by agency. Some agencies, including the North Carolina Department of Transportation (NCDOT) require point-of-placement testing for acceptance, with the concrete sampled and tested after pumping. Recent research has indicated that although a drop in air content is often measured after pumping, the air bubbles pressurized into solution during pumping can return minutes or hours after pumping. This phenomenon is documented in Ley et al. of Oklahoma State University in several publications. Laboratory and field studies on the air system behavior before and after pumping have resulted in a number of agencies changing their specified point of air content testing from the point of placement (which interrupts work and presents safety and logistics challenges) to testing at the truck before placement. NCDOT is interested in exploring modifications to their specifications related to testing pumped concrete. This work aims to investigate typical NCDOT AA (structural) concrete mixtures with different local materials, pumped using several boom configurations, to assist NCDOT in determining whether they desire to modify their specifications regarding air content testing.

24 – Utilizing Artificial Intelligence for Traffic Sign Detection and Classification for Safe
Operation of Connected and Automated Vehicles in Rural Areas

Mohammed Zakaria (NC A&T University)

This research presents an approach to traffic sign detection and classification tailored for autonomous driving in rural environments. Utilizing the state-of-the-art deep learning techniques, we developed a model capable of identifying and categorizing traffic signs into three primary classes: regulatory, warning, and guide signs. Our study addresses the unique challenges posed by rural roadways, where traffic sign detection is crucial for safe autonomous vehicle operation. To ensure relevance and accuracy, we curated a diverse dataset by collecting images from Google Maps Street View, focusing on rural settings. This dataset was meticulously annotated to train our AI model. The developed model was chosen for its superior performance in real-time object detection, a critical factor for autonomous driving applications. Our model's streamlined classification into three broad categories allows for efficient processing while still providing essential information for navigation and safety decisions. This research contributes to the growing body of work on computer vision applications in autonomous driving, with a specific focus on addressing the needs of rural transportation infrastructure. Our findings have implications for improving the safety and reliability of autonomous vehicles operating outside of urban centers, potentially bridging the gap in autonomous driving capabilities between urban and rural environments.

25 – Using Ground Penetrating Radar to monitor the condition of Pavement Structure Sublayers

Ngonsah Obasi Ndikum Sally (UNC Charlotte)

Moisture content and density are crucial parameters for controlling and assessing the quality of pavement structures, particularly the sub layers such as the base, subbase, and subgrade. Ground Penetrating Radar (GPR), a non-destructive methodology, was used to scan two flexible pavement sites in North Carolina to monitor and determine the quality of the pavement structure layers and the top 2.44 m (8 ft) of the embankment at these sites. The frequencies and amplitudes generated from the scans were used to predict the dielectric constant of each layer material, from which the thickness of each layer within the pavement structure was estimated. Preliminary evidence indicates that the estimated thicknesses from the GPR results match the design thicknesses of the asphalt concrete layer of the flexible pavement at the sites. The ongoing study involves using the predicted dielectric constants to estimate moisture contents and densities of the subbase and subgrade layers, as well as the embankment at different depths, to assess the current integrity of subsurface below the asphalt and base layers of the pavement structures. The outcome of this non-destructive and non-intrusive monitoring methodology can be leveraged to improve pavement construction and maintenance strategies.

26 – Long term Performance of MSE Wall used as Bridge Foundation

Adams Familusi (UNC Charlotte)

A 7m (23 ft) high and 9m (30ft) wide instrumented mechanically stabilized earth (MSE) retaining Wall was constructed to support a bridge foundation as an alternative to pile foundation due to site configuration restrictions. Pressure and settlement data were collected from the sensors installed below the MSE wall and the bridge foundation for approximately six (6) months, starting from the construction period. Numerical analysis of the of the wall's performance using FLAC-3D, a finite difference computer program, was conducted and compared with pressure and settlement readings from the embedded sensors. The simulated pressure and settlement values from the numerical analysis were about 15% and 3% less than the measured pressure and settlement from the sensors, respectively. It was observed that in addition to the interface cohesion and angle of internal friction, one of the main factors contributing to the pressure distribution and settlement around the MSE wall is the value used in the simulation for coupling normal and shear stiffness between the selected fill material and MSE wall facing. This is largely dependent on the method of installation and type of MSE wall facing. Parametric studies are ongoing to better understand the effect of the different reinforcement types on the behavior of the MSE wall and to inform the longer-term performance of the MSE wall towards developing a quide for future reference.

27 – What's the Fuss About the Bus?: How Parent Perceptions of Transit Affect Youth Transit Use in Chapel Hill, North Carolina

Rachel Oommen (UNC Chapel Hill)

The Chapel Hill-Carrboro area of North Carolina benefits from a unique transportation dynamic wherein a 24-route bus system (Chapel Hill Transit), funded in large part by the local university, provides service to both university

students and the general public, completely free of charge. Although the combined population of the two towns is under 100,000 residents, the area's youth have the type of mobility typically offered to those of larger cities. Even so, the design, structure, and culture of the area lends itself to automobile dominance. In light of these conflicting realities, understanding how individuals relate to transportation can highlight avenues for intervention to encourage greater transit use. Thus, my research question is: What are the factors impacting youth ridership of transit in the Chapel Hill-Carrboro area? I hypothesize that Chapel Hill-Carrboro parents have pro-transit ideologies, but in practice caution their adolescent children against bus ridership, resulting in low ridership among this age cohort. It is so rare to grow up in a town that provides free public transit. Youth that grow up in this context are uniquely situated to continue a life-long connection to transit, as the cost barrier is removed for themselves and their peers. Thus, learning the reasons why adolescents do or do not take advantage of such a resource will be crucial for Chapel Hill Transit in understanding not just what they're doing well to retain youth riders, but also what changes could be made to support a transit lifestyle for them in adolescence and beyond.

28 – Efficient Traffic Monitoring Using High-Resolution Aerial Images

Tewodros Gebre and Leila Hashemi Beni (NC A&T University

Remote sensing technology has become increasingly important for real-time, effective monitoring approaches in transportation management. One of the prominent methods of remote data acquisition involves the utilization of drones, which provide high-resolution aerial imagery to enhance data collection and analysis.. However, the processing of high-resolution images, a crucial component of remote sensing, poses significant computational challenges. The sheer size of these images, combined with the intense computational demands of object detection algorithms, can result in prolonged processing times and substantial computational costs, hindering the effectiveness of remote sensing in transportation applications. This study aims at processing high-resolution aerial images for traffic monitoring. We have developed an Adaptive Input Sampler (AIS) to optimize input data volume while maintaining detection performance in remote traffic sensing applications. The AIS utilizes pixel change monitoring and predictive algorithms based on historical object locations and speeds, enabling historical success-based object trajectory extrapolation. By detecting vehicles and selectively sampling image areas, the AIS reduces data input for downstream object detection systems, reducing computational load and improving inference speed. Our experiments demonstrate that the AIS achieves a 96.40% traffic counting accuracy and 95.60% classification accuracy while reducing data size for analysis by up to 79.00%. The AIS presents a promising solution for managing large datasets in traffic monitoring applications, enhancing computational efficiency, and speeding up inference results.

29 – Graph-Powered Defense: Controller Area Network Intrusion Detection for Unmanned Aerial Vehicles

Reek Majumder (Clemson University)

In the last decade, Unmanned Aerial Vehicles (UAVs) have shown significant growth in the network of services, including product delivery, agriculture, environment monitoring and many more. However, UAVs are not secure enough against cyber-attacks, especially on the Controller Area Network (CAN) bus. The CAN bus is a general-purpose vehicle-bus standard designed to allow microcontrollers and computers in vehicles to communicate with each other, primarily connecting different Electronic Control Units (ECUs). In this study, we focus on solving some of the most critical security weaknesses in UAVs by developing a novel graph-based intrusion detection system (IDS) leveraging the Uncomplicated Application-level Vehicular Communication and Networking (UAVCAN) protocol. First, we decode CAN messages based on UAVCAN protocol specification; second, we present a comprehensive method of transforming tabular UAVCAN messages into graph structures. Lastly, we apply various graph-based machine learning models for detecting cyber-attacks on the CAN bus, including graph convolutional neural networks (GCNNs), graph attention networks (GATs), Graph Sample and Aggregate Networks (GraphSAGE), and graph structure-based transformers. Our findings show that inductive models such as GATs, GraphSAGE, and graph-based transformers can achieve competitive and even better accuracy than transductive models like GCNNs in detecting various types of intrusions, with minimum information on protocol specification, thus providing a generic robust solution for CAN bus security for the UAVs.

30 – Real-Time Animal	Detection System	to Enhance	Automated	Driving Safe	ety in R	ura
Roads						

Sita Ram Prasad Martha (NC A&T University)

Animal-vehicle collisions are a significant safety concern particularly in rural communities, resulting in numerous fatalities, injuries, and economic losses annually. Traditional methods like static animal crossing signs depend heavily on driver awareness, making them insufficient for preventing sudden encounters with wildlife. This research presents a real-time animal detection system that can be used for enhancing the safety of automated driving or advanced driver-assistance systems. By leveraging deep learning models, the developed system can accurately detect high-risk species, such as deer and moose, and provide timely alerts to avoid collisions. The system was trained on a comprehensive dataset that includes images captured in varied lighting and environmental conditions, ensuring accurate detection in low visibility settings typical of dawn, dusk, and nighttime driving. This ongoing research seeks to demonstrate high accuracy and responsiveness, with the potential to significantly improve road safety.

31 – Accessing Current and future Implementations of Transit-Oriented Development related Social Housing in the United States.

William Evans and Rongfang Liu (NC A&T University)

This research will explore how integrating social housing policies with Transit-Oriented Development (TOD) can reshape housing affordability in the United States. By examining affordable housing policies across three areas of the United States—Cleveland, OH, Charlotte, NC, and the River COG in Connecticut —this study aims to reveal the potential of U.S. housing policies to support social housing near transit hubs. Through these case studies, the research seeks to illuminate pathways for transforming housing policy to support accessible, affordable housing solutions tied to robust public transit, ultimately offering insights to shape more inclusive urban development strategies.

32 – Teaching Safety: Analyzing North Carolina's Driver Education Program and its Approach to Young Drivers' Perceptions and Interactions with Vulnerable Road Users

Annalisa Sims (UNC Chapel Hill)

My project will analyze the North Carolina Driver Education program and assess how young drivers are taught to interact with Vulnerable Road Users (VRUs). It will evaluate not only the more technical skills of driving in a multimodal environment but will also assess the way the current curriculum and training depicts vulnerable road users, thereby shaping perceptions of drivers. I will look at NC's written curriculum and compare it to other states' that have been identified as exemplary in their inclusion of interactions with VRUs. I will also interview driver education instructors to better understand how they deliver the training, any gaps they see in the current curriculum, and their own perceptions of VRUs. The final deliverable of this project will be a policy paper that provides recommendations for the driver education program. This project aims to support NCDOT's 2024 Strategic Highway Safety Plan, Emphasis area: "Develop and promote public education programs that support education for all road users on safety for pedestrians, bicyclists, and personal mobility users. Strategy: Incorporate interactions with pedestrians, bicyclists, and users of personal mobility in the driver education curriculum."

