2021 NCDOT Research & Innovation Summit Final Report

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RESEARCH & DEVELOPMENT

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On October 5-6, 2021, the University of North Carolina Highway Safety Research Center hosted the third annual/second virtual NCDOT Research & Innovation Summit as part of an extended agreement starting in March 2020. The Summit placed a strong focus on transformative new research methods and innovations being used to advance North Carolina's roadway and multi-modal transportation system. This report summarizes the activities associated with the planning and execution of this event.

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Table of Contents

Executive Summary

In October 2020, the UNC Highway Safety Research Center (HSRC) hosted the North Carolina Department of Transportation's (NCDOT's) second annual Research & Innovation Summit. After the event, which was turned into a virtual conference due to the COVID-19 pandemic, NCDOT asked HSRC to extend its agreement so that the Center could again host the Summit in 2021, with a stronger focus on transportation innovations in the state and beyond.

Starting in early 2021, NCDOT and HSRC undertook several planning tasks for the 2021 Summit including save-the-date promotions, the call for abstracts, setup of the registration system, agenda development, speaker trainings, and more.

The third annual/second virtual Summit was held on October 5-6, 2021. The program included two plenary sessions and 24 breakout sessions (compared with 18 total sessions in 2020) including a lightning talk session and an interactive student poster session (which was new in 2021). There were 421 pre-registrants and 347 final attendees.

Post-event activities included distributing a feedback survey, providing attendance certificates, producing attendance reports, converting session recordings for posting on the internet, posting these recordings on YouTube and the Summit site, and determining and announcing the winners of the poster competition.

This report provides additional details on the planning, implementation, and outcomes of the event.

Introduction

NCDOT recognizes the importance of having forums where policy makers, researchers, technology developers, social scientists, planners, engineers, and other transportation stakeholders can come together to explore and exchange ideas around emerging concepts in transportation innovation and safety. Therefore, NCDOT launched the Research & Innovation Summit in 2019 to provide just such a venue to discuss and promote the most critical new technologies that impact transportation systems in the state and beyond.

After planning and hosting the second annual NCDOT Research & Innovation Summit, HSRC proposed to host the event again to ensure that the agency achieved its goals to promote implementation and tech transfer of transportation innovations by bringing together transportation professionals from the public sector (state and federal), academia, and the private sector to discuss transportation-related innovations and research topics.

HSRC has a long history of working with NCDOT on a variety of projects designed to improve the state's roadway system, and, given the Center's recognized leadership in North Carolina and beyond in managing effective tech transfer and learning opportunities, HSRC was uniquely positioned to help NCDOT's event succeed.

Presentation and Poster Selection

Conducting a call for abstracts for session and poster ideas was a top priority. NCDOT provided this list of desired topics:

- Environmental & Hydraulics
- Implemented Research Products
- Innovative Technologies, Projects or Processes
- Integrated Mobility / Multi-Modal
- Pavement & Materials / Operations & Maintenance
- Planning & Policy
- Roadway Design
- Structures, Construction & Geotech
- Traffic & Safety
- Transportation Network Resilience
- Unmanned Aerial Systems

HSRC created an online submission form to collect abstracts (Appendix A), which encouraged these topics. The call for abstracts was announced on April 28, 2021. It was also posted on the NCDOT Summit website, and multiple follow up promotions were sent. The initial June 9 deadline was extended to July 7, 2021. Ultimately, 71 abstracts were submitted (compared with 97 in 2020). Concurrently, a preliminary skeleton agenda was prepared and posted on the website. The Summit event was scheduled to start in the late morning each day, allowing more time for additional sessions than in 2020.

On July 20, 2021, NCDOT sent the abstracts to the planning committee for review. The committee returned comments by August 6, 2021. In mid-August 2021, the preliminary agenda with sessions slotted was ready, and the chosen session abstract presenters were sent acceptance notices and presenter guidelines (Appendix B); those chosen for recorded lightning talks were sent separate guidelines (Appendix C). All submitters whose sessions were not chosen for sessions were invited to submit posters instead; of the 26 people invited, 18 submitted posters. Facilitators who were invited to moderate sessions were also sent guidelines (Appendix D).

Agenda
The full basic agenda was posted on the website in early September 2021. The website was regularly edited leading up to the event with developing program updates, while a link to the full, expanded agenda (Appendix E) and presenter bios (Appendix F) were also posted on the site. The final agenda:

October 5
- 10:15AM-10:35AM – Introductory Remarks
- 10:45AM-12:00PM - Breakout sessions
    - Technology
    - Unmanned Aerial Systems
    - NCDOT CLEAR Implemented Innovation Winner
    - Freight Application Workshop
- 12:30PM-1:15PM - Plenary Address: NCDOT Update

- 1:30PM-3:00PM - Breakout sessions
  - Environmental & Hydraulics
  - Multimodal
  - Pavement & Materials
  - Lightning Talks – Unmanned Aircraft Systems / Aviation
- 3:15PM-4:45PM - Breakout sessions
  - Traffic & Roadway Design
  - Bicycle / Pedestrian
  - Structures, Construction & Geotechnical
  - NC Transportation Center of Excellence in Advanced Technology Safety and Policy Update

October 6
- 10:30AM-11:45AM - Breakout sessions
  - NCDOT Technology / Innovation
  - Railroad Incidents & Trespass
  - Hydraulics & Structures
  - Research Grant Writing Session
- 12:15PM-1:15PM - Plenary Address: Unpacking Safe Systems concepts to inform our research and practice
- 1:30PM-3:00PM - Breakout sessions
  - Traffic Safety
  - Transportation Resiliency
  - Equity / Social Impacts on Transportation
  - NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology Update
- 3:15PM-4:45PM - Breakout sessions
  - Interactive Poster Session
  - National Cooperative Highway Research Program (NCHRP)
  - Transportation Equity
  - NC Transportation Center of Excellence on Mobility and Reducing Congestion Update

Poster Gallery
As was done for the 2020 event, an online gallery featuring selected research posters of students and researchers (Appendix G) was built; poster presenters were sent their own guidelines (Appendix H). The 2021 gallery (located here: www.hsrc.unc.edu/ncdot-ri-summit/virtual-poster-gallery/) consisted of a main webpage listing 18 posters by category along with their principal authors, main campuses, and head shots of the submitters. Each listing linked to a dedicated page for each poster featuring the names of the principal authors, all co-authors, the image of the poster, a link to a pdf version of the poster, videos of the students and researchers explaining the poster (when available), and the email of the principal author to contact with questions. In a separate post-event survey, respondents were asked to choose their favorite poster. The three top ranked posters were chosen, and the authors were sent certificates honoring their achievements on October 28, 2021:

- First place: Microsimulation-based model and SVM-ARIMA hybrid model for traffic condition prediction
  Submitted by: Benjamin Lartey, North Carolina A&T State University
  Co-authors: Abdollah Homaifar and Ali Karimoddini
- Second place: Cost Reduction of Worker Compensation Claims Resulting from Driver License Road Test Related Injuries
  Submitted by: Abdullah Alsharef, North Carolina State University
  Co-author: Alex Albert
- Third place: Mini Roundabout CMF Development
  Submitted by: Raunak Mishra, University of North Carolina at Charlotte
  Co-authors: Sonu Mathew & Srinivas S. Pulugurtha

Digital Event Collateral

Digital materials created for this event included the save-the-date email postcard, the website hosted on the HSRC website, attendance certificate generators, and poster competition winner certificates (selected examples in Appendix I).

Presenter Trainings

To prepare presenters for presenting in Zoom, HSRC held three one-hour speaker trainings in late September 2021. These trainings were intended to prepare speakers for presenting online, outline how the sessions would run, and provide practice on using the Zoom online meeting platform. A PowerPoint presentation for the trainings was created and distributed (Appendix J), as was a recording of one of the trainings.