33 – Utilizing Artificial Intelligence Tools to Assess Physical and Digital Infrastructure for Safe Connected and Automated Vehicle Operations in Rural Areas

Mohammed Zakaria (NC A&T University)

The safe operation of connected and automated vehicles (CAVs) in rural areas presents unique challenges due to the distinct characteristics of rural roadway infrastructure. This research focuses on assessing both the physical and digital infrastructure components crucial for CAV deployment in rural settings. Our study evaluates key physical infrastructure elements, including road surface conditions, lane markings, traffic signs, and traffic lights. We employ advanced deep learning models to analyze and assess the quality and readiness of these components for CAV operations. On the digital infrastructure front, we examine critical elements such as network connectivity, GPS accuracy, high-definition map availability, and the presence of roadside sensors. These digital components are essential for enabling reliable communication, precise localization, and real-time data exchange for CAVs in rural environments. By combining assessments of both physical and digital infrastructure, our research provides a holistic view of the current state of rural roadways for CAV deployment. This comprehensive evaluation helps identify gaps, challenges, and opportunities for improving rural infrastructure to support the safe and efficient operation of CAVs. Our findings contribute to the understanding of rural-specific needs for CAV infrastructure and offer insights for policymakers, transportation agencies, and technology developers. This research aims to bridge the urban-rural

divide in CAV readiness and promote equitable access to advanced transportation technologies across diverse geographic areas. 34 – Mobilizing Mutual Aid: A toolkit for community resource exchange to minimize travel needs **Audrey Compiano (UNC Chapel Hill)** The 2022 National Household Travel Survey indicates that people travel beyond a typical walkshed to access resources daily. The necessity of transportation for accessing resources poses an issue for people experiencing transportation insecurity, which, disproportionately, is people experiencing poverty. Affected households' ability to access resources can be further exacerbated by time poverty, affordability of resources, and relational impacts such as feeling guilty about relying on others for transportation. The inadequacies of current transportation systems warrant the need for alternative solutions that minimize travel needs and address the implications of poverty. Resource exchange through mutual aid projects is a way to leverage existing community resources, minimize travel, eliminate costs, and build solidarity over shared struggles. Mutual aid is an organizational model where collectives coordinate non quid pro quo exchanges of resources at no cost to members, fostering community agency and resilience. Existing discourse does not position resource exchange mutual aid as a transportation insecurity solution, resulting in a lack of supportive resources to implement mutual aid projects that facilitate exchange while minimizing the need for travel. This research will focus on the question: What tools and strategies can be employed to develop resource exchange mutual aid projects that minimize the need for travel in North Carolinian communities? A thorough review of mutual aid projects will be conducted through case study review and interviews, with a focus on tools and strategies for creation and implementation. Research will culminate into a toolkit for community members that supports the replication of mutual aid projects. 35 – Assessing Arterial Performance Using Probe Data: A Comparative Analysis of Capital Boulevard and Concord, NC Sk Nahia Ahsan (NC State University) With the increasing availability of probe data, there is a significant opportunity to enhance our understanding of arterial performance. Probe data provides detailed insights into travel rates, which are crucial for assessing arterial performance and the impacts of signal control. In this study, we are analyzing one month of probe data for Capital Boulevard in Raleigh, NC, in conjunction with Automated Traffic Signal Performance Measures (ATSPM) to see how much better we can understand the system's performance. We want to see whether the findings from this new assessment align with those from our previous study of an arterial in Concord, NC. We again see evidence that the 5th percentile of travel rate can serve as a useful indicator of arterial performance. This result is attributed to the behavior of faster-moving vehicles, whose travel times are more immediately affected by increasing traffic density. By incorporating cumulative distribution functions (CDFs) of travel rates—particularly the 5th, 50th, and 95th percentiles—both analytical and simulation-based models can more accurately represent network performance. Our analysis suggests that CDFs offer a more comprehensive depiction of traffic conditions compared to traditional delay metrics at individual intersections. In this case, we are using TransModeler to develop a simulation model of the arterial. Moreover, in this instance, we are seeking to use machine learning to identify ways in which system performance can be enhanced by making probe-driven enhancements to the way in which the traffic signal control

36 – Preliminary Findings on RP2023-02 Balanced Mix Design for North Carolina Project

Pablo Vestena (NC State University)

system responds to the temporally- and spatially-varying demands.

Since implementation of Superpave Mix Design, states have moved towards an asphalt mixture design approach explicitly concerned with preventing distresses and balancing performance. Throughout the years, some agencies have added performance testing to its protocols, either at design, assurance or quality check phases. In the current specification, NCDOT has only limited rutting evaluation for designing mixtures. To feasibly add new testing protocols, and further recommend thresholds, it is paramount that the current performance properties of North Carolina mixes is well understood and that the State understand the approach that contractors take to mixture design. This work aims to benchmark 14 North Carolina surface mixes (RS9.5B, RS9.5C, and RS9.5D) in terms of simple and inexpensive Balanced Mix Design (BMD) testing (IDEAL-CT and APA), and fundamental tests. Besides that, a survey was conducted to identify the status of North Carolina asphalt plant contractors in terms of size, operation location, training of personnel, and familiarity with BMD protocols. The cracking results suggest that there

for the selected testing protocols. In terms of rutting, the actual thresholds are well above most results, showing that there is room to improve the cracking side without hurting the overall performance. Ultimately, with the understanding of the collective results, the research team identified possible thresholds for design of North Carolina asphalt mixes (laboratory-mixed laboratory compacted) and identified design protocols that could enhance cracking with minor impact on rutting, as COAC and AAMD.
37 – Characterizing the Unique Properties of Natural Fiber Composites Nondestructively
David Warren (Elizabeth City State)
Aircraft manufacturers need sustainably derived thermoplastic composites in order to build environmentally friendly aircraft so that the environmental impacts of air commercial transport is reduced. This research develops non-destructive test methods and structural health monitoring approaches for these materials, aiming to determine what nondestructive evaluation techniques are most suitable for characterizing these natural fiber composites. Considering the non-conductive and dielectric properties of these natural fiber composites, identifying effective NDE methods can pose a challenge. This study investigates these composites using Terahertz Time Domain Spectroscopy, Laser Doppler Vibrometry, an LCR Meter, and ultrasonic techniques to characterize acoustic and electric properties of the Flax Fiber composites. The research also involves optimizing the scanning equipment's parameters in order to achieve the ideal setting for repeatability of data collection. Equipment and software include MATLAB, LabVIEW, SolidWorks, Ultrasonic Transducers, Pulser Receiver, Terahertz systems, Laser Doppler Vibrometer, LCR Meter, and 3D Printing. A Terahertz Time Domain Moisture Experiment identified that Terahertz scanning can effectively detect moisture content in natural fiber composites. A Terahertz distance offset experiment identified the optimum scanning distance a material should be analyzed away from the lens regarding maximum amplitude intensity. A laser doppler vibrometry experiment identifies how guided waves propagate and interact with the natural fiber composite using non-contact vibrational methods. An impedance, inductance, and capacitance test on a wooden tongue depressor identifies the harmonic resonance, dielectric properties, and electrical properties of natural wooden fibers. These investigations successfully identified effective nondestructive evaluation methods, and characterized the unique properties of natural composites.
38 – Analyzing driving behavior distraction during animal crossing in rural road Amir Milad Javadi (NC A&T University)
The rapid advancement of autonomous driving technology provides a potential solution to improve transportation in rural areas. The interaction between the driver and the autonomous vehicle has an impact on road safety. Rural roads have their unique characteristics (i.e., narrow roads, steep hills) and conditions (i.e., animal crossing). This research aims to use the cutting-edge eye tracking technology integrated with the vehicle in the loop, human in the loop driving simulator to investigate the driver's behavior in rural road driving. Findings of the research will help improve autonomous vehicle design and improve rural road safety.
39 – 3D Printed VTOL Mini Flying Wing
Rylan Penley (Elizabeth City State)
The overall objective of this project is for a proof-of-concept vertical take-off and landing flying wing with theoretically better efficiency than a typical fixed wing UAV, as well as having the landing and transportation capabilities of a quadcopter UAV while being faster. The success of this objective would help to ensure a pathway for future UAVs that can be utilized for a multitude of tasks and services. Some of these possible tasks could include, grocery delivery, emergency delivery, search and rescue, and observations. A UAV with combined characteristics of a quadcopter and a fixed wing while also being lighter and quicker could become much more successful than common UAVs at those previously stated tasks. All of these would further compliment the ease of manufacturing, as well as the fact that the body of the UAV would be made entirely from 3D printed materials, therefore potentially cutting down on the overall costs of drone manufacturing.

40 – A Probabilistic Evaluation of Recycled Binder Replacement Limits

Wei Xie (NC State University)

Reclaimed asphalt pavement (RAP) is widely used in US pavement construction for its economic and environmental benefits, but the oxidized binder in RAP can affect pavement performance. While state agencies typically limit recycled binder replacement (RBR) percentages, previous studies have used deterministic analyses that don't fully account for variability in virgin and RAP binder properties. This study conducts a probabilistic evaluation of RBR limits for North Carolina asphalt mixtures, where current specifications allow up to 0.4 RBR with different virgin binder grade requirements based on RBR level. The research analyzed NCDOT Quality Assurance data from 361 virgin binder samples (PG 64-22 and PG 58-28) collected between 2022-2024, along with 33 RAP binders extracted from various North Carolina stockpiles. Bootstrap resampling was employed to expand both virgin and RAP binder datasets to 10,000 points each, enabling comprehensive analysis of blended binder properties using linear blending charts. Complementary testing of a subset of blends of virgin and RAP binder was conducted to verify the accuracy of the linear blending charts for NC materials. The study assessed the reliability of meeting PG 64-22 grade requirements at various RBR levels and virgin binder grades, while also evaluating the statistical similarity between PG 64-22 virgin binders and blends of PG 58-28 and RAP binder at different RBR values to gain further insight. This analysis, combined with low-temperature grading results, aims to develop robust RBR specification recommendations for North Carolina.

41 – Secure Navigation in Connected and Automated Urban Transportation

Ahmad Mohammadi (NC A&T University)

GPS spoofing attacks pose significant threats to the safety and security of Connected and Automated Vehicles (CAV), as it can manipulate navigational data and mislead vehicles into erroneous paths, potentially leading to dangerous situations. To address this problem, we developed a detection algorithm that utilizes onboard sensor data from vehicle to detect these threats in real-time and more effectively. The proposed algorithm processes data from the speedometer and inertial measurement unit (IMU) using artificial intelligence (AI) to forecast vehicle movements. These forecasts are then compared against GPS data to detect various spoofing scenarios, including turn-by-turn, stop, and overshoot attacks. Moreover, the algorithm is equipped to identify sequences of multiple biased attacks that, although individually undetectable, cumulatively lead to significant deviations in vehicle rout over time and lead to dangerous situations such as accidents caused by driving in wrong direction and kidnapping by going to a wrong destination. To assess the accuracy of this algorithm, we simulated four distinct spoofing scenarios—turn-by-turn, overshoot, stop, and multiple biased—from real-world data sourced from the Honda Research Institute Driving Dataset (HDD). Multiple tastings were done using various driving conditions such as days and nights, different speeds in both urban and rural areas. The data were then analyzed by the algorithm. This testing confirms that our model effectively identifies these spoofing attacks with high precision: it detected turn-by-turn, stop, overshoot, and multiple biased attacks with accuracies of 100%, 99.95%, 99.91%, and 97.83%, respectively.

42 – Investigating Automated Shuttle Readiness for Rural Areas: A North Carolina Case Study

Oladimeji Alaka and Dr. Venktesh Pandey (NC A&T University)

Recent decades have seen the potential of automated shuttles in addressing transportation needs for vulnerable communities; however, the infrastructure and community readiness in urban and rural underserved communities for the deployment of these shuttles remains unexplored. This research evaluates the level of readiness of rural counties in North Carolina for implementing autonomous vehicle (AV) technology, focusing on physical infrastructure, digital infrastructure, and social vulnerability using a range of indicators derived from secondary data sources, including road quality, bridge conditions, broadband availability, and socio-economic factors. The geospatial analysis reveals a diverse landscape of readiness across the counties, with variations in physical and digital infrastructure and social vulnerability indices. Despite being rural and located in coastal regions, Camden County emerged as a leading candidate for AV deployment due to the better availability of the internet, good road conditions, and a population in need of autonomous shuttles. This was followed by Halifax, Chatham, and Bladen counties. To further understand regional differences, we used clustering analysis to identify distinct clusters within census tracts that reflect varying readiness levels. While some clusters are well-positioned for early AV deployment, others require infrastructural improvement. Conversely, counties with higher social vulnerabilities indicate a potential need for autonomous shuttle interventions to enhance the livelihood of the population in need of these services. The study findings emphasize the importance of a multi-weighted analysis for readiness assessments that can guide investments and strategic interventions and the potential of data-driven approaches that can be generalized to other states for determining readiness.

4:	B – What do Applicants	Really Need for the	Grant Application	Process?
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Brooke Kongmany (UNC Chapel Hill)

What do grant applicants really need for federal grant applications? Increasing professionalization within the transportation space has increased the complexity of USDOT discretionary grant applications. The application process itself is very complicated with specific details and requirements that applicants must adjust to in order to get funding. Before being considered for funding, potential grantees must submit several documents detailing every component of their proposed project and must go through eligibility requirements before it is passed along for evaluation. All of this complexity can hinder many applicants from obtaining funding for their projects and forces them to redo and reapply for these grants during the next grant cycle. This project will analyze and examine what applicants really need for the grant process and can inform ways to simplify the process in order to relieve some of the burden placed on applicants. This analysis will delve into discretionary grant programs from the FHWA, FRA, and FTA and will include a cross analysis of their similarities and differences along with pros and cons of application materials for both the Federal and applicant sides to conclude what is really necessary and helpful for a successful grant application.

44 – Trajectory Prediction under GPS Spoofing Attacks for HATS: Leveraging Synthetic Data for Enhanced Resilience

Frederick Owusu-Ambrose (NC A&T University)

Highly Automated Transportation Systems (HATS) have gained attention and adoption in the transportation sector as they improve safety by reducing total reliance on human drivers. However, the inherent risk of the capabilities that enable these automations provides avenues for malicious attacks, which can cause HATS to deviate from their intended routes. In this research, we develop an advanced predictive modeling framework designed to forecast the future states of the HATS under adversarial conditions. We predict plausible vehicle trajectories post-attack by leveraging machine learning, state estimation methods, and time series analysis. Using synthetic data to simulate GPS spoofing scenarios, we create a controlled environment to observe system vulnerabilities, analyze potential attack patterns, and forecast likely outcomes. This approach facilitates understanding of disruption impacts, enabling efficient deployment of first responders and informing preemptive adjustments to mitigate safety risks. Our work underscores the importance of traffic safety and system integrity in urban environments, highlighting how accurate forecasting of vehicle trajectories post-attack can significantly enhance the resilience of HATS. This capability strengthens system reliability, contributing to public trust by demonstrating the system's ability to anticipate and respond to unexpected disruptions. This research thus supports a foundation of trust, ensuring that autonomous vehicles remain dependable and resilient components of modern transportation networks, even in the face of cybersecurity threats.

45 – Evaluating the applicability of UAV-based sonar for bridge substructure monitoring.

Quinn Keefer (Appalachian State University)

Currently, NCDOT manages approximately 13,700 bridges, with 8.4 percent of these bridges considered in poor condition. Despite systematic inspection protocols, traditional methods have limitations, such as insufficient monitoring of upstream scour features. UAV based sonar offers considerable benefits compared to traditional methods. The current inspection protocols involve taking soundings at specific points around bridge substructures and making additional measurements after high water events to track changes in the streambed profile. UAV sonar systems are able to capture thousands of points rapidly, yielding a much more detailed view of the streambed and bridge substructure. The Appalachian State Drone team conducted a case study on Huffman bridge along Rhodhiss Lake using a DJI Matrice 600 Pro equipped with an ECT 400S echosounder. This data was validated with multiple ground control measurements taken from a canoe using a measuring rod and D-GPS. Results from the survey were extremely encouraging, with the R-squared of the ground truth and UAV measurements being 0.9. Following the initial data collection, Hurricane Helene swept through Western North Carolina leaving massive damage. To further test the UAV sonar system, the team returned to Huffman bridge and conducted a second data collection. Preliminary results showed massive changes in the bathymetry of Rhodhiss lake, demonstrating a practical application of UAV based bathymetry. Capturing similarly detailed data using traditional methods would require substantially more labor to collect.

46 – Wireless Jamming Mitigation Methods

Wireless jamming attacks pose a threat to the integrity, reliability, and security of modern wireless communication systems, impacting military infrastructure, emergency services, and public safety networks. These attacks interfere with signal transmissions, which can not only compromise critical and highly sensitive data, but also endanger the lives of citizens should there be a significant delay in emergency services. This research project aims to explore effective methods for anti-jamming attacks, along with ensuring wireless communication remains constant and functional under the most hostile environments. To study these effects, we are utilizing HackRF, a software-defined radio, to simulate and analyze various jamming scenarios across different frequency bands. HackRF enables fine control over signal manipulation, allowing for real-time parameter adjustments, filtering, and decimation, which support high-fidelity data collection and analysis. Key methods include FM demodulation and Python-based signal processing to isolate and assess interference impacts on essential communication signals. Our research aims to create adaptive and responsive strategies that reinforce wireless network resilience, such as frequency hopping and power modulation techniques. In summation, we plan to use HackRF as the first stepping stone towards identifying and mitigating the impact of a wireless jamming attacks through the rigorous testing of data and constant analysis of radio signals. Findings from this project will contribute to the growing field of cyber resilience, offering insights into practical mitigation measures against wireless jamming threats.

47 – Urban Air Mobility Flight Operations Risk Assessment Based on Battery Energy Constraint

Yonas Ayalew, Abdul-Rauf Nuhu, Lydia Zeleke, Vahid Hemmati, Abdollah Homaifar, and Edward Tunstel (NC A&T University)

As cities become increasingly congested and environmentally conscious, the need for innovative solutions to address transportation challenges has never been more pressing. Urban Air Mobility (UAM) envisions a future where electric Vertical Takeoff and Landing (eVTOL) aircraft, and other aerial vehicles seamlessly integrate into existing transportation networks, offering efficient, safe, and sustainable alternatives to traditional modes. In this research study, risk assessment of UAM operations and routes considering separation automation and mission structure sensitivity based on energy demand is presented. Identified UAM potential routes in major US metropolitan areas are simulated using agent-based simulation considering level flight conflict management. We evaluated the energy consumption of a hexacopter eVTOL vehicle for all the routes with a mission parameter sensitivity study for operational flexibility and assessed the associated risk level of the vehicle's overall flight energy consumption using statistical metrics. Our results demonstrate that the feasibility and energy demand of the flights can be affected greatly by the vehicle, range of operational routes, conflicts, and different parameter values of the mission structure. This study highlights that a mission parameter-based sensitivity study, that respects the minimum operational and performance regulations, can provide information about possible safety degradation in response to the choice of different airspace structures. Additionally, the statistical approaches reveal the level of risk associated with high energy-demanding flights for the potential routes in two metropolitan regions. These findings provide air transportation modelers with crucial insights for enhancing strategies aimed at accelerating the implementation of advanced mobility and mitigating their operational hazards.

48 – Security Risks in Urban Air Mobility: Evaluating Trojan Attacks on Autonomous Landing Systems

Reza Ahmari (NC A&T University)

In this study, we explored the vulnerabilities of autonomous landing systems in Urban Air Mobility (UAM) vehicles, specifically examining the risks posed by Trojan attacks on deep learning models used for navigation. Trojan attacks are a significant cybersecurity concern, as it inserts hidden triggers within Convolutional Neural Networks (CNNs), leading to misclassifications under specific conditions while maintaining normal functionality under typical operations. We focused on assessing the susceptibility of Urban Autonomous Aerial Vehicles (UAAVs) to these attacks, using models like DroNet, which are widely employed for real-time obstacle avoidance. To investigate this, we collected a custom dataset of over 5,000 images of landing pads, simulating both clean and Trojan-triggered conditions. Our deep learning model was trained on this dataset, and its performance was evaluated under both normal and triggered scenarios. The results revealed a substantial drop in accuracy, from 96.4% on clean data to 73.3% on Trojan-infected data, illustrating the severe impact of Trojan attacks on model reliability, particularly during critical phases like landing. These findings highlight the pressing need for robust defense mechanisms to mitigate Trojan-induced vulnerabilities and stress the importance of further research into enhancing the security of autonomous systems in UAM applications. These applications include navigation during takeoff and landing, obstacle avoidance, and communication with ground control. UAM vehicles have the potential to revolutionize passenger transport,

emergency services, cargo delivery, and surveillance. Ensuring the security of these systems is essential, as any vulnerability could endanger lives, sensitive data, or critical infrastructure. 49 – Spatial Patterns in Logistics Warehouse Development in North Carolina **Graham Bishai (UNC Chapel Hill)** The rise in online shopping has driven construction of fulfillment and distribution centers that can process high volumes of freight headed for doorsteps each day. We analyze the location of these facilities in North Carolina and document a trend towards logistics sprawl, with some countervailing trends toward proximity logistics in large population centers, to facilitate last-mile delivery. We compare the North Carolina results with studies of other North American regions. We couple the geospatial data analysis with interviews with land use planners to understand key factors in the development approval and siting processes. We find that in North Carolina, most logistics facilities are built on land already zoned for industrial activities and therefore are developed by-right. Because of this, local communities and planners have limited mechanisms to mitigate the traffic and road safety impacts of proposed logistics developments. Interviews found varied local attitudes toward logistics facilities across jurisdictions. In some localities, local leaders entice logistics development as part of their economic development strategy, in others such development is viewed more skeptically. As warehouses increasingly develop in spatially deconcentrated and unplanned patterns, we found only limited regional coordination on freight planning to be occurring between North Carolina counties and municipalities. 50 - Enhancing Corrosion Resistance in Civil Infrastructure: The Role of Zirconium-**Doped Blast Media in Protecting Transportation Assets** Ismail Megri (NC State University) The application of zirconium-doped blast media presents a significant advancement in addressing corrosion problems within civil transportation infrastructure, such as bridges, highways, and tunnels. Corrosion poses a substantial threat to the structural integrity and longevity of these critical assets, often leading to costly repairs and safety hazards. By integrating zirconium-treated garnet media into the surface preparation process, this innovative approach not only enhances the adhesion of protective coatings but also actively delivers corrosion inhibitors during blasting. The study reveals that larger particle sizes in the blast media yield a remarkable 28% reduction in corrosion compared to untreated controls, highlighting the effectiveness of this method in real-world applications. This strategy not only improves the performance of protective coatings but also offers a proactive solution to mitigate the effects of environmental factors that contribute to corrosion. As civil transportation infrastructure continues to face challenges from moisture and corrosive agents, the adoption of zirconium-doped blast media could significantly extend the service life of these structures, ensuring safer and more reliable transportation systems for the future.

51 – Impact model validation and case study on overheight collisions with prestressed concrete girder bridges using finite elements.