Attendance

A total of 347 people attended the Summit (compared with 356 in 2020). Following are the attendance numbers for each Summit session:

October 5
- Introductory Remarks: *162 participants*
- Breakout sessions
    - Technology: *74 participants*
    - Unmanned Aerial Systems: *79 participants*
    - NCDOT CLEAR Implemented Innovation Winner: *52 participants*
    - Freight Application Workshop: *39 participants*
- Plenary Address: NCDOT Update: *155 participants*
- Breakout sessions
    - Environmental & Hydraulics: *34 participants*
    - Multimodal: *75 participants*
    - Pavement & Materials: *47 participants*
    - Lightning Talks – Unmanned Aircraft Systems / Aviation: *37 participants*
- Breakout sessions
    - Traffic & Roadway Design: *46 participants*
    - Bicycle / Pedestrian: *47 participants*

- o Structures, Construction & Geotechnical: *50 participants*
- o NC Transportation Center of Excellence in Advanced Technology Safety and Policy Update: *51 participants*

October 6
- Breakout sessions
  - o NCDOT Technology / Innovation: *77 participants*
  - o Railroad Incidents & Trespass: *40 participants*
  - o Hydraulics & Structures: *45 participants*
  - o Research Grant Writing Session: *26 participants*
- Plenary Address: Unpacking Safe Systems concepts to inform our research and practice: *114 participants*
- Breakout sessions
  - o Traffic Safety: *57 participants*
  - o Transportation Resiliency: *74 participants*
  - o Equity / Social Impacts on Transportation: *38 participants*
  - o NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology Update: *42 participants*
- Breakout sessions
  - o Interactive Poster Session: *63 participants*
  - o National Cooperative Highway Research Program (NCHRP): *54 participants*
  - o Transportation Equity: *44 participants*
  - o NC Transportation Center of Excellence on Mobility and Reducing Congestion Update: *43 participants*

Documentation

To document the activities and outcomes of the Summit, sessions were recorded, and session slide decks and posters were archived on the Summit website (located here: www.hsrc.unc.edu/ncdot-ri-summit/2021-agenda/). A post-event survey was distributed, and results were shared with NCDOT.

Post-event Survey

An online feedback survey (Appendix K) was created, and the link was distributed to all Summit attendees on October 7, 2021, with a deadline of October 15. The survey asked participants what they liked most and least about the Summit, to offer ideas for future topics, and to provide additional feedback. Also captured were the business sectors of the attendee respondents. 97 people responded to the survey, which is a 28% response rate. All feedback survey responses, including comments, were forwarded to the NCDOT project manager for use in future Summit planning activities. Highlights of the survey results:
- The industry sector with the highest attendance was engineering with more than 43 percent, following by the public sector (e.g., DOT, Municipality, FHWA) with more than 35 percent.
- 41 percent were attending their first Summit, while 25 percent had attended all three.
- Several comments praised the variety and quality of the topics and presentations.
- Other comments criticized some of the technical problems and expressed a desire to return to an in-person event.

Continuing Education Units and Attendance Verification
In addition to the overall event post survey, NCDOT created a survey specific to gather feedback related to earning PDH credit. This survey was emailed to session attendees. NCDOT approved the Summit for 10.25 PDH hours (compared with 6.5 in 2020). Also, HSRC staff coordinated to make the Summit eligible for American Planning Association/American Institute of Certified Planners certification maintenance credits.

HSRC provided an online attendance certificate generator to all attendees who attended at least ¾ of the sessions to support filing for up to 10.25 hours of continuing education from the professional organization and/or association of their choice.

Recommendations
As indicated by the post-event feedback survey, the Summit was viewed favorably overall. There were, however, some recommendations that could be taken into consideration during the planning of the next NCDOT Research & Innovation Summit. The survey results showed that attendees would prefer a hybrid format with both in-person and virtual options. Other recommendations:

- Consider other meeting platforms other than Zoom.
- Consider more options for attendees to interact with poster presenters.

Conclusion
The NCDOT Research & Development and HSRC teams worked together collaboratively and well to design, coordinate, and execute yet another successful event for NCDOT. We look forward to additional opportunities to work together in the future.

Appendix A: Abstract Submission Form

2021 NCDOT Research & Innovation Summit Call for Presentation Abstracts

Questions   Responses   74   Settings

RESEARCH & DEVELOPMENT

Section 1 of 3

2021 NCDOT Research & Innovation Summit: Call for Presentation

Please use this form to submit a presentation idea for the 2021 NCDOT Research & Innovation Summit, October 5-6, 2021. This will be a virtual event.

Presentation abstracts due July 7, 2021. (This deadline was extended.)

NCDOT encourages submitters to consider a variety of online presentation formats beyond the traditional lecture format. Options include panel discussions, workshops, and more. The review committee will consider a submitter's indicated presentation format. NCDOT is planning to also present an online poster hall as part of this event.

Email *

Valid email

This form is collecting emails. Change settings

After section 1   Continue to next section

11

Section 2 of 3

Presenter information

Description (optional)

First name *

Short answer text

Last name *

Short answer text

Presenter's title *

Short answer text

University/company/organization name *

1. NCDOT

2. Appalachian State University

3. Duke University

4. East Carolina University

6. Fayetteville State University

7. FHWA

8. NC A&T State University

9. NC Central University

10. NC State University

11. UNC Asheville

12. UNC Chapel Hill

13. UNC Charlotte

14. UNC Greensboro

15. UNC Pembroke

16. UNC Wilmington

17. Western Carolina University

18. Winston-Salem State University

Phone number *

Short answer text

City *

13

State *

Short answer text

Presenter bio (100 word limit) *

Long answer text

After section 2   Continue to next section   ▼

Section 3 of 3

Session information   ⌄   ⋮

Description (optional)

Proposed presentation title *

Short answer text

Proposed online presentation format *

◯ Traditional presentation

◯ Panel discussion

⊕   ⤵   T   🖼   ▶   ▤

○ Poster presentation (only open to current students)

○ Lightning talk (presentation lasting a few minutes; may be bundled with other presentations)

○ Other…

Are you a current student? *

○ Yes

○ No

Presentation topic *

○ Environmental & Hydraulics

○ Implemented Research Products

○ Innovative Technologies, Projects or Processes

○ Integrated Mobility / Multi-Modal

○ Pavement & Materials / Operations & Maintenance

○ Planning & Policy

○ Roadway Design

○ Structures, Construction & Geotech

○ Traffic & Safety

⊕   ⇥   T_T   🖼   ▶   ▤

○ Unmanned Aerial Systems

○ Other...

Business sector *

☐ State departments of transportation

☐ Federal transportation agencies (e.g., FHWA)

☐ Municipalities

☐ State legislatures

☐ Private industry

☐ Academia

☐ Engineering firms

☐ Consultants

☐ Other...

If you have presented this topic before, please describe when and where.

Long answer text

Session abstract (250 word limit) *

What challenge or unmet need are you addressing? *

Short answer text

Who is the audience for your presentation? *

☐ State departments of transportation

☐ Municipalities

☐ State legislatures

☐ Private industry

☐ Academia

☐ Engineering firms

☐ Consultants

☐ Federal transportation agencies (e.g., FHWA)

☐ Other…

Please list 5 keywords for your session. *

Short answer text

Appendix B: Presenter Guidelines

RESEARCH & DEVELOPMENT

2021 NCDOT Research & Innovation Summit: Presenter Guidelines & Checklist

NCDOT and the UNC Highway Safety Research Center (HSRC) request that all selected 2021 Summit presenters be familiar with the following presenter guidelines and use the checklist to prepare for Summit sessions. The Summit will be held October 5-6, 2021. The preliminary program is available here. Visit www.hsrc.unc.edu/ncdot-ri-summit for additional Summit information.

<u>**In advance of your Summit session**</u>

- ☐ If you haven't already, register for the Summit. Registration is free for all participants.
- ☐ Ensure you have the system requirements to accommodate Zoom; this resource provides the details you need: https://support.zoom.us/hc/en-us/articles/201362023-System-requirements-for-Windows-macOS-and-Linux
- ☐ Download the Zoom desktop app.
- ☐ Consider getting a headset and microphone to use for audio during your sessions; this will help reduce background noise.
- ☐ Participate in a practice session (timing TBD). Practice sessions will generally cover the following areas:
  - o Zoom audio features
  - o Sharing screens, advancing slides
  - o Q&A
  - o Keeping to the session schedule with multiple presenters
  - o Specific guidelines for breakout facilitators, presenters, and lightning talk presenters
- ☐ Create a slide deck for your presentation; if you would like to use a slide deck specifically branded for the Summit, contact Jennifer Palcher-Silliman at silliman@hsrc.unc.edu.
- ☐ Summit breakout sessions will be either 1.25 or 1.5 hours long; each breakout will feature multiple presenters. Plan for a presentation of no more than 15-20 minutes long for a breakout session. There can be only one speaker for each 15-20 minute presentation (i.e., no co-presenters).
- ☐ Lightning talk sessions will also be either 1.25 or 1.5 hours long and will feature multiple presenters. Plan for a lightning talk no longer than 10 minutes long.
- ☐ Avoid all commercialism in your presentation.
- ☐ Forward a final copy of your presentation to Jennifer Palcher-Silliman at silliman@hsrc.unc.edu no later than Friday, October 1, 2021. (All presentations will be posted online after the Summit.)
- ☐ Plan what to wear — business and business casual attire work best. Avoid busy patterns and bright white tops.
- ☐ Sessions will have a designated person to coordinate the Zoom meeting technology, as well as a session facilitator.

- ☐ Work with your facilitator and co-presenters in advance to coordinate your session's timing and flow.
- ☐ If you have any specific logistical questions about presenting for the Summit, please contact Jennifer Palcher-Silliman at silliman@hsrc.unc.edu.

Preparing the day of your session

- ☐ Determine where you will be presenting from physically for this virtual session and make any minor adjustments that may enhance presentation quality (e.g., angle of camera, limit background noise, adjust lighting, etc.)
- ☐ Close unnecessary programs and tabs in your browser and turn off any pop-up notifications, such as email or instant/chat messages, while you are presenting.
- ☐ Log on and call in 10-15 minutes prior to the beginning of your webinar to go over any last-minute questions and test your audio quality levels.
- ☐ Test your audio and video. And be sure you are muted when you are not speaking, unmuted when you want to be heard.
- ☐ Lighting should come from in front of you or from the side to best light your face.
- ☐ Use the provided NCDOT Summit branded Zoom background.

During your session

- ☐ All Summit sessions will be recorded (and later posted online).
- ☐ All participants will be muted, and their cameras will be turned off.
- ☐ In virtual events, your computer is your lectern. Remember that you are presenting to the Summit participants via your webcam, not your screen. Look directly at the camera as much as possible. Consider printing out slides or notes to reference these instead of the computer screen.
- ☐ When you are presenting, you will be given "control" of the session. Be prepared to advance your own slides.
- ☐ Use gestures and mannerisms that you would typically use in person.
- ☐ Keep to your allotted time frame.
- ☐ Work with the session moderator to answer questions submitted via the chat box during the Q&A portion.
- ☐ HSRC staff will handle admitting participants and assist with fielding questions – *please do not admit attendees from the Zoom waiting rooms.*

After your session

- ☐ Confirm that you have sent your final session slide deck to Jennifer Palcher-Silliman at silliman@hsrc.unc.edu. All presentations and session recordings will be posted on the event website.
- ☐ Complete the post-event survey.
- ☐ Be prepared to answer follow-up questions from Summit participants via email.
- ☐ Thank you for being a Summit presenter!

Please stay tuned for any additional details and updates leading up to the event.

Appendix C: Lightning Talk Guidelines

RESEARCH & DEVELOPMENT

2021 NCDOT Research & Innovation Summit:
Lightning Talk Guidelines & Instructions

Thank you for providing a recorded lightning talk presentation for the 2021 NCDOT R&I Summit. All recorded lightning talk presentations are due *September 14, 2021*. Lightning talk sessions will be either 1.25 or 1.5 hours long and will feature multiple presenters. Plan for a lightning talk no longer than 10 minutes long. View the Summit agenda here: www.hsrc.unc.edu/ncdot-ri-summit/2021-prelim-agenda

The following guidelines are intended to help prepare for and record your remarks in Zoom. If you have any questions, please contact Jennifer Palcher-Silliman, silliman@hsrc.unc.edu.

If you haven't already, register for the Summit. Registration is free for all participants.

How to record your quick video via Zoom
- Ensure you have the system requirements to accommodate Zoom; this resource provides the details you need: https://support.zoom.us/hc/en-us/articles/201362023-System-requirements-for-Windows-macOS-and-Linux
- Download the Zoom desktop app.
- Please use the provided Summit image for your virtual Zoom background setting/option.
- Settings:
    o Please be sure the following video options/settings are **CHECKED**:
        ▪ Enable HD **(yes)**
        ▪ Widescreen format **(yes)**
        ▪ Mirror my video **(yes)**
        ▪ Touch up my appearance **(yes)**
    o Please be sure the following video options/settings are **UNCHECKED**:
        ▪ Always display participant names in video **(no)**
- Adjust Zoom recording settings to be sure file will be saved to an easy-to-find location.
- Put any PowerPoint slides or written remarks in a location on your computer screen that makes it easy to reference while, generally, looking into the camera as much as possible while you're talking.

Self-interview prep tips
- Practice before you hit record. Notes are great for prep, but you need to avoid looking away from the camera as much as possible.
- Keep running the self-recorded video even if you want to restart a response and/or do a "retake."

Recording specs
- **Sound.** Good-quality audio is imperative. Choose your location according to low sound pollution. Record a test session to check for sound quality (and check for any distracting background noise) before you record the entire session.

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22

- **Angle.** Adjust the height of your computer (chair or hard surface) so your computer's camera is at eye level. This will make it easier for you to make natural eye contact with the camera.
- **Framing your shot.** The best way to frame your face is to set your computer up a little off-center, using the Rule of Thirds (as demonstrated below). Position yourself on the mid-right or mid-left of the screen.

 - **Physical space.** In addition to picking a space with a simple, clean background for your video, can you make any changes to make the physical space where you are conducting your self-interview more comfortable? (Does anything in the background distract you? Can you sit in a chair that doesn't spin? Would you rather stand than sit?)
- **"Wardrobe and makeup."** Simple is best. Wear a solid-color shirt (but not white) with basic collar/neckline. Limit makeup, earrings, and other jewelry that may be distracting. Reminder, the video will only include the middle of your torso to the top of your head.
- All Summit sessions will be recorded (and later posted online).

More guidelines
- Avoid all commercialism in your presentation.
- Forward a final copy of your presentation to Jennifer Palcher-Silliman at silliman@hsrc.unc.edu no later than Friday, October 1, 2021. (All presentations will be posted online after the Summit.)

After your session

- Confirm that you have sent your final session slide deck to Jennifer Palcher-Silliman at silliman@hsrc.unc.edu. All presentations and session recordings will be posted on the event website.
- Complete the post-event survey.
- Be prepared to answer follow-up questions from Summit participants via email.
- Thank you for being a Summit presenter!

Please stay tuned for any additional details and updates leading up to the event.

Appendix D: Facilitator Guidelines

RESEARCH & DEVELOPMENT

2021 NCDOT Research & Innovation Summit:
Facilitator Guidelines & Instructions

Thank you for participating in the 2021 NCDOT Research & Innovation Summit. You have been a designated as a "Facilitator" for the Summit. Summit breakout sessions will be either 1.25 or 1.5 hours long; each breakout will feature multiple presenters. You may view "Expanded preliminary agenda" here: www.hsrc.unc.edu/ncdot-ri-summit/2021-prelim-agenda

Listed below is the general format for the Presentations / Lightning Talks:
- Presentation: Each presentation should last between 15 – 20 minutes.
- Lightning Talk: Each presentation should only last 10 minutes. (Most of them will be prerecorded.)

Your role as the facilitator is as follows:
- Introduce the name of the presenter: (i.e., Name, Affiliation, and Title of Presentation)
- Keep the presenter on time (when applicable).
- To ask / facilitate the Question & Answer period.

We ask that you reach out (i.e., set up a web meeting / call) to discuss the contents of the presentations (this should happen no later than September 27, 2021). More specifically we recommend that you develop one – two questions per presenter that will be asked during the session to encourage questions from the general audience (Note: You may not need to ask those questions, but if you find that there aren't any questions, please ask the "canned" questions that you coordinated with the presenters.). We will provide the name and contact information for each speaker.

The general flow of the presentations should go as follows:
- Read housekeeping details.
- Brief introduction of the speakers.
- Speaker conducts their presentation (no more than 20 minutes for presentations and 10 minutes for Lightning Talks).
- The facilitator will introduce the next speaker.
- The facilitator will ask the speaker questions (either by way of the Chat box in zoom or based on the coordinated questions that you worked out with the speakers).
- Keep the speakers to their allotted timeframes.

Other items to know and do when preparing to facilitate your session:

- Ensure you have the system requirements to accommodate Zoom; this resource provides the details you need: https://support.zoom.us/hc/en-us/articles/201362023-System-requirements-for-Windows-macOS-and-Linux
- Download the Zoom desktop app.