Seth Cathey (UNC Charlotte)

The accidental collision of prestressed concrete (PC) girder bridges from overheight construction vehicles and objects such as dump trucks with raised beds or excavators on trailers presents engineers with the challenge of evaluating residual strength and serviceable life from field observations of visible damage. Accepting a damaged girder based on visual inspections exclusively may contribute additional safety concerns since damage mechanisms critical to ductile behavior in prestressed concrete, such as strand debondment or prestress loss, can be present without indicative visible indicators. One of the overarching goals of RP2023-06 aims to leverage practical tools and quidance for damage assessment on the strength and durability of laterally-impacted PC girder bridges from parametric finite element simulations and statistical methods using high-fidelity LS-DYNA models which are capable of predicting damage mechanisms (e.g., spalling, cracking, and inelastic deformation). This poster presents validation of the dump truck bed impactor model against recent PC bridge girder collision case study. The case study includes LiDAR scan information and photographs of visible damage.. In this study, the impactor model is evaluated with a primary focus to accurately predict residual deformation and observed damage with a sensitivity analysis of impact location, velocity and bed angle. These results afford the ability to develop pressure-impulse (P-I) statistical curves exclusive to the dump truck model and while the preliminary results are a representation of the collision analysis architecture, the analysis results are used to identify controlling bridge characteristics and investigate generalized P-I statistical curves and simplified impactor model analysis

52 – Today's Science, Yesterday's Past: Photogrammetric Mapping of Hickory Grove Missionary Church Cemetery in Chapel Hill, North Carolina
Barron Allison (NC Central University)
Accurately documenting cemeteries like the historic Hickory Grove Missionary Church Cemetery presents both challenges and opportunities. Traditional records, such as headstones and death notices, provide vital links to the past, but these often lack completeness due to missing markers, unmarked graves, and natural reforestation. By utilizing advanced technologies like Uncrewed Aerial Systems (UAV) and photogrammetry, we aim to capture high-resolution imagery to create precise spatial products that honor and preserve these sites. This project, a collaboration between North Carolina Central University's Department of Environmental, Earth, and Geospatial Sciences (DEEGS) and Department of History, focuses on generating photogrammetric models from drone-captured imagery. These models support historical research by integrating data layers, including GPS and GIS-based cemetery records, which can indicate potential unmarked graves. The results offer a framework for preservation and potential use in planning, environmental justice, and cultural heritage initiatives.
53 – Assessment of the Aging Sensitivity of High Reclaimed Asphalt Pavement Asphalt Mixtures with Recycling Agents
Emilio Turbay (NC State University)
This study investigates the use of various recycling agents (RAs) in-lieu of using soft virgin binders to improve the cracking and long-term aging resistance of asphalt mixtures with high Reclaimed Asphalt Pavement (RAP) content. Two RAP sources and five RAs were evaluated using Short-Term Oven Aging (STOA) and a 1-day, 95°C Long-Term Oven Aging (LTOA) protocols. Performance was measured through the Cracking Tolerance Index (CTIndex) at the mixture scale and Glover-Rowe Parameter (GRP) at the binder scale. The results showed that the RA modified mixtures yielded equal or better CTIndex values at both age levels and associated aging sensitivity compared to the mixtures with soft virgin binders. However, the CTIndex values varied with the mixture source, RA type, and dosage in many cases. A mixture source-specific negative correlation between GRP and CTIndex was observed, confirming the importance of binder properties on mixture cracking resistance. However, given that the mixture source also had a strong impact, this study underscores the importance of LTOA protocols in Balanced Mix Design (BMD) procedures for reliable performance evaluation.
54 – Scooting After Sundown: Understanding Nighttime Usage Patterns and Regulatory Impacts
Lydia Adjetey (UNC Chapel Hill)
E-scooters have emerged as a popular mode of active travel, perceived as an environmentally friendly transport solution. The benefits of e-scooters include reduced congestion and air pollution. A study by NACTO (2019) revealed that shared e-scooter trips in 2019 doubled compared to 2018 and accounted for two thirds of all shared micromobility trips in the US. This trend has ignited academic and government interest in understanding the usage pattern of e-scooter users across the country. Largely, e-scooters are used for commuting, leisure trips, shopping related trips, and errand trips (Hardt et al., 2019). Despite the significant contribution of past research on users' travel behavior, a gap remains in understanding how bans placed on e-scooter usage at night impact users who heavily rely on them for trips. This study seeks to ascertain nighttime e-scooter use, and the impact of nighttime bans on e-scooter use by analyzing a survey of e-scooter users in over twenty U.S. cities, including nine cities with nighttime e-scooter bans. Preliminary findings indicate that riders generally feel safe (85%) using e-scooters at night. This is reflected in the leading e-scooter trips of commuting to/from school (38%) and attending social gatherings (48%). In the absence of e-scooters at night, users shift their transport modes to walking, taxi cabs/ ride hailing, and bus/ shuttles which they find relatively unsafe with scores of 19%, 45%, and 20% respectively.
55 – User's Preference for Trip Planner Interface and Factors Influencing Sustainable Transport Choices in Rural and Urban Areas
Ridwan Tiamiyu and Dr. Venktesh Pandey (NC A&T University)
Promoting sustainable transportation modes requires understanding the factors influencing user behavior and preferences. The study aims to examine the determinants of transportation choices in rural and urban areas,

focusing on behavioral and infrastructural factors, and assesses user preferences for trip planner interfaces. To achieve this, a survey was conducted to identify key insights into what influences individuals' choices for sustainable transportation. Results highlight strong support for trip chaining features, with 40% of respondents favoring the ability to plan multiple destinations and 41% preferring to select different modes for trip segments. Cost and travel time information emerged as top priorities, with 66% and over 50% of respondents, respectively, ranking them as essential criteria. The findings reveal significant disparities between urban and rural respondents. Urban participants were more receptive to sustainable transportation modes, while rural respondents identified poor infrastructure, limited public transit options, and longer travel distances as primary barriers. Across all demographics, practical information like avoiding congestion, road safety, and amenities such as gas stations and medical facilities were highly valued, while environmental data, such as carbon footprint, ranked lower in importance. The study emphasizes the importance of user-centric trip planner interfaces that prioritize cost, convenience, and safety to foster broader adoption of sustainable transportation. These insights emphasize the need for targeted infrastructure improvements, enhanced public awareness, and user-friendly digital tools to bridge the gap between urban and rural transportation needs and preferences. By addressing these challenges, this research provides actionable recommendations for promoting sustainable travel behavior.

56 – Mileage-Based User Fees: Addressing Equity and Behavioral Changes in North Carolina's Transportation System

Rifa Tasnia (NC A&T University)

Our research explores mileage-based user fees (MBUF) as a sustainable solution to North Carolina's declining motor fuel tax revenues, which are increasingly strained by the rise of fuel-efficient and electric vehicles. MBUF charges drivers based on miles traveled, offering an equitable distribution of infrastructure costs across geographic and demographic groups while supporting the state's long-term transportation funding goals. The empirical data for this paper is obtained through "SUMTC" in April, 2024, in the North Carolina State. Our study focuses on three key objectives: (1) analyzing behavioral changes in individual and freight travel under varying MBUF rates, such as reduced travel demand, increased carpooling, shifts in departure times, and higher adoption of fuel-efficient vehicles; (2) assessing MBUF's equity implications to ensure a fair distribution of cost burdens. A SP-survey and discrete choice modeling were used to assess travel behavior and mode preferences under hypothetical MBUF scenarios. Results show that 58% of respondents are willing to adopt MBUF if per-trip cost increases remain minimal. Urban respondents prioritize shorter travel times, while rural travelers value cost savings. Younger individuals are more MBUF-sensitive, while older adults are less likely to shift modes. Analysis on large-scale networks reveal that differential rates encourage higher-shifts to transit, carpooling, or park-and-ride options, show some reduction in congestion and emissions in urban areas by encouraging shifts to transit, carpooling, or park-and-ride options. Findings provide actionable-insights for the NCDOT to design equitable MBUF policies, implement effective pilotprograms, and support resilient infrastructure funding while addressing future transportation challenges.

57 – Equitable Flood Impact Analysis Modeling Transportation and Water Infrastructure Interoperability

Rifa Tasnia (NC A&T University)

Flooding poses a significant threat to transportation infrastructure, yet research on the effects of dynamic flood levels on road networks remains limited. Smart cities can leverage digital data on travel demand, infrastructure, and water levels to improve integrated flood management and promote social equity. This approach could specifically benefit vulnerable populations without vehicle access. Traditional traffic models do not consider terrain and elevation, which limits their ability to assess flood risks during a disaster. For state-level planning, this omission affects resource allocation and also long-term resilience strategies. The NCDOT Resiliency Report highlights the importance of resilient transportation infrastructures. Our study aims to capture the intertwined nature between water and transportation infrastructures, evaluating flood risks and their impact on road networks. We develop an interoperable digital twin framework that integrates road networks with simulations of rising water levels, focusing on rerouting strategies during floods to assess infrastructure vulnerabilities in both Hyde County, NC (a rural area) and Wilmington, NC (an urban area), Using tools like SUMO, Python, and QGIS, alongside elevation and HAND datasets, we simulate flooding scenarios to identify high-risk roads and intersections. Our findings indicate that (a) open-source tools can capture the impacts of rising water levels in identifying submerged roads, which show up as transverse or longitudinal lane closure in traffic simulators, enabling dynamic rerouting decisions, and (b) interoperable flood and water infrastructure models can enable prompt identification of at-risk roads and mitigate flash flooding events. Our findings can help facilitate better disaster preparedness and response strategies.

58 – Environmental Monitoring to Support Revised Steel Pile Corrosion Protection Specifications
Nazmuz Sakib (NC State University)
Premature corrosion of steel piles supporting bridges in North Carolina has been observed in many sites across the state, which may lead to significant maintenance costs and reduced structural longevity of these structures. Protective coatings have been observed to fail within 20 years, far earlier than anticipated. This research project, conducted in collaboration with NCDOT, aims to address this issue by developing a data-driven framework to improve corrosion protection strategies. The study includes comprehensive environmental monitoring at bridge sites prone to corrosion as well as control sites with minimal corrosion to compare conditions. A field-deployable monitoring system has been developed, integrating pH, dissolved oxygen, electrical conductivity, temperature, turbidity, and water depth sensors. Powered by solar energy and equipped with GSM communication for real-time data transmission, the system collects continuous data on factors affecting corrosion. Additional field sampling provides detailed lab analysis of parameters such as chloride and sulfate concentrations, establishing correlations with sensor data. A literature review will examine the effectiveness of existing protective coatings and include a comparison of standard corrosion prevention guidelines across different states. The project will use the collected data to identify critical environmental factors contributing to accelerated corrosion and recommend revised coating specifications tailored to site-specific conditions. This research will result in actionable insights for NCDOT, including specification criteria, updated protective policies, and cost-effective solutions for extending steel pile service life. By addressing this critical infrastructure challenge, the project aims to enhance the durability and safety of bridges statewide.
59 – Performance evaluation of a Freeway segment using microscopic simulation

Md Abdullah Al Hasan (NC State University)

This study aims to evaluate the performance of a freeway segment in Portsmouth, Virginia, using TransModeler 7.0. The primary focus is to assess whether the freeway operates efficiently, analyzing key performance metrics. We selected the weaving segments to understand the challenges faced by drivers in decision-making for gap selection, which often lead to safety critical scenarios and increased travel times. We modified the existing Portsmouth simulation model by incorporating additional sensors at the freeway segments to capture dynamic flow patterns (speed, travel time, headway, lane changing events). Simulations were segmented into 15-minute time intervals for peak hours. We conducted a headway analysis which gives the estimation of the saturation flow rate. Additionally, we determined the cumulative distribution function (CDF) of travel times and identified their distribution through percentile values to identify slow and fast-moving vehicles. Our analysis also includes speed evaluation, lanechanging behavior, and a detailed examination of weaving actions within critical segments. The research outcome will provide insights into driver behavior in weaving sections, congestion management and overall network connectivity. In future, the policymakers can implement the improvement techniques such as VSL, ramp metering, etc.

60 - Enhancing Efficiency and Service Quality at License Plate Agencies in North Carolina

Mohammad Ashraf Ali (NC A&T University)

License Plate Agencies (LPAs) in North Carolina are vital for DMV-related services like titling and registration but face challenges in customer satisfaction and business profit in the existing transaction-based compensation model. This research, part of the ongoing RP2025-12 project funded by NCDOT, aims to address these issues by creating tiered, data-driven compensation models focused on customer service, financial viability, and technological alignment. Key findings from the review of LPA-related literature and compensation models from other domains highlight the need for performance-based contracts with metrics like customer satisfaction and error rates. Recommendations include system upgrades, self-service kiosks, and online service promotion to improve efficiency and reduce wait times. Research across other service industries shows that tailored compensation strategies, such as practical discounts or experiential rewards, align compensation with service expectations and ensure operational continuity. Furthermore, data-driven analysis reveals that complaints are uncorrelated to the transaction volume handled by the LPA and are likely governed by factors such as service quality, employee behavior, and facility accessibility, emphasizing the role of staff training, workflow optimization, and infrastructure improvements in enhancing customer satisfaction. State comparisons reveal diverse fee structures, such as Florida's fixed fees and Pennsylvania's market-driven rates. Texas and Louisiana rely on private providers, using convenience fees to

enhance customer experience, with regulatory frameworks ensuring accountability. This ongoing study clarifies issues surrounding LPA operations, service obstacles, customer complaints, and areas for improvement. The findings aim to enhance customer satisfaction, support future contract designs, and provide a model for similar systems nationwide.