- Consider getting a headset and microphone to use for audio during your sessions; this will help reduce background noise.
- Participate in a practice session (timing TBD). Practice sessions will generally cover the following areas:
    - Zoom audio features
    - Sharing screens, advancing slides
    - Q&A
    - Keeping to the session schedule with multiple presenters
    - Specific guidelines for breakout facilitators, presenters, and lightning talk presenters
- Plan what to wear – business and business casual attire work best. Avoid busy patterns and bright white tops.
- Sessions will have a designated person to coordinate the Zoom meeting technology.
- Determine where you will be presenting from physically for this virtual session and make any minor adjustments that may enhance presentation quality (e.g., angle of camera, limit background noise, adjust lighting, etc.)
- Close unnecessary programs and tabs in your browser and turn off any pop-up notifications, such as email or instant/chat messages, while you are presenting.
- Log on and call in 10-15 minutes prior to the beginning of your webinar to go over any last-minute questions and test your audio quality levels.
- Test your audio and video. And be sure you are muted when you are not speaking, unmuted when you want to be heard.
- Lighting should come from in front of you or from the side to best light your face.
- Use the provided NCDOT Summit branded Zoom background.
- All participants will be muted, and their cameras will be turned off.
- In virtual events, your computer is your lectern. Remember that you are presenting to the Summit participants via your webcam, not your screen. Look directly at the camera as much as possible. Consider printing out slides or notes to reference these instead of the computer screen.
- Use gestures and mannerisms that you would typically use in person.
- HSRC staff will handle admitting participants and assist with fielding questions – *please do not admit attendees from the Zoom waiting rooms.*

Curtis T. Bradley (cbradley8@ncdot.gov) and Jennifer Palcher-Silliman (silliman@hsrc.unc.edu) will be your points of contact. Please contact Curtis if you need any clarification on your role as a facilitator. Please contact Jennifer if you have any questions registering or accessing the content (i.e., presentations).

If you have not already, please register for the 2021 NCDOT Research & Innovation Summit at the following link. We thank you for your willingness to participate in this year's Summit. Please stay tuned for any additional details and updates leading up to the event.

2

Appendix E: Expanded Agenda

North Carolina Department of Transportation Research & Innovation Summit
2021 Agenda *updated October 4, 2021*

Visit www.hsrc.unc.edu/ncdot-ri-summit for additional information.

Tuesday, October 5, 2021

10:15 a.m.– 10:35 a.m.   Introductory Remarks

10:35 a.m. – 10:45 a.m.   *Break*

10:45 a.m. – 12:00 p.m.   Breakouts 1

Technology
Facilitator: Katie Harmon, UNC Chapel Hill

SafeWorkZone: AI-enabled Wearable-based IoT Infrastructure for Increasing the Safety of Highway Work Zones
Presenter: Sepehr Sabeti, University of North Carolina Charlotte
Highway work zones are among the harshest working environments. Working near high-speed traffic, inclement weather, and physically demanding tasks are some of the reasons that have resulted in fatalities and severe injuries among the body of the highway operation and construction community members. For mitigating these risks, we propose SafeWorkZone, a novel IoT infrastructure that leverages Artificial Intelligence and wearable technology delivering an intelligent and real-time safety system to workers for increasing their situational awareness. To this end, SafeWorkZone (1) identifies real-time risks imposed on workers from multiple origins in real-time, and (2) delivers a multimodal and latency-aware notification to users. Overall, the focus of this article is to elaborate on the software architecture and the designed IoT infrastructure of SafeWorkZone.

Understanding the Influence of Precipitation Intensity on Car Crash Risk in North Carolina *Presenter: Montana Eck, University of North Carolina Chapel Hill*
Approximately 23% of the nearly six million car crashes that occur in the United States each year are attributable to adverse weather. Among all potential meteorological detriments to driver safety, rainfall remains of primary concern to the United States Department of Transportation, as 46% of all weather-related fatalities occur during active rainfall and 78% of all weather-related injuries occur on wet pavement. Although significant advancements have been made in assessing the relationship between inclement weather and crash risk, there remain gaps in understanding these patterns at a finer spatiotemporal scale. Furthermore, as many locations in the southeastern United States have observed significant increases in the frequency and intensity of heavy precipitation events in the last 30 years, it is important to understand how the changing climate may be influencing crash risk across North Carolina. This research aims to overcome these historic limitations by modifying the matched-

pair statistical routine, a technique that compares collisions during identified meteorological events with corresponding control periods. By incorporating the Multi-Sensor Precipitation Estimate dataset, an hourly gridded product that blends radar estimates and station gauge observations (2003-2019), this work overcomes limitations of previous research that relied solely on isolated point measurements of rainfall. Thus, this analysis is better equipped to capture variability of precipitation locally and will illuminate differences in crash risk based on the duration and intensity of precipitation events. Lastly, statistically significant differences in crash risk will be determined for light, moderate, and heavy precipitation events across all 100 counties in North Carolina.

A Deep Learning Artificial Intelligence Model to Extract Roadside Hazard Features from Video Log Data
Presenter: Randa Radwan, University of North Carolina Chapel Hill
An artificial intelligence (AI) tool, using computer vision neural networks models, is being developed for automated analysis, extraction, and annotation of roadside features on rural roads from video log data in a close partnership between HSRC, NCDOT, the Renaissance Computing Institute (RENCI), and the Volpe National Transportation Systems Center. In this project, the feasibility of using an AI tool to identify guardrails and utility poles has been established in video log data collected by NCDOT in 2018 and 2019 for all secondary roads. The resulting guardrail model identification accuracy is 90% and the utility pole model accuracy is 88%, both on balanced holdout video log test sets. The AI tool first allows data analysts and safety researchers to semi-automatically annotate video logs with features of relevance to roadside safety using web-based visualization tool. The AI tool then employs deep learning methods to identify safety features in unlabeled images, using an active learning feedback loop to rapidly direct human annotators to the most valuable images for labeling, speeding up the annotation process. This feedback loop helps to improve the ability of the AI tool to identify the selected features, and the manual effort goes from annotation to correction as the machine learning improves. This feedback loop continues until the AI tool can reliably identify the features automatically. Route-based image browsing, and analysis capabilities have been added in the tool to assist in analyzing model performance.

Unmanned Aerial Vehicles
Facilitator: Richard Greene, NCDOT

Applying Small UAS to Produce Survey Grade Geospatial Products for DOT Preconstruction & Construction Activities
Presenter: Yajie Liu, North Carolina State University
Unmanned aerial systems (UAS) and sensing technologies are effective tools in 3D mapping with relatively low cost and effective survey methods in different and difficult terrains. However, the commercial software that accompanies these technologies produces inconsistent and unreliable survey results, and there is no guideline to ensure a consistent quality of the data. This research aims to develop a comprehensive set of guidelines, specifications, and recommendations for producing survey-grade geospatial data sets using UAS solutions for applications in preconstruction, construction, and slope sites.

Panel discussion: NCDOT Unmanned Aerial System Tools and Usage
Panelists:
J. R. Hayes, NCDOT Division 7
Rodney Hough, NCDOT, Photogrammetry Unit
Matthew Macon, NCDOT, Photogrammetry Unit
Jaimie Nevins, NCDIT-Transportation GIS
Stephen Robinson, PE, NCDOT Division 7
Nicholas Short, PE, NCDOT Photogrammetry
Mark Ward, PLS, NCDOT Location and Surveys
NCDOT employees experienced in the use of unmanned aerial system technology will discuss how they make use of these systems as part of their workflows. This session will include examples of data collection, management, and presentation.

NCDOT CLEAR (Communicate Lessons, Exchange Advice, Record) Implemented Innovation Winner

Facilitator: Clare Fullerton, NCDOT

Enabling Intelligent Semantic Information Retrieval on NCDOT Projects for Knowledge Management
Presenter: Siddharth Banerjee, North Carolina State University
The North Carolina Department of Transportation (NCDOT) recently commissioned its internal-only knowledge repository program called Communicate Lessons, Exchange Advice, Record (CLEAR) under the aegis of the Value Management Office for organization-wide dissemination of knowledge gained by personnel. A few factors that warrant the use of the CLEAR program are the shortage of personnel due to turnover or retirement, lack of a formal mechanism to record and retrieve knowledge, and increased claims and supplemental agreements caused due to repeat mistakes. From past experience, most lessons learned database have been rendered obsolete due to the abstention by end-users due to complexities, rendering the entire effort useless.
In a novel effort, researchers from the North Carolina State University have developed an artificial intelligence (AI) model based on neural language modeling for intelligent knowledge dissemination to the end-users. The AI model learns an inference model of the domain vocabulary from various sources such as contract documents, textbooks, and specifications. This model allows the system to make meaningful connections between lessons learned and best practices within CLEAR and the domain knowledge. The model is currently in its validation phase and once deployed will display pertinent lessons learned and best practices within CLEAR based on the semantic similarity of keywords inputted by the end-users. It is envisioned that the AI model will aid in generating interest about the CLEAR program thereby enabling enhanced quality input from the end-users. In the long run, the NCDOT will greatly benefit from improved workflow processes and reduced repeat mistakes.

Innovative solution from Division 14 to go paperless by using QR codes for e-ticketing
Presenter: Bryan Edwards, NCDOT

(prepared in collaboration with NCDOT's Kenny McCourt, Luke Templeton, and Nathan Tanner)
First Place: "Simple QR Codes," submitted by Kenny McCourt, Assistant Resident Engineer – Division 14, Whittier Office.

Innovation Solution from Division 3 to use Geographic Information Services (GIS) for a Right-of-Way and Utility Dashboard
Presenter: Michael Madsen, NCDOT
(prepared in collaboration with NCDOT's Trace Howell, Lonny Sleeper, and Monica Duval)
Second Place: "GIS Dashboard," submitted by Michael Madsen, Division GIS Analyst – Division 3.

Freight Application Workshop
Facilitator: Dana Magliola, NCDOT

Safety of the Urban Freight System: Key Performance Indicators
Presenter: Charles Edwards, University of North Carolina Chapel Hill
Freight movement and delivery represents the physical manifestation of economic activity. In the urban environment, freight transportation faces a unique in nearly every town or city. Safety remains one of the most important considerations and the freight and logistics sector has long monitored key performance indicators (KPIs) focused on safety, as well as delay and efficiency. This project focused on how monitoring of road safety KPIs could benefit goods movement in North Carolina and by extension offer insight into improving the safety environment in operations and policy for freight movement in the urban environment.

Rural Freight Transport Needs
Presenter: Steven Bert, Planning Communities
The transportation needs of rural North Carolina are very different from its urban counterparts. Implementing transportation investments that generate economic development requires a deep-seeded understanding of both the competitive advantages and local challenges within rural areas. For example, in southwestern North Carolina, the region does not act as one unit, but instead as a collection of many microeconomies that transcend county and state boundaries. People may live in North Carolina, work in South Carolina, and recreate in Georgia, or vice versa.
Similarly, in northeastern North Carolina economic activities across the border have spillover effects that can generate growth for the entire region. The Hampton Roads harbor area in southern Virginia has the largest concentration of military bases and government facilities of any metropolitan area in the world and is within a 45-minute commute to the North Carolina border. Military personnel stationed in Hampton Roads as well as other employees working in the area, are looking at Currituck County and other areas in the northeast as a place to call home or visit on weekends.
Transportation efforts that strengthen the cross-pollination of business activities between North Carolina are just one example of many economic development insights gleaned from Rural Freight Transport Needs study completed last June.
The NCDOT Research and Innovation Summit provides an opportune venue to connect with state leadership, transportation practitioners, and general audience members attending the summit. The

presentation will shed light on the primary areas where rural transportation investments and policies can guide economic development.

12:00 p.m. – 12:30 p.m.   *Break for Lunch*

12:30 p.m. – 1:15 p.m.   Plenary Address: N.C. Department of Transportation Update

Speakers:
J. Eric Boyette, Secretary of Transportation, NCDOT
Neil Mastin, PE, Research & Development Unit, NCDOT
State Transportation Secretary Eric Boyette gives an update on the agency's financial outlook, and latest initiatives to improve resiliency, innovation, equity, and safety.

1:15 p.m. – 1:30 p.m.   *Break*

1:30 p.m. – 3:00 p.m.   Breakouts 2

Environmental & Hydraulics
Facilitator: Natasha Earle-Young, NCDOT

Managing Stormwater Quantity and Quality with Compost Incorporation
Presenter: Christina Kranz, North Carolina State University
Urban development often involves removal of topsoil, heavy equipment traffic, and mass grading that degrade the natural structure and functions of soil. The exposed and compacted subsoil results in reduced infiltration rate, which often leads to problems establishing vegetation, increased erosion, and runoff volumes that are similar to impervious surfaces. One management solution is to incorporate compost into these soils to enhance physical properties, vegetation establishment, and pollutant removal. The goal of this field study was to determine the efficacy of soil improvement measures to reduce runoff volume, improve runoff quality, and increase vegetation establishment along roadsides. The effects of compost incorporation on runoff volume, runoff quality (total suspended solids, turbidity, and dissolved pollutants), and biomass production were evaluated over one growing season. Two sources of compost were used: (1) a yard waste commercial product at 10%, 30%, and 50% by volume, and (2) a yard waste campus-based product at 30% by volume, both compared to a tilled, no-compost control. Treatment plots were established at Lake Wheeler Road Field Laboratory in Raleigh, NC. Tilling alone may have been sufficient to reduce runoff quantity and quality as few differences were found between tilled and compost amended plots. However, the commercial compost increased biomass production proportional to the amount added. The commercial compost outperformed the campus-based compost likely due to its lower C/N ratio and nutrient profile. The improved vegetation establishment with compost is important for long-term erosion control and ecosystem services. The results of this study suggest (1) tilling is a viable option to achieve high infiltration rates and reduce runoff volumes, (2) compost incorporation does not reduce nor improve water quality, and (3) compost may yield more robust vegetation establishment.

A Web-based Approach for the Application of Deep Learning to the Automated Point Cloud Classification of Hydraulic Structures

Presenter: Zachery Slocum, University of North Carolina Charlotte

Machine learning and deep learning-based methods have been applied to a wide variety of problems in the study of transportation. Despite its adoption across science, deep learning remains inaccessible to those without graphics processing units (GPUs) or other high-performance computing (HPC) resources. Therefore, it is necessary to connect domain scientists and professionals with a means of easily utilizing deep learning for artificial intelligence-driven analytics in their respective fields. In this study, we reflect on advances made during an NCDOT funded project to connect engineers with deep learning capabilities via a web-based solution. We take advantage of the ubiquity and interactivity of web technologies to develop a more user friendly, flexible, and powerful approach for DeepHyd, a deep learning-based artificial intelligence approach for the automated classification of hydraulic structures from lidar and sonar data. Such a web-based approach is well suited for access to a complicated software system because it has a lower learning curve than directly accessing GPUs and HPC facilities often through a command-line approach. In this study, we present the web interface to DeepHyd, as well as the supporting framework and technologies required to orchestrate such a web-based system. Features of this system include asynchronous execution, logging, and high availability through containerization technologies. We present this approach to accessibility of deep learning in hopes that it will facilitate the development and use of web-based tools for complicated DeepHyd systems, thus the dissemination of NCDOT products.

Multimodal

Facilitator: Julie White, NCDOT

Investigation of Wait Time Technology for the Ferry System

Presenter: Daniel Coble, North Carolina State University

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 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.

Wireless Power Transfer for Locomotive Trains

Presenter: Tiefu Zhao, University of North Carolina Charlotte

The Rail Energy Research team at UNC Charlotte has been developing wireless charging technology for potential train applications since 2016. This presentation will present the design, simulation, and lab test results of NCDOT sponsored project Wireless Power Transfer for Switcher Trains. The project has developed the high frequency power electronics based Inductive Power Transfer (IPT) technology

to allow the switcher trains to be charged overnight and minimize the heavy labor involved in the current plug-in charging system thus minimizing exposing rail yard personnel to working hazards due to heavy loading. The proposed IPT charging system will provide substantial support for the rapid and reliable charging of the electric power supply of the locomotive trains, which will greatly facilitate asset management in terms of efficiency, effectiveness, and safety. Ultimately, the results of this research will benefit the railyard as to the enhancement and safety of the yard operations and provide an enabling charging technology to modernize intercity and commuter rail to reduced/zero emissions operation.