61 – Utilization of qualitative interview findings to mobilize community members and decision-makers to implement evidence-based cross-sector Safe Systems interventions

Audrey Payne (UNC Chapel Hill)

Despite declines in fatal traffic injury over the last few decades, surveillance data indicate that progress has stalled in recent years, even rising since 2022 in NC and across the nation. For the most vulnerable road users (pedestrians, cyclists), fatal crashes are on a precipitous rise. Significant racial and socioeconomic inequities exist in serious and fatal road injury with American Indian and Alaskan Natives experiencing more than twice the fatality rate compared to the general population, for example. In response to this issue, UNC Injury Prevention Research Center has adopted Vision Zero (VZ), a strategy to eliminate all traffic deaths and severe injuries, while increasing safe, healthy, equitable mobility for all persons. Though there is a rise in popularity of VZ in the US, there is still a need to address gaps and limitations to realizing VZ in communities. This project utilizes interview findings to create infographics that will mobilize community members with a vested interest in road safety (e.g. government leaders, constituents, etc.) about interventions that integrate the Safe Systems Approach (SSA) and advance the mission of VZ. Infographics are informed by interviews conducted with SSA and VZ thought leaders, implementers, and communication professionals providing perspectives on priority issues, successful interventions, and common themes related to transportation safety. This presentation reviews findings from the interviews and how the analysis process will inform the creation of infographics to be used to mobilize decision-makers on what interventions can be implemented to address the concerns of the communities they serve.

62 – Enhancing Traffic Safety and Efficiency in North Carolina: A Framework for Optimized Truck Parking and Reservation Systems

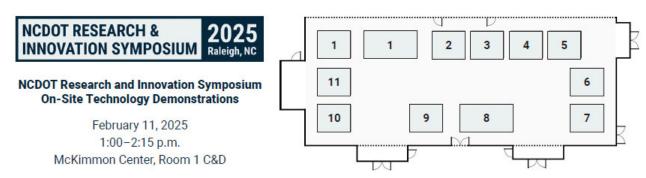
Komal Gulati (NC A&T University)

Truck parking shortages along North Carolina's critical interstates—including I-26, I-77, I-85, and I-95—have resulted in illegal parking on freeway shoulders and interchange ramps, creating serious safety hazards and operational challenges. To address these issues, this research identifies and prioritizes candidate locations for additional truck parking along these corridors, solved as a facility location problem using geospatial prioritization. The prioritization framework evaluates parking size, safety metrics (number and type of crashes), proximity to amenities, detour times from existing facilities, and potential parking capacity for both short-haul and long-haul vehicles. These factors ensure selected sites meet trucker needs while enhancing regional safety. Building on these findings, budget scenarios are analyzed to optimize resource allocation. Under a high-budget scenario (\$7.5M per lot), 19 of 519 state-owned parcels are shortlisted, while under a low-budget scenario (\$3.5M per lot), 49 locations are selected. These optimized solutions maximize coverage and cost efficiency, addressing 90% of the unmet demand for additional truck parking capacity. To further improve parking efficiency and safety, a parking reservation model is developed as a complement to the facility location framework. This model integrates a Markov Decision Process (MDP) to simulate truckers' decision-making processes and a Mixed-Integer Linear Programming (MILP) model to optimize parking allocation and minimize costs. Reinforcement learning techniques enable the system to dynamically adapt to fluctuating demand and operational constraints. These findings provide policymakers with actionable strategies to reduce illegal parking, enhance safety, and improve freight mobility across North Carolina.

Appendix I – Tech Demos

Tech Demos

The 2025 R&I Symposium will feature a new on-site tech demo session, giving attendees an up-close look at a range of interesting and cutting-edge technology applications in the transportation space.

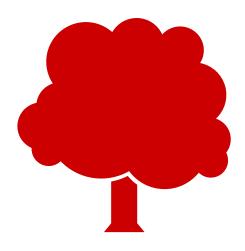


Booth	University	Technology	Booth	University	Technology
1	NC State	Tethered and training drones	7	NC State	Small-scale automated vehicle testbed
2	Elizabeth City State	h City State Multiple drones 8		East Carolina	Work zone intrusion detection and alert device
3	UNC Charlotte	Wireless power transfer (WPT) technology	9	UNC Charlotte	Automated vehicle control system
4	NC State	Power wheelchair charging system	10	NC A&T	Automated vehicle teleoperations platform
5	UNC Chapel Hill	Tactile walking surface indicators	11	NC State	Driving simulators
6	NC State	Small-scale automated vehicle	Outside parking area	NC State	Full-size automated vehicles

The tech demo session will be 75 minutes long on Day 1 of the Symposium, and will primarily be held indoors in a large room.



Weather permitting, selected demos will take place outdoors due to space, logistics, and safety considerations. This includes (but is not necessarily limited to) full-size vehicles and untethered drones.



Interested in sharing a demo?

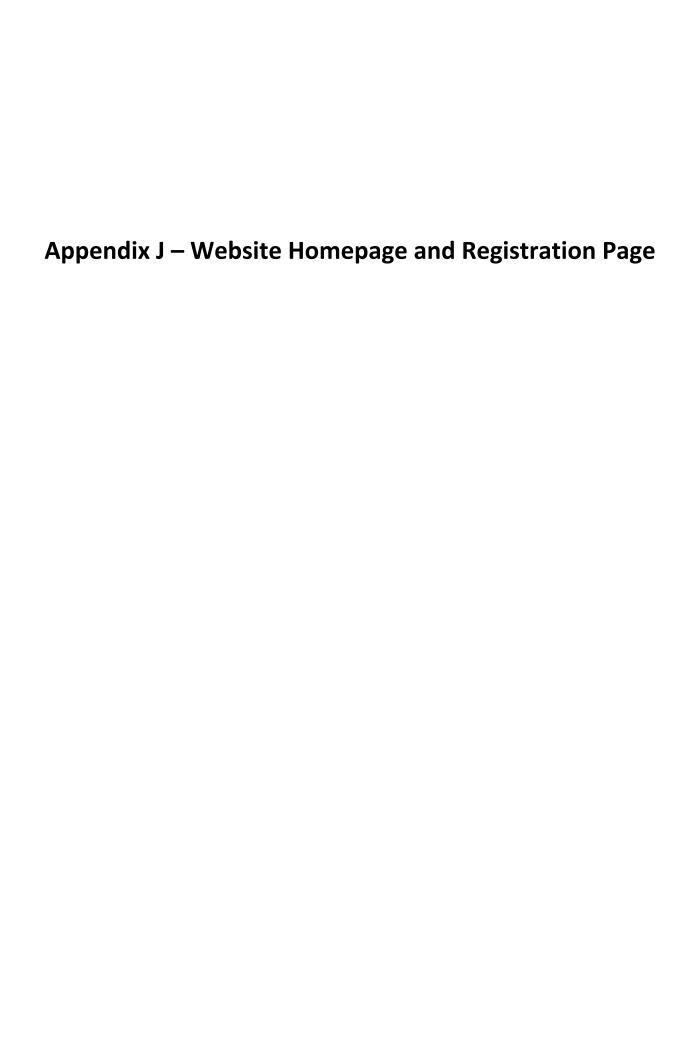
Proposed tech demos will be evaluated and selected by the event planning team in consultation with subject matter experts.

The standard demo setup consists of: one eight-foot table, two chairs, access to 120 volt power, and shared wireless internet.

If your demo has additional space or infrastructure requirements, or would need to be done outdoors, please note that in the form, and the event planning team will get in touch to discuss.

Any demo that includes a powered-on drone is subject to additional requirements and approval from the NC State Drone Team, and drone pilots must be FAA Part 107 certified.

Tech demo submissions are now closed.





NCDOT Research and Innovation Symposium

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Register

This event has concluded and registration is closed.

Jump to a Section

<u>Virtual Attendee Registration (CLOSED)</u>

<u>General Attendee Registration (CLOSED)</u>

NCDOT Employee Registration (CLOSED)

Important registration info

- > Credit card payment only is accepted for online registration.
- > An NC State University PCard cannot be used for payment.
- > NC State University participants may also pay with a Project ID number.
- > Need to pay by check or make a group registration?
- > Email researchinnovation@ncdot.gov for instructions.

About the R&I Symposium

- > A two-day event with plenary, breakout, and poster sessions.
- > In-person capacity is limited; register early for the lowest cost and guarantee your spot.
- > NC Professional Engineers can earn up to 9 PDHs for this event.



> Agenda

QUESTIONS?

Email the planning team at ITRE

Accessibility Privacy Log In



NCDOT Research and Innovation Symposium

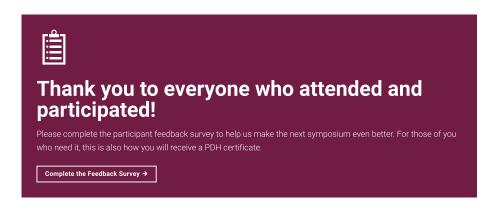
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February 11-12, 2025 in Raleigh

The 2025 NCDOT Research and Innovation Symposium (formerly Summit) was held at the McKimmon Center at NC State University.

Attendees included NCDOT staff, researchers, students, and other transportation industry professionals exploring the latest in research and innovative practices, in a hybrid in-person and virtual format.



UPDATES

The 2025 R&I Symposium event photo gallery is now available

View on Google Photos →

The 2025 Symposium has concluded

This website will remain online for the foreseeable future as an informational reference, and will be updated with any news of future iterations of the event.

The Call for Presentations is now closed

Thank you to everyone who submitted an abstract!

Tech Demos are coming to the 2025 Research & Innovation Symposium

Attendees will get an up-close look at a range of interesting and cutting-edge technology applications in the transportation space.

Submit a tech demo idea →

One or more scholarships up to \$2,500 will be awarded for student poster presentations!

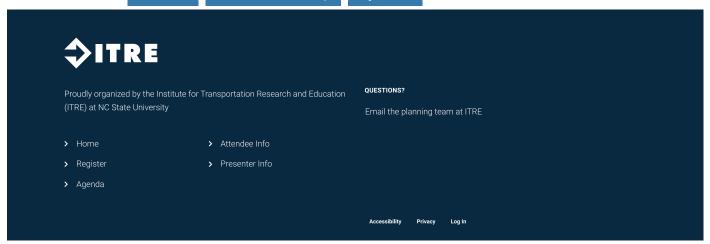
More details will be shared closer to the Symposium.

Add to your calendar:

Outlook on web →

Download .ics for Outlook on desktop →

Google Calendar →

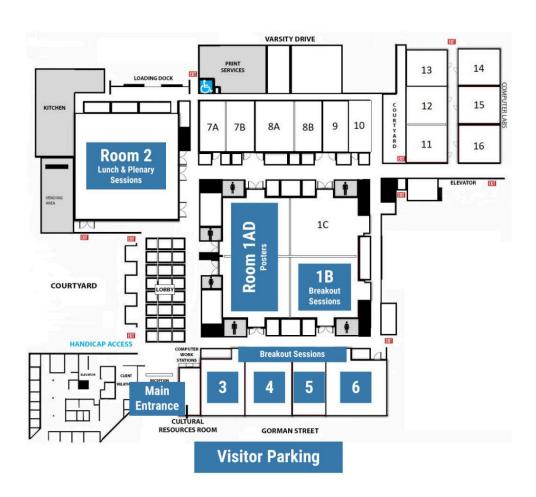


Appendix K – Attendee Info and Venue Map

Attendee Info



Venue Map



Location

Parking

Parking in the front lots of the McKimmon Center is free and usually plentiful. There are three smaller parking lots on each side of the Center that are reserved for University employees. Visitors are asked to park in designated visitor parking spaces in order to avoid ticketing.

Area Hotels

There are many hotels conveniently located near the McKimmon Center in Raleigh, including the StateView Hotel on campus.