Transportation Barriers to Health Care Access During COVID-19 Pandemic Among NC Residents
Presenter: Abigail Cochran, University of North Carolina Chapel Hill
Drawing on results of a large survey study, we investigate transportation barriers to accessing health care during the COVID-19 pandemic among North Carolina residents. Transportation problems are known barriers to health care and can result in delayed care, as well as missed appointments and missed or delayed medication use. Groups that are already prone to greater social and economic disadvantage, including individuals who are poor and/or under or uninsured and who have chronic conditions, are more likely to encounter transportation barriers and to experience negative health consequences. Addressing transportation barriers resulting in missed or delayed care is important not only for mitigating adverse health outcomes among patients, but also for avoiding costs to the health care system stemming from increased use of emergency departments and hospitalizations. Analyzing survey results, we examine if and how North Carolina adult residents enrolled in Medicaid or Medicare encountered transportation barriers to health care during the COVID-19 pandemic. We explain how barriers affected respondents care and describe their experiences traveling to in-person appointments during the pandemic as well as using telemedicine. Using demographic and home location information collected for respondents, we analyze what factors were associated with reporting transportation barriers and related outcomes including missed or delayed care. We conclude by making recommendations regarding strategies to address transportation barriers that might meet the needs of low-income, high-frequency health care users who have higher health care-related transportation burdens and are more likely to encounter transportation barriers to care.

Pavement & Materials
Facilitator: Matthew Hildebran, NCDOT

Performance Engineered Concrete Mixtures – Pilot Project Implementation for Pavements and Structures
Presenter: Tara Cavalline, University of North Carolina Charlotte
Agencies must maintain aging infrastructure with increasingly limited resources. New infrastructure and repairs must be constructed with concrete mixtures that provide durable performance and extended service life. Performance Engineered Mixtures (PEM) is a FHWA initiative supporting design and construction of more durable, sustainable concrete infrastructure. NCDOT has sponsored a series of research studies to support development of shadow specifications and performance targets for targeted performance-related testing technologies for concrete mixtures for pavements and structures. Recently, these shadow specifications and performance targets were deployed on two

pilot project studies in order to gain NCDOT and contractor insight on these PEM specification provisions and to increase stakeholder experience with the PEM technologies. The first pilot project study focused on use of PEM technologies during construction of a rigid pavement at I-85 in Rowan County. During the project, the contractor successfully utilized the Box Test to support mixture development and field modification, as well as surface resistivity and Super Air Meter testing to support evaluation of concrete permeability and freeze-thaw durability. The second pilot project study included use of PEM technologies on several bridge structures included the in I-485 widening in south Charlotte. PEM tests included in this pilot project are surface resistivity, Super Air Meter, and shrinkage. Findings of the pilot projects will be presented, including an evaluation of the shadow specifications developed through laboratory research, and insight into the experience of NCDOT and contractor personnel. Lessons learned through implementation will be provided, along with a path for future implementation efforts.

Durability of Pipe Materials in Soils
Presenter: Moe Pour-Ghaz, North Carolina State University
Numerous culvert pipes are installed every year along North Carolina roads and highways as new construction or as replacements for deteriorated pipes. While structural requirements are considered, current selection criteria for pipe materials are limited. In this on-going study, relevant culvert exposure conditions across the state, including pH, resistivity, and chloride, are collated, and cataloged in a GIS database. The data are obtained from the United States Department of Agriculture (USDA) and the National Atmospheric Deposition Program (NADP). In addition, backfill material data provided by NCDOT are also cataloged in the GIS database. With exposure conditions determined through triangulation of the project location, a process is established for assessing the pipe materials most appropriate for the site exposure conditions. The pipe selection process is programmed in the Excel platform and is referred to as Pipe Assessment and Selection Software (PASS). The software is developed with a readily accessible user interface. It is envisioned that PASS will facilitate rapid and informed implementation of most suitable culvert material type(s) for a successful project outcome. This presentation discusses the development of the program and illustrates its application through several examples.

Autonomous Robotic Systems of Pipes Inspection through Mapping and Nondestructive Testing
Presenter: Sun Yi, North Carolina A&T State University
The interdisciplinary research team at NC A&T is developing a mapping and nondestructive test system using advanced technologies for condition assessment of pipeline networks. Several pipeline leak detection methods have been developed and used during the last decades. The exterior approach utilizes various human-made sensing systems to achieve the detection task outside pipelines. Moreover, the biological approach utilizes visual, auditory and/or olfactory senses of trained dogs or experienced personnel to detect leakage. Methods involving animals are not effective for prolonged operation for more than 120 min of continuous searching due to fatigue. It has been shown that remotely operated vehicles are durable for performing pipeline inspection tasks and functioning where cannot be accessible by dog, pigging or human. In the past decades, many technologies have been developed and used for condition assessment of pipeline networks: closed-

circuit television (CCTV), acoustic methods, and lately laser-based scanning and GPR. Beyond the above techniques, infrared thermography (IRT) is one of the possible methods for pipeline condition assessment that has attracted less attention. The research presented here focus on the inspection of open-end culverts and storm drain systems. The machine learning-based algorithms are developed and implemented for data collection, analysis, and decision making. The sensor network, which consists of 3D lidar/3D camera/radar with NDT sensors, on autonomous vehicles reduces the extent of human operator involvement in unmanned vehicles through intelligent control algorithms for pipeline inspection and monitoring. More safe and accurate remote monitoring is achieved by using smart robots and sensor networks equipped with advanced AI-based techniques. In the systems, ground robots are used with onboard sensing enable environmental observation. The ground robots are equipped to enable remote communication, teleoperation, and the transmission of collected data. Effective automated mapping requires the flexibility to allow real-time changes in planning to accommodate unmodeled/unexpected uncertainties and disturbances. The autonomous system can be used over and over with reduced cost only for maintenance. In addition, making the process autonomous would reduce the risk by human inspection, and save time for inspection, and less trained persons can obtain the data.

Lightning Talks – Unmanned Aircraft Systems/Aviation
Facilitator: Richard Greene, NCDOT

Construction-specific UAV Safety Training
Presenter: Mohammad Khalid, East Carolina University

Despite the remarkable advancements in research and innovation, the construction industry still suffers from high rates of workplace fatality and non-fatal injury every year. Construction is rapidly adopting the technological benefits of drones, which however can present a range of unforeseen safety risks and operational challenges. To mitigate the safety risks of Unmanned Aerial Vehicles (UAVs) in construction, proper safety training is necessary. Contemporary safety management programs must integrate UAV safety training programs customized for construction environments. The current study aims to present a safety training program to provide essential safety knowledge to the workforce on the safety of UAVs in construction. The developed training program was successfully tested and validated to ensure its effectiveness in enhancing UAV-related safety in construction. The program incorporates basic knowledge about non-recreational drones, relevant Federal Aviation Agency (FAA) regulations, major safety risks of drones, operational challenges, accident preventive actions, pre-flight preparations, during flight safety requirements, and post-flight procedures. The construction companies and agencies such as NCDOT along with professionals and practitioners benefit from this study to incorporate necessary safety actions to mitigate the safety risks of drones in construction.

Constructing a Coastal Plains Wetland Delineation Model Using Hyperspatial LiDAR Data
Presenter: Narcisa Pricope, University of North Carolina Wilmington

Wetlands provide critical ecosystem services across a range of environmental gradients and are at heightened risk of degradation from anthropogenic pressures and continued development, especially in coastal regions. There is a growing need for high resolution, spatially and temporally, accurate habitat identification and precise delineation of wetlands across a variety of stakeholder groups, including wetlands loss mitigation programs. Traditional wetland delineations are costly, time-

intensive and can physically degrade the systems that are being surveyed, while aerial surveys are relatively fast and unobtrusive and can be performed on demand. One significant drawback of delineations performed using remote sensing is often the lack of structural data to help differentiate between spectrally similar vegetation types. To assess the vertical structure of complex forested wetlands more accurately in the Atlantic Coastal Plains, we quantitatively assess the relative performance of UAS-borne LiDAR data in terms of point cloud and terrain metrics when compared with traditional airborne LiDAR. We show that UAS-borne LiDAR data is effective in penetrating canopies to provide high resolution, high accuracy ground measurements, supplemented by vegetation structure measurements under a range of canopy cover densities. The ultra-high resolution of LiDAR-derived topography models can fill wetlands mapping needs and increase accuracy and efficiency of detection and prediction of sensitive wetland ecosystems.

Persistent UAV Operations
Presenter: Andy Ham, North Carolina A&T State University
Unmanned Aerial Vehicles (UAV) are now poised to gain widespread adoption. This project defines a persistent surveillance mission through two different designs: hands-off and rendezvous. The rendezvous design is creatively conceptualized through UAV-Flying Charging Station (FCS) teams, where FCSs recharge themselves at the base station after charging multiple UAVs. Constraint programming models effectively capture temporal, spatial, synchronization, and battery constraints, generate a detailed travel route of each vehicle in addition to task allocation and sequencing schedule, and prove optimality of small-scale instances.

Counting Aircraft Operations
Presenter: Daniel Findley, North Carolina State University
This effort evaluates airport operations tracking tools for use in the states airport system. These use sensors to capture and provide real time data 24/7 on a wide range of airport operational parameters, including takeoffs, landings, based aircraft, aircraft types and operational categories. N.C. airports could benefit in numerous ways from this tool, including properly assessing charges to aircraft operators, better informing property tax assessments from based aircraft, providing awareness of activity during off hours and providing data for decision making.

3:00 p.m. – 3:15 p.m.   *Break*

3:15 p.m. – 4:45 p.m.   Breakouts 3

Traffic & Roadway Design
Facilitator: Joseph Hummer, NCDOT

Identifying Critical Weight-Restricted Bridges with a Two-Step Network Analysis Model
Presenter: Chase Nicholas, North Carolina State University
Improving the weight restrictions on weight-restricted bridges can make transportation networks more suitable for economic development; however, identifying the bridges that are most critical to commerce on a consistent, statewide scale poses a challenge to prioritizing state funding for bridge

improvements and replacements. This study develops a novel methodology for identifying and prioritizing weight-restricted bridges critical to commerce freight. Bridge criticality is evaluated from two perspectives using a Geographic Information System (GIS) travel model to predict truck routes from trucking-dependent businesses. Bridges traversed in the travel model receive scores based on the count of modeled traversals and the cost of modeled detours. Scores are weighted by the trucking intensity of businesses generating the traversals and the distance from traversed bridges to route origins. Automation of the model with Python programming makes this otherwise time-prohibitive task possible and easily repeatable. This process offers an objective system-wide evaluation of weight-restricted bridges that can be used to inform bridge improvements and replacement projects that fall outside of dedicated funding prioritization processes. A targeted validation of final bridge scores based on local stakeholder input should be considered to confirm the modeled criticality scores. The model developed for this research could be leveraged to support other infrastructure prioritization needs.

Equity in EV Charging Access: A Case Study of Guilford County, North Carolina
Presenter: Gregory Carlton, University of North Carolina Greensboro
Electric Vehicles (EVs) were once considered a transportation mode afforded only to the wealthy. Over the past decade, a growing market of used EVs has emerged, putting this once unaffordable technology in reach of all consumers. While EVs have become more affordable and accessible, it is unclear if the charging infrastructure used to energize them has followed suit. Residents of multi-family rental properties, and residents of housing units without dedicated parking space, are less likely to have access to home-based chargers and are more likely to have to use public charging stations. Studies of west coast cities have shown that the distribution of these stations favors higher income socioeconomic groups, while disadvantaging the groups who need to access them the most. If EVs are going to become a predominant mode of transportation for citizens of all backgrounds, then EV infrastructure will need to be distributed in an equitable manner. This research used a small-scale case study of Guilford County, NC to examine (1) whether charging stations are distributed in a relatively equitable manner and (2) to evaluate the covariates that may be responsible for this distribution. Variables that were considered in this analysis included traffic flows, population density, household income, home ownership, as well as race and ethnicity. This work is essential since little research has been done to analyze charging equity in a Southeastern context. Findings from this study indicate that there are inequalities in the local charging network, driven primarily by differences in neighborhood income and population density.

Multi-Sensor Data Fusion for Signalized Arterial Travel Time Estimation
Presenter: Shoaib Samandar, North Carolina State University
There are around 330,000 traffic signals in the United States. Three-quarters of which could be significantly improved by updating their timing plans. According to a Texas A&M Transportation Institute's Urban Mobility Report, bad traffic signal timing accounts for about 300 million vehicle hours of delay on major roadways alone. The conventional operations and maintenance of traffic signals heavily rely on several inefficient and ineffective methods. Local knowledge and driver complaints are a couple of these methods. Recently, the FHWA and NTOC have shown the

importance of travel time in identifying signal retiming needs. Hence, accurate estimation of arterial travel time is of paramount importance to transportation managers. Traditionally, arterial travel time is obtained via a single source. However, as additional travel time data sources become available to transportation managers, there is difficulty surrounding the appropriate usage of each data source. This article uses the available data sources, including commercial probe, fixed-sensor, signal timing, and Bluetooth/WiFi datasets, to develop a framework in which accurate signalized arterial travel times can be estimated through data fusion. The developed framework allows combining data with different spatiotemporal resolutions both at the system and path levels. Application of the framework to a signalized arterial in Atlanta, GA, shows that the framework's performance depends on the available datasets and fusion algorithms employed. Artificial neural networks outperformed other fusion algorithms used in the case study.

Bicycle / Pedestrian
Facilitator: John Vine-Hodge, NCDOT

State-of-the-Art Approaches to Bicycle and Pedestrian Counters
Presenter: Sarah Searcy, North Carolina State University
East Carolina University collaborated with the Institute for Transportation Research and Education (ITRE) at NC State University to determine the state of the practice for bicycle and pedestrian counting technologies to inform the enhancement and future growth of the North Carolina Non-Motorized Volume Data Program (NC NMVDP). The North Carolina Department of Transportation (NCDOT) supported this research to determine alternative technologies and equipment that may have the potential to improve the effectiveness and efficiency of current pedestrian and bicycle data collection approaches. The objective was accomplished by interviewing agencies who manage counting programs, counting companies, and technology manufacturers; evaluating performance of current technologies; identifying costs, benefits, limitations, and operational requirements for technologies; and determining options for managing the cost and data integration across data collection platforms.

A Novel Arrangement and Mathematical Model of Spring and Damper in Bike Seat Mounting to Improve Ride Counter
Presenter: Chandra Asthana, Elizabeth City State University
(prepared in collaboration with Kuldeep Rawat and Akbar Eslami, both of ECSU)
Ride comfort is the most important consideration for all types of bike users. The comfort is improved by the design of the suspension mechanism. These are used at various locations in a bike such as front, rear, and hub suspension apart from saddle and seat suspensions depending on various types of bikes. Many new designs of the frame have been attempted but they are seldom used in common bikes due to the high price.
This work focuses on improving ride comfort by designing seat mounting with a novel arrangement of springs and dampers. The aim is to provide a low-cost solution to the problem. The user can buy the new seat with its mounting and use it in the available bikes of all types. The most common bikes are the road bikes that are mostly used by city or rural commuters. These are usually lighter and are good on paved trails but not comfortable on unpaved trails. The new designs suggested in this paper are

aimed at benefiting the daily bike commuters.

In this new design, a hinged four-legged mounting is used such that the vertical motion pushes the lower ends of front two legs forward and the rear two legs backward. The legs are hinged on top under the seat while the lower ends slide on two left and right rails. This allows springs and dampers to be placed horizontally between the lower end of the front and rear legs.

An Innovative Approach for Characterizing Child Pedestrian Injury: An Underestimated and Understudied Problem in NC

Presenter: Katie Harmon, University of North Carolina Chapel Hill

During October 1, 2010, September 30, 2015, there were 517 and 1,655 child pedestrians, 0-17 years-of-age, involved in non-trafficway and trafficway motor vehicle collisions, as reported in the NC crash data. Although this number is alarming, the number of injured child pedestrians treated in NC emergency departments (EDs) (N=3,323) was 1.5 times that reported in the crash data. Children are disproportionately underrepresented in the crash data, with a percent difference of 42% between the two data sources, as compared to a 31% difference among adults. The reasons for this discrepancy are multifactorial but could include a reluctance to involve law enforcement.

In addition to providing a more accurate assessment of the burden of child pedestrian injury in NC, when integrated with crash data, health data provide a more comprehensive understanding of the severity of child pedestrian injury. For example, among child pedestrians with linked crash-ED visit data (N=974), 238 child pedestrians assessed as having Evident injuries in the crash data, had serious injuries based on information present in the ED record. This has considerable implications for transportation safety decision-making and the application of countermeasures, which may be based solely on the frequency of severe and fatal injuries. Also, integrated health data provide information about the proportion of children who are admitted or die in the hospital (17%) and who are diagnosed with costly, debilitating injuries, such as traumatic brain injuries (12%). Furthermore, integrated data can be used to characterize child pedestrian injury disparities, an issue of growing importance.