More info and promotional rate codes are available at the McKimmon Center's Hotel page.

Appendix L – Post Event Feedback Survey

Participant Survey

Please complete the participant evaluation survey to help us make the next symposium even better. For those of you who need it, this is also how you will receive a PDH certificate.

Your Name(Required)
First
Last
Your Email(Required)
Enter Email
Confirm Email
Do you need a PDH certificate?(Required)
No
How did you participate in the 2025 NCDOT Research & Innovation Symposium?(Required)
In-person only
Virtual only
Hybrid (attended some sessions in-person and
viewed others virtually)
Which days did you attend?(Required)
Both Days (Tues-Wed, February 11-12)

Day One only (Tues, February 11)
Day Two only (Wed, February 12)
Was this your first time attending a NCDOT Research & Innovation Symposium?(Required) Yes No
Which business sector best describes your professional role as a Symposium participant? (Required) Academia / Research (non-student) Advocacy Engineering Government / Public Sector Law Enforcement / Judicial Planning Public Health Public Policymaker Technology Student
Other Sector
Which of the Symposium session topics did you attend or were most interested in? Select all that apply.(Required) Connected and Autonomous Vehicles
Enviromental
Hydraulics
Implemented Research Products
Innovative Technologies, Projects or Process
Integrated Mobility / Multi-modal
Machine Learning / Artificial Intelligence
Pavement & Materials / Operations & Maintenance
Planning & Policy

Roadway Design
Structures, Construction & Geotech
Traffic & Safety
Transportation Network Resilience
Uncrewed Aerial Systems / Vehicles (USAs/UAVs)
Poster Presentations
Which topics would you like to see included or expanded upon in a future Symposium? O of 1000 max characters
Which were your favorite sessions or presentations, and why? Refer to the Symposium Agenda to recall titles and presenter names.
0 of 1000 max characters
Which were your least favorite sessions or presentations, and why?
0 of 1000 max characters

Please rate your satisfaction with these aspects of the Symposium.

Ove	erall quality of sessions & presentations(Required)
	Extremely Satisfied
	Somewhat satisfied
	Neither satisfied nor dissatisfied

Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Overall usefulness of presentation content(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Meeting space (McKimmon Center)(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Event location (Raleigh / Triangle Region)(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Virtual Technology (Zoom)(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied

Extremely dissatisfied
Does not apply
Food & beverage service(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Event organization (Registration, check-in, staff support, etc.)(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Event communication (Website, emails, etc.) (Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied
Extremely dissatisfied
Does not apply
Costs to attend (Registration fee, travel expenses, etc.)(Required) Extremely Satisfied
Somewhat satisfied
Neither satisfied nor dissatisfied
Somewhat dissatisfied

	Extremely dissatisfied
	Does not apply
	Overall value of the Symposium(Required) Extremely Satisfied
	Somewhat satisfied
	Neither satisfied nor dissatisfied
	Somewhat dissatisfied
	Extremely dissatisfied
	Does not apply
	What aspects did you like most about the Symposium or vorked well for you?
) of 4000 was all are stars
C	of 1000 max characters
у 	What aspects did not work well or what suggestions do you have to improve future Symposiums?
 - 	f you were to attend a future Symposium, which attendance format would you prefer?(Required) In-person only
	Virtual only
	Hybrid with both in-person and virtual options

Appendix M – Attendee Feedback Survey Results

2025 R&I Symposium Attendee Feedback Survey Results

After removing 3 duplicate submissions, 123 total responses were received.

How did you participate in the 2025 NCDOT Research & Innovation Symposium?	Count	Percentage
In-person only	107	86.99%
Virtual only	15	12.20%
Hybrid	1	0.81%

Which days did you attend?	Count	Percentage
Both days	101	82.11%
Day 1 only	11	8.94%
Day 2 only	11	8.94%

Was this your first time attending a NCDOT Research & Innovation Symposium?	Count	Percentage
Yes	78	63.41%
No	45	36.59%

Which business sector best describes your professional role as a Symposium participant?	Count	Percentage
Engineering	40	32.52%
Government / Public Sector	40	32.52%
Academia / Research (non-student)	21	17.07%
Student	14	11.38%
Other Sector	2	1.63%
Planning	2	1.63%
Technology	2	1.63%
Advocacy	1	0.81%
Public Health	1	0.81%

Which of the Symposium session topics did you attend or were most interested in?	Count
Traffic & Safety	60
Connected and Autonomous Vehicles	48
Integrated Mobility / Multi-modal	46
Innovative Technologies, Projects or Process	45
Planning & Policy	41
Transportation Network Resilience	40
Poster Presentations	40
Machine Learning / Artificial Intelligence	38
Roadway Design	37
Structures, Construction & Geotech	37
Pavement & Materials / Operations & Maintenance	33
Environmental	29
Hydraulics	22
Implemented Research Products	21
Uncrewed Aerial Systems / Vehicles (USAs/UAVs)	18

If you were to attend a future Symposium, which attendance format would you prefer?	Count	Percentage
In-person only	59	47.97%
Hybrid with both in-person and virtual options	56	45.53%
Virtual only	8	6.50%

Please rate your satisfaction with these aspects of the Symposium			
Aspect	Average	Std. Dev.	
Overall quality of sessions & presentations	1.58	0.57	
Overall usefulness of presentation content	1.42	0.66	
Meeting space (McKimmon Center)	1.65	0.64	
Event location (Raleigh / Triangle Region)	1.8	0.47	
Virtual Technology (Zoom)	1.24	0.84	
Food & beverage service	0.99	1.06	
Event organization (Registration, check-in, staff support, etc.)	1.81	0.53	
Event communication (Website, emails, etc.)	1.7	0.61	
Costs to attend (Registration fee, travel expenses, etc.)	1.58	0.74	
Overall value of the Symposium	1.63	0.58	
Extremely satisfied = 2			
Somewhat satisfied = 1			
Neither satisfied nor dissatisfied = 0			
Somewhat dissatisfied = -1			
Extremely dissatisfied = -2			

Open-ended questions

Responses to open-ended questions were summarized using the Google Gemini 2.5 Flash large language model (LLM). The summaries were initially reviewed by the event planning team and found to be appropriately representative of the raw text response. The summaries then went through a quality-control check in Gemini. Finally, they were manually edited as needed. Gemini was accessed via a NC State University license, and the inputs were not used for model training.

Which topics would you like to see included or expanded upon in a future Symposium?

Diverse Interests and General Satisfaction

The feedback indicates a broad range of interests among attendees, with many expressing general satisfaction with the variety of topics presented at the symposium. Phrases like "great mixture of topics," "good mix this year," and "wide variety of topics presented" appeared frequently, suggesting that the current approach to topic selection is largely successful.

Demand for Practical, Implementable Research

A recurring theme is the desire for more practical, "useful," and "implementable research findings." Attendees are interested in topics that have direct applications and real-world impact, moving beyond purely theoretical discussions. This also extends to a desire for presentations that acknowledge federal grants, indicating an interest in funding avenues for research.

Technology and Innovation remain popular

Several responses highlight a strong interest in technology and innovation. Artificial Intelligence (AI) and Machine Learning (ML) were frequently mentioned, particularly in the context of traffic, safety, and geotechnical engineering. Other technological areas of interest include LiDAR and imagery usage, innovative data collection methods, and general "innovative technologies, projects or processes."

Focus on Safety and Infrastructure

Traffic safety remains a high-priority topic, with specific mentions of intersection and corridor conversions, road diets, RCIs, and general "traffic safety related topics." Alongside this, there's a consistent call for more content related to fundamental infrastructure, including roadway design and engineering, asphalt pavement, structures, construction, and geotech.

Emerging and Specialized Areas of Interest

Attendees also expressed interest in more specialized and emerging areas. These include flood warning systems, cybersecurity for transport IT networks, adaptation strategies to climate change, active transportation, complete streets, and multi-modal development, including bike-ped infrastructure. There's also a specific request for more rail and transit-specific topics.

Room for Expansion and Deeper Dives

While generally positive, some feedback suggests opportunities for deeper dives into specific subjects. Examples include expanding on traffic signal design, providing updates on disaster rebuilding efforts like Hurricane Helene, and exploring the "nuts and bolts" of autonomous vehicle systems. The idea of incorporating more student presentations was also positively noted.

Which were your favorite sessions or presentations, and why? Refer to the Symposium Agenda to recall titles and presenter names.

Focus on Real-World Relevance and Current Events

A recurring theme in the feedback is the strong preference for sessions directly addressing current events and real-world challenges. Presentations on Hurricane Helene efforts and their impacts were frequently cited as favorites, highlighting the value attendees place on timely and relevant information. Future R&I planners should consider prioritizing topics that resonate with current industry concerns and providing updates on ongoing initiatives.

One-on-One Interaction in Poster Sessions

The poster presentations consistently received high praise. Attendees appreciated the opportunity for one-on-one conversations with presenters, finding it easier to gain a clear synopsis and engage in direct discussion. This format fostered deeper understanding and personalized engagement. Those planning future events should consider expanding or enhancing poster sessions, recognizing their unique value for attendee interaction and knowledge transfer, particularly for student involvement.

Engaging Presenters and Novel Topics Drive Interest

The impact of a presenter's style and the novelty of a topic were significant factors in session preference. Seth LaJeunesse's "relaxed but very informative" style, Tim Brock being "a really good presenter," and Alyson Wilson's ability to make data science "relatable to a broad swath of the audience" were some of the specific mentions. Topics like the "Traffic Garden" and "Geospatial Cemetery Mapping" were highlighted for their novelty and community engagement. Future event planners should consider prioritizing selecting engaging speakers and including unique, innovative topics that spark interest and showcase diverse applications.

Emerging Technologies: Interest in AI and UAS

Sessions focusing on emerging technologies, particularly Artificial Intelligence (AI) and Unmanned Aircraft Systems (UAS), garnered considerable interest. The AI panel discussion and presentations on drones (UAS) were frequently cited as favorites. This indicates a strong desire among attendees to learn about cutting-edge advancements and their implications. Future symposia should continue to feature and potentially expand content related to AI, UAS, and other developing technologies.

Accessibility and Integrated Mobility: Growing Importance

Several attendees highlighted sessions on pedestrian accommodations, accessibility principles, and integrated mobility as favorites. The "Walk a Mile in Someone Else's Shoes" session was praised for its impactful content and presentation. This suggests an increasing awareness and demand for information on inclusive design and multi-modal transportation solutions. Future agendas should ensure robust coverage of accessibility, pedestrian safety, and integrated mobility topics.

Opportunities for In-Depth Discussion

While some attendees found the lunch discussions interesting, others felt they were not universally engaging. However, the desire for in-depth discussion was evident in comments about Dr. Doll's "pertinent and interesting" but "rushed" presentation and Dr. Hummer's "very large topic that needs a follow-up." This indicates a potential need for dedicated sessions or formats that allow for more extended Q&A or deeper dives into complex subjects. Future planners may consider incorporating longer session times or moderated discussion panels to facilitate more thorough exploration of key topics.

Which were your least favorite sessions or presentations, and why?

Presentation Clarity and Delivery

A recurring theme was difficulty understanding presenters due to rapid speaking, strong accents, or low volume. Several attendees also noted presentations that were too wordy, with speakers simply reading from slides, or flashing slides too quickly to absorb. Future event planners should emphasize the importance of clear, well-paced delivery and legible, concise visuals. Consider offering speakers resources on effective presentation skills and perhaps encourage a "less text, more visuals" approach for slides.

Relevance and Audience Connection

Many attendees expressed a preference for sessions directly relevant to their work or interests. Presentations on topics like AI and autonomous vehicles, while innovative, were sometimes perceived as too abstract, pessimistic, or not immediately applicable to the daily work of transportation and mobility professionals. It's recommended to clearly articulate how "innovative" topics connect to current industry needs and to provide a range of sessions catering to diverse professional interests, perhaps even offering "beginner" or "advanced" tracks for certain subjects.

Content Depth and Timeliness

Some feedback indicated that certain research felt outdated or lacked sufficient depth, with attendees desiring more exploration of practical implications or proposed solutions. There was also a desire for more tangible takeaways and a clearer understanding of how presented research could be implemented. Future planners should encourage speakers to focus on the practical applications and conclusions of their research, ensuring content is both current and actionable.

Networking vs. Formal Presentations

The lunch panel discussion on AI was specifically called out as awkward, with attendees preferring networking time over a lengthy formal presentation. This highlights a desire for more informal interaction opportunities. Future events could consider shortening lunch presentations or offering alternative networking activities during meal times to foster connections among attendees.

Audibility and Accessibility Issues

Beyond content, practical issues like presenters speaking too softly or being difficult to understand due to accents were noted. Future planners should ensure that all presenters properly use the microphones and are encouraged to speak clearly and at an appropriate volume for the room.

Overall Positive Sentiment

Despite the criticisms, several attendees explicitly stated they enjoyed all sessions they attended or had no least favorite presentations. This indicates a generally positive experience. Future event planners can build on this by addressing the identified areas for improvement to enhance the overall attendee experience.

What aspects did you like most about the Symposium or worked well for you?

Networking and Collaboration Opportunities

Attendees consistently highlighted networking and the poster sessions as major successes. The opportunity to meet and interact with other professionals, researchers, and colleagues from various disciplines was highly valued. The communal sessions and dedicated time for networking were particularly appreciated, allowing for in-depth discussions and the exchange of ideas.

Convenient Location and Excellent Organization

The Raleigh location, specifically the McKimmon Center, received widespread praise for its convenience, accessibility, and ample parking. Many attendees found the venue to be ideal, with one response specifically mentioning the convenience for "Raleigh- and Garner-based NCDOT staff." The overall organization of the symposium, including clear agendas, easy-to-find rooms, and a seamless check-in process, was also frequently commended.

Diverse and Engaging Content

The variety of topics, presentations, and content was a significant draw. Attendees appreciated the opportunity to learn about new technology trends, innovative ideas, and advancements in the transportation industry. The inclusion of tech demos and student poster presentations added a dynamic and engaging element to the program, with one attendee finding them "a nice complement to the technical sessions."

Value of Virtual and Hybrid Options

The availability of a virtual or hybrid attendance option was a key positive for many, enabling participation even for those unable to attend in person. While some acknowledged that the in-person experience offered more opportunities for networking and viewing demonstrations, the flexibility of the virtual option was greatly appreciated.

Recommendations for Future Events

Future event planners should prioritize and potentially expand dedicated time for networking and poster sessions, as these were exceptionally popular. Consider extending the duration of the poster session to allow for even more interaction. Continue to select convenient and accessible venues like the McKimmon Center in Raleigh. Maintain a diverse range of presentation topics and continue to incorporate interactive elements like tech demos and student presentations to keep the program engaging.

Enhancing Accessibility and Content Access

Given the positive feedback on virtual options, explore ways to further enhance the hybrid experience, perhaps by ensuring seamless technical support for virtual attendees and clearer access to presentations and discussions that occur onsite. Consider making presentation materials and recorded sessions available online after the event, as this was suggested as a valuable resource for those unable to attend all sessions of interest.

What aspects did not work well or what suggestions do you have to improve future Symposiums?

Logistical Lapses

Several attendees reported issues with signage, unclear agendas, and difficulty navigating the online platform. For future events, implementing clear and consistent signage throughout the venue is crucial. A comprehensive hard copy of the agenda with detailed session descriptions, speaker information, and venue maps would also greatly benefit attendees, serving as a reliable backup when technology fails. Additionally, ensure the online platform is user-friendly and well-tested, providing clear instructions for accessing sessions and information.

Technical Troubles

A recurring theme was technical difficulties, including issues with Zoom links, audio problems (e.g., sound bleeding from other rooms), and presentation slides not displaying correctly. Prior to the event, thoroughly test all AV equipment and online platforms. Consider having dedicated technical support staff available in each session room to address issues promptly. For hybrid events, optimize camera placement to ensure virtual attendees have a clear view of the speaker.

Refreshment and Comfort Deficiencies

Attendees consistently requested more frequent and diverse refreshment options throughout the day, specifically mentioning the need for non-coffee caffeine, water, and afternoon coffee service. Providing a wider range of food options, including more vegetarian choices and

healthier breakfast items, would also be appreciated. Additionally, event and catering staff should ensure sanitary practices and provide hand sanitizer, especially during cold and flu season.

Presentation and Session Structure

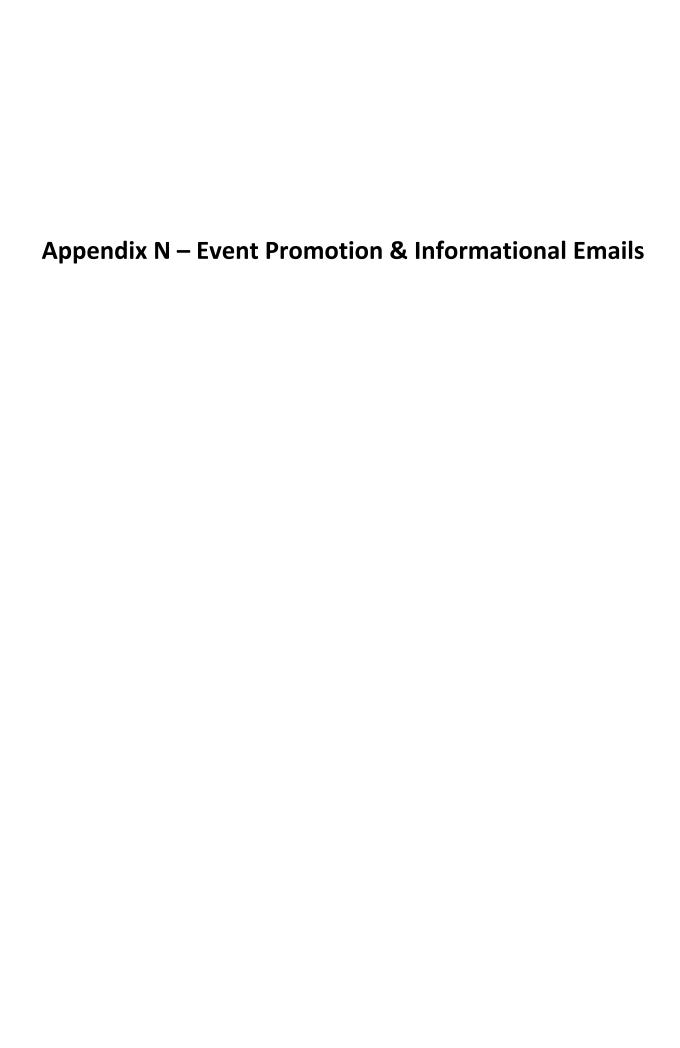
Feedback indicates a need to optimize session timing and content. Some presenters felt rushed, while others had too much time. Consider implementing a system where presenters can apply for different time slot lengths based on their content depth. For future symposiums, explore different breakout session formats that allow for more in-depth discussion and cater to niche interests. There's also a strong desire for more interactive sessions through methods like digital voting, moderated discussions, and ad hoc panels. Finally, ensure presentation slides are available to attendees afterward.

Networking and Engagement Opportunities

Attendees expressed a desire for more structured networking opportunities, particularly during lunch. Implementing themed networking ideas and clearly communicating these at registration could encourage engagement beyond familiar circles. Future R&I planners may also consider ways to increase involvement for first-time attendees.

Content and Speaker Considerations

While the overall content was valued, some felt the AI Lunch Panel was too technical for the audience. Future panels should ensure speakers are prepped to tailor their discussion to the audience's understanding, avoiding excessive jargon and unfamiliar acronyms. Additionally, some attendees felt there was too much focus on AI and CAV, suggesting a broader range of topics emphasizing implementation. Finally, it would be beneficial to capture and share phonetic pronunciation for speakers' names, as well as provide speakers with guidance on presentation skills that encourages engaging delivery, varied voice pitch, and clear takeaways relevant to practitioners.



Save the date: NCDOT Research & Innovation Symposium - Feb. 11-12, 2025

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: "itre-information@ncsu.edu" <itre-information@ncsu.edu> Fri, Sep 20, 2024 at 1:11

SAVE THE DATE



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

The 2025 NCDOT Research and Innovation Symposium (formerly Summit) will be held at the McKimmon Center at NC State University.

Join NCDOT staff and other transportation industry professionals to explore the latest in research and innovative practices.

The Call for Proposals will open on October 1.

Call for Presentations is open: NCDOT Research & Innovation Symposium - Feb. 11-12, 2025

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: "itre-information@ncsu.edu" <itre-information@ncsu.edu> Tue, Oct 1, 2024 at 3:50 PM



NCDOT Research & Innovation Symposium

February 11-12, 2025
Raleigh, NC
Hybrid In-Person & Virtual

The Call for Presentations is now open!

Abstracts for podium and poster presentations are now being accepted from university researchers, students, and transportation professionals working in public and private sectors.

Learn more and submit an abstract

- Submissions are due by November 3, 2024.
- Students presenting posters will be eligible to receive one or more scholarships up to \$2,500.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Mostracts are due by 11/3 | NCDOT Research & Innovation Symposium - Feb. 11-12, 2025

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Thu, Oct 24, 2024 at 1:22



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC Hybrid In-Person & Virtual

Reminder: Submit an abstract for presentation by November 3, 2024

Abstracts for podium and poster presentations are now being accepted from university researchers, students, and transportation professionals working in public and private sectors.

Learn more and submit an abstract

- Submissions are due by November 3, 2024.
- Students presenting posters will be eligible to receive one or more scholarships up to \$2,500.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Abstract deadline extended to 11/17 - Registration opens soon | NCDOT R&I Symposium

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Mon, Nov 4, 2024 at 4:55



NCDOT Research & Innovation Symposium

February 11-12, 2025
Raleigh, NC
Hybrid In-Person & Virtual

Deadline extended: Submit abstracts by November 17, 2024 at 11:59pm EST

Please help spread the word by forwarding this email to colleagues and students who may be interested in presenting.

Thank you to everyone who has already submitted an abstract!

- Abstracts for podium and poster presentations are being accepted from university researchers, students, and transportation professionals working in public and private sectors.
- One or more scholarships up to \$2,500 will be awarded for student poster presentations.
- Tech Demos are coming to the 2025 R&I Symposium.
- Registration is opening soon be on the lookout for more details.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar



Final reminder: Submit abstracts by Sunday 11/17 | NCDOT R&I Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: "itre-information@ncsu.edu" <itre-information@ncsu.edu> Fri, Nov 15, 2024 at 11:49



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Final Reminder: Submit abstracts by this Sunday 11/17 at 11:59pm EST

Please help spread the word by forwarding this email to colleagues and students who may be interested in presenting.

Thank you to everyone who has already submitted an abstract!

- Abstracts for podium and poster presentations are being accepted from university researchers, students, and transportation professionals working in public and private sectors.
- One or more scholarships up to \$2,500 will be awarded for student poster presentations.
- Tech Demos are coming to the 2025 R&I Symposium.
- · Registration opens next week!

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Register for the 2025 NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Tue, Dec 10, 2024 at 4:32



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Join current and future transportation professionals for a collaborative exploration of the latest in research and innovative practices

- In-person registration is just \$100 (increases to \$125 on 2/1) and includes breakfast and lunch on both days. Students get a \$25 discount on in-person registration.
- Virtual attendee registration is \$50.
- NC Professional Engineers can earn PDHs for this event; the maximum PDH amount will be confirmed after the agenda is finalized.
- In-person capacity is limited, so register early for the lowest cost and guarantee your spot.

Learn more and register today

The 2025 R&I Symposium will feature some exciting additions:

- The Day 1 agenda now includes a Tech Demos session, offering attendees an up-close (and maybe even hands-on) experience with interesting and cutting-edge technology applications in the transportation space.
- Two off-site learning experiences are planned: a live demonstration utilizing a drone to inspect a bridge structure at nearby Lake Johnson, and an exploration of wayfinding and street crossing for blind and visually-impaired people at a busy intersection near the venue.

The 2025 agenda promises to be bigger and better than ever, with 43% more total abstracts submitted for consideration compared to 2023. Poster presentation submissions increased by an astounding 106%, as the announcement of scholarship awards up to \$2,500 for poster presentations clearly amplified student participation.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Abstract Accepted - 2025 NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: Firstname Lastname <firstlast@example.com> Fri, Dec 20, 2024 at 6:07



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Dear Firstname Lastname,

We are pleased to inform you that the following abstract has been accepted for presentation at the 2025 NCDOT Research and Innovation Symposium:

Presentation Title: **Example Title**

Accepted Presentation Format: Podium Presentation

The full Symposium agenda will be shared in January, as soon as it has been confirmed. If you haven't already done so, now is a great time to Register to attend.

Thank you for being part of the 2025 Research & Innovation Symposium; we look forward to learning more about your research.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Abstract Not Accepted - 2025 NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: Firstname Lastname <firstlast@example.com> Fri, Dec 20, 2024 at 6:13 PM



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC Hybrid In-Person & Virtual

Dear Firstname Lastname,

We regret to inform you that the following abstract has not been accepted for presentation at the 2025 NCDOT Research and Innovation Symposium:

Presentation Title: Example Title

Presentation Format: Podium Presentation

We appreciate your interest in being part of the 2025 Research & Innovation Symposium, and hope to see you there as an attendee.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Full agenda now available | Register for the NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: "itre-information@ncsu.edu" <itre-information@ncsu.edu> Fri, Jan 10, 2025 at 10:51



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC Hybrid In-Person & Virtual

Full agenda is now available

Learn more and register today

- In-person registration is just \$100 (increases to \$125 on 2/1) and includes breakfast and lunch on both days. Students get a \$25 discount on in-person registration.
- Virtual attendee registration is \$50.
- NC Professional Engineers can earn PDHs for this event; the maximum PDH amount will be confirmed after the agenda is finalized.
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- The Day 1 agenda now includes a Tech Demos session, offering attendees an up-close (and maybe even hands-on) experience with interesting and cutting-edge technology applications in the transportation space. **Interested in sharing a demo? There's still time to submit a proposal.**
- Two off-site learning experiences are planned: a live demonstration utilizing a drone to inspect a bridge structure at nearby Lake Johnson, and an exploration of wayfinding and street crossing for blind and visually-impaired people at a busy intersection near the venue.

If your abstract was selected for presentation: Be on the lookout for more info on next steps and what to expect. For now, please register to attend if you have not already done so.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Presentation day & time - 2025 NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> To: Firstname Lastname <firstlast@example.com> Wed, Jan 15, 2025 at 5:40 PM



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Hello,

Now that the <u>full agenda</u> has been released, we wanted to follow up with specific details regarding the day and time of your presentation:

Presentation Title: Example Title

Accepted Format: Podium Presentation

Presenter(s): Firstname Lastname (Institution)

Session 1, Strand A February 11, 2025 10:15 am – 11:30 am

Please reply to this email with any revision/update requests or questions. And if you haven't already done so, please be sure to Register to attend.

Thank you again for being part of the 2025 Research & Innovation Symposium; we look forward to learning more about your research.

If you are a dual podium / poster presenter:

To be considered for a scholarship award, presenters must provide a PDF of their poster **no later than 11:59pm on Sunday, February 2.** More info on the submission process will be provided in a subsequent email.

The poster session is scheduled on **Wednesday**, **February 12 from 9:45 – 11 am** in Room 1AD at NC State's McKimmon Conference and Training Center. Several poster presentations will be taking place at once in the room. **Poster presenters are encouraged to set up early**, **starting at 7:30 am**, but should ensure setup is completed **no later than 9:45 am**.

Please see the Poster Guidelines page for information on preparing your poster for presentation.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Reminder: Register by 1/31 for the NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Thu, Jan 16, 2025 at 3:25



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Full agenda is now available

Learn more and register today

- In-person registration is just \$100 (increases to \$125 on 2/1) and includes breakfast and lunch on both days. Students get a \$25 discount on in-person registration.
- Virtual attendee registration is \$50.
- NC Professional Engineers can earn PDHs for this event; the maximum PDH amount will be confirmed after the agenda is finalized.
- Register early for the lowest cost and guarantee your spot.

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- Two off-site learning experiences are planned: a live demonstration utilizing a drone to inspect a bridge structure at nearby Lake Johnson, and an exploration of wayfinding and street crossing for blind and visually-impaired people at a busy intersection near the venue.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Session moderator info - NCDOT R&I Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov>

Fri, Jan 24, 2025 at 4:44



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Dear Firstname Lastname,

Here are the details on the breakout session you're scheduled to moderate at the R&I Symposium next month. Please review the Moderator Duties and Guidelines page on the Symposium website, and reach out to your presenters as soon as possible. Presenter guidelines are being finalized, and will be shared with all presenters early next week.

Please note: If your session includes less than 3 presentations, some content below will be blank. If you are moderating multiple sessions, you will receive a separate email for each.

If you have any questions, please email lctabor@ncsu.edu.

Session 1, Strand A

2/11/2025

10:15 am – 11:30 am

Room 1AB

Presentation 1:

Ghosts of the Past: Restrictive Covenants and their Lasting Imprint on Raleigh's Urban

Equity

Presenter(s): Sneha Bora (UNC Chapel Hill)

Contact info: REDACTED

Format: Podium Presentation

Abstract:

The legacy of racial segregation in American cities continues to shape urban landscapes and communities. Restrictive covenants, which historically barred non-white individuals from property ownership or rental, have left an indelible mark on contemporary urban equity. Despite being ruled unenforceable in 1948, the repercussions of these discriminatory practices persist, contributing to ongoing racial segregation and economic inequality. This research investigates the enduring impacts of restrictive covenants on the city of Raleigh, North Carolina, and proposes strategies for equitable urban development that address these historical injustices.

Presentation 2:

Bridging Racial Wealth Gaps through Bridges

Presenter(s): Weilin He (Syracuse University)

Contact info: REDACTED

Format: Podium Presentation

Abstract:

Racial wealth disparities continue to be a significant challenge in the United States. Such disparities are not just a result of income differences; they are also influenced by historical and systemic factors that have limited opportunities for wealth accumulation for marginalized groups. Public infrastructure, especially bridge conditions, plays a crucial role in economic development. Deteriorating bridges lead to increased transportation costs, reduced economic activity, and fewer job opportunities. These conditions disproportionately affect marginalized communities, exacerbating wealth disparities. This research investigated the impact of bridge conditions on local economies, with a focus on wealth disparities. It developed a comprehensive framework for prioritizing bridge preservation activities that consider the economic implications on marginalized communities, aiming to provide more equitable bridge maintenance strategies to facilitate equal accessibility to infrastructure among communities with wealth disparities. The research quantitative analyzed bridge conditions and local economic census data, and developed a decision framework for bridge preservation prioritizing wealth equity. This includes geospatial analyses to examine the association between bridge conditions and wealth disparities, and a cost-benefit tradeoff model to guide preservation efforts. Preliminary analyses indicated a significant correlation between poor bridge conditions and lower median household incomes in marginalized communities. Addressing the link between infrastructure quality and wealth disparities offers a transformative insight into public policy and infrastructure management. The research findings highlight the need for a paradigm shift in how bridge preservation activities are prioritized, advocating for the integration of wealth equity into infrastructure planning and decision-making processes.

Presentation 3:

Addressing Accessibility Barriers in Rural and Disconnected Communities

Presenter(s): Venktesh Pandey and Komal Gulati (NC A&T University); Abhay Lidbe (University

of Alabama)

Contact info: REDACTED

Format: Podium Presentation

Abstract:

Transportation accessibility is vital for connecting rural communities to essential opportunities such as employment, healthcare, and education. At its core, assessing accessibility involves two key factors: the availability of sufficient opportunities and the ability to reach these opportunities via diverse transportation modes, including driving, public transit, biking, or alternative means. Disparities in accessibility create "opportunity deserts," which hinder social and health outcomes. This presentation reviews accessibility barriers in rural areas, with a focus on the Southeastern United States. It examines trends in how our understanding of accessibility has evolved and highlights emerging modeling approaches for addressing accessibility gaps. Key methods discussed include integrating new datasets and socio-economic measures, modeling latent demand for more accurate forecasts, and evaluating the affordability of emerging transit solutions such as micro-transit. The presentation is structured around two key themes of results: (a) By leveraging increasingly available disaggregate data at the building footprint level and employing scalable approaches for quantifying travel times, we quantitatively investigate discrepancies between macro-level (using census-tract centroids) and micro-level measures (using residential parcels) of healthcare access. (b) Using uncertainty in travel time evaluations, we explore how k-reliable shortest paths with limited overlap minimizing a weighted function of mean and variance have direct applications in assessing worst-case healthcare accessibility and finding that in rural areas, k-reliable paths exhibit high variance in travel times, signaling increased vulnerability. Broadly, this presentation contributes to understanding how accessibility barriers impact diverse populations and offers insights to inform the planning of equitable rural transportation systems.

Add to your calendar:

Outlook on Web | Download .ics for Outlook on desktop | Google Calendar

Final week to save \$25 on registration | NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Mon, Jan 27, 2025 at 1:55



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Register by this Friday to save \$25!

- In-person registration is just \$100 (increases to \$125 on 2/1) and includes breakfast and lunch on both days. Students get a \$25 discount on in-person registration.
- Virtual attendee registration is \$50.
- NC Professional Engineers can earn up to 9 PDHs for this event
- The Full Agenda and Poster Presentations are available online

The 2025 R&I Symposium will feature some exciting additions:

- The Day 1 agenda now includes a Tech Demos session, offering attendees an up-close (and maybe even hands-on) experience with interesting and cutting-edge technology applications in the transportation space.
- Two off-site learning experiences are planned: a live demonstration utilizing a drone to inspect a bridge structure at nearby Lake Johnson, and an exploration of wayfinding and street crossing for blind and visually-impaired people at a busy intersection near the venue.

Add to your calendar:

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Important info for presenters - 2025 NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation Symposium <researchinnovation@ncdot.gov> Thu, Jan 30, 2025 at 2:04



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Hello,

Please visit the Podium Presenter Guidelines page for important information regarding your upcoming presentation. Please upload your presentation file(s) to our online portal no later than **9am on Monday**, **February 10**, **2025**.

All presenters are required to register to attend the Symposium - so if you haven't already done so, be sure to register before the price goes up on 2/1.

Below are the details of your session, as well as the name and contact information for your session's moderator:

Session 1, Strand A 2/11/2025 10:15 am – 11:30 am

Moderator: Firstname Lastname firstlast@example.com

Presentation Title: Example Title

Accepted Format: Podium Presentation

Presenter(s): Firsname Lastname (Institution)

Please reply to this email with any revision/update requests or questions.

Thank you again for being part of the 2025 Research & Innovation Symposium; we look forward to learning more about your research.

If you are a dual podium / poster presenter:

We are excited to share that at least three scholarships between \$1000 and \$2500 will be awarded at the NCDOT Research and Innovation Symposium next month.

If you would like your poster presentation to be eligible to win a scholarship award, please use this form to upload a final (or near-final) PDF of your poster by 12:00pm on Monday, February

3rd.

As a reminder, please be sure to carefully review the Poster Guidelines page in preparation for your presentation.

Add to your calendar:

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Last day to save \$25! Register for the NCDOT Research & Innovation Symposium

1 message

NCDOT Service Account - Research Innovation
Symposium <researchinnovation@ncdot.gov>
To: "itre-information@ncsu.edu" <itre-information@ncsu.edu>

Fri, Jan 31, 2025 at 8:27



NCDOT Research & Innovation Symposium

February 11-12, 2025 Raleigh, NC

Hybrid In-Person & Virtual

Register before midnight to save \$25!

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