Structures, Construction & Geotechnical

Facilitator: Gichuru Muchane, NCDOT

Evaluation of the Bonner Bridge Girders: Assessing Residual Capacity, Prestressing Losses and Degradation of the 56-year-Old Members

Presenter: Giorgio Proestos, North Carolina State University

The North Carolina Department of Transportation (NCDOT) is in the process of deconstructing the 56-year-old Bonner Bridge. This deconstruction provides an opportunity to evaluate the aged concrete girders of the bridge and to compare their performance with load rating calculations. Such a comparison will provide a better understanding of the accuracy and assumptions associated with prestressing losses and will allow for refinements to the load rating procedures. This presentation summarizes the performance evaluation of the Bonner Bridge girders including full-scale load testing of the 61 ft. by 45 in. deep AASHTO Type III girders, conducted in the Constructed Facilities Lab (CFL) located at North Carolina State University. The research will provide recommendations and guidelines

for how the evaluation of aging bridge infrastructure is conducted in North Carolina and how the operating lives of such structures could be extended.

Automated Semantic Segmentation of Point Cloud Data Driven by Deep Learning in 3D *Presenter: Tianyang Chen, University of North Carolina Charlotte*

In transportation, LiDAR is used to monitor the as-built status of the structures and track the geometry changes for safety management. Manually interpreting LiDAR data is time-consuming and labor-intensive to label the point cloud for subsequent processing. Semantic segmentation algorithms are designed to automate this process. Deep learning-based 3D classification algorithms are developed in recent years, and they appear to represent the state-of-the-art-performance. Deep learning-based methods require a quite large training dataset to achieve a reasonable performance. However, specialists may face limited availability of 3D data, which may further lead to imbalanced labeled classes distracting the model generalization, especially in a 3D content of a specific application, represented by hydraulic structures in this study. The development of mobile LiDAR increased its mobility and efficiency to collect 3D point clouds, spurring the emergence of related real-time applications in the 3D Geographic Information System (GIS). 3D GIS is featured by its greater details with adding one more dimension. Capabilities of 3D GIS rather than visualization are still in early stages, such as GIS Augmented Reality, disaster response, safety management. We shared our empirical knowledge generated from a related NCDOT project, DeepHyd. Typically, we will share the knowledge used in the development process, from training data preparation to hyper-parameter tuning. This will benefit the future practice of related applications using deep learning-based methods in 3D context. At last, we will discuss how deep learning-based methods can contribute to the data collection in 3D GIS especially for those mentioned applications in early stages.

Issues that Affect the Constructability of Complex Transportation Infrastructure
Presenter: Minerva Bonilla, North Carolina State University

Diverse, Modern, Unconventional Intersections and Interchanges (DMUIIs) are important elements of transportation infrastructure that improve traffic flow but are unfamiliar to the driving public and to contractors. One challenging problem with DMUIIs is that they are uncommon and there is a perception that they result in additional construction time and cost compared to conventional projects. Therefore, it is important to assess the constructability of DMUIIs so that these designs are more often selected for construction and their full benefit can then be achieved.

Enhancing the constructability of complex transportation infrastructure requires a deep understanding of best practices that have evolved over time and are only known through experience. The literature in both transportation and construction identifies such practices in general but not for DMUIIs. To address this shortcoming, the identification of the primary construction barriers related to DMUIIs and the appropriate set of best practices that most benefit (or most inhibit) their construction is needed.

One of the most promising constructability enhancement tools is Building Information Modeling (BIM) which supports 3D visualization of construction processes while establishing a link between those processes and the schedule and budget. Another enhancement tool is accelerated (modular) construction which combines offsite element construction with onsite assembly to reduce delays and

minimize construction impacts.

The presentation reports on the results of an extensive literature search focused on the constructability of DMUIIs. Key literature sources include FHWA, NCHRP, TRB, AASHTO, the Smart Work Zone Deployment Initiative, the Construction Industry Institute, as well as numerous university researchers.

NC Transportation Center of Excellence in Advanced Technology Safety and Policy

Facilitator: J. Neil Mastin, NCDOT

NC Transportation Center of Excellence in Advanced Technology and Policy (TSAP) Overview
Presenter: Randa Radwan, University of North Carolina Chapel Hill

Impacts of CAV-Ready Infrastructure on Vulnerable Road Users (VRUs): Guidance of North Carolina's Local and State Transportation Agencies
Presenter: Elizabeth Shay, Appalachian State University
As the technology and systems supporting Connected and Automated Vehicles (CAVs) continue to advance, policy and programs to help cities prepare remain underdeveloped. While CAVs have the potential to enhance mobility, accessibility, efficiency, and safety, they also raise questions about impacts on non-motorized travelers using the same road networks. There is little design and engineering guidance on adapting infrastructure to accommodate CAVs while still protecting vulnerable road users (VRUs). TSAP project #1 addresses this gap by identifying strategies cities or agencies may find useful for adapting intersections for CAVs. Further, it uses an off-the-shelf visualization tool to demonstrate the utility of rendering intersections with 3D representations of current conditions and future CAV-adapted configurations in three test cities (small, mid-sized, and large). Field surveys will use 3D and video renderings to gauge perceived level of comfort and safety of vulnerable road users. Findings from the analysis will be used to identify the most promising intersection treatments for CAV-ready but VRU-friendly design, and support policy and programs to prepare for CAVs.

IOT Solutions for Near Horizon Challenges in Smart City Pedestrian Travel
Presenter: Sean Tikkun, North Carolina Central University
Traffic and highway safety is advancing at an incredible rate with automation and AI at the lead. Pedestrians, especially those with disabilities, will continue to experience access as these new technologies emerge. This project seeks to address opportunities using existing and near horizon technologies to improve access and inclusion for pedestrians with disabilities. To advance this effort the project is engaged in three efforts centered around intersection corners and individuals with visual impairments. The first effort is to explore the use of video analytics to interpret and analyze pedestrian actions for individuals with visual impairments. These individuals learn a unique skill set that may differentiate their travel patterns and behavior at intersections when intending to cross. The second effort seeks to address potential solutions to walk request buttons. A good deal of focus has been placed on signal communication, but button location and orientation can be just as critical. Investigation has been committed to communication opportunities with mobile devices. The final

effort is exploring the communication of corner orientation and crossing information via Bluetooth device linking with personal smart phones. These projects together hope to guide future adoption of technology and inform the review of critical features to individuals with disabilities.

Operational and Economic Impacts of Connected and Autonomous Vehicles
Presenter: Srinivas Pulugurtha, University of North Carolina at Charlotte
Connected and automated vehicles (CAVs) have recently drawn increased attention from researchers in the fields of transportation planning and engineering, particularly, on investigating the potential benefits CAVs will bring regarding mobility and safety. The increase in demand of CAVs with different levels of automation, over time, are expected to have varying impacts on the operational performance, safety, and economic aspects of the transportation network. The focus of TSAP's Project # 3 is 1) to evaluate the operational and safety performance of the transportation network at various penetration rates of CAVs, and, 2) to research and assess the impact of CAVs on the economy. The findings from this project are expected to help proactively plan, design, build, operate, and maintain North Carolina's future transportation infrastructure. The Research Team has conducted a review of literature and recommended practices pertaining to CAVs, on capabilities of simulation software to model and assess operational performance measures, and on analytical methods to assess economic impacts. The Research Team is currently working on assessing operational and economic impacts of CAVs by developing microscopic traffic simulation models for selected corridors in Charlotte, North Carolina. The presentation will include an overview of literature, microscopic traffic simulation model development, calibration/validation of parameters, and preliminary results from the operational evaluation of selected corridors of different road functional classes in Charlotte, North Carolina.

Intelligent Data Exploration & Analysis for New & Existing Transportation Technology
Presenter: Hyoshin (John) Park, North Carolina A&T State University
Current Dynamic Traffic Assignment (DTA) research typically considers groups of drivers seeking either Dynamic User Equilibrium (DUE) or Dynamic System Optimal (DSO) equilibrium. Real-world solutions for minimizing congestion by routing heterogeneous road users under mixed information frameworks require more reliable and robust methods for heterogeneous users' decision-making. This research provides a methodology for reducing congestion using the competing strategies of DUE and DSO seeking drivers. A realistic simulation of the responses of drivers to sudden road network perturbations is presented by applying Dynamic Traffic Assignment (DTA) to two groups of drivers; informed and uninformed. A navigation app provides within-day route suggestions to informed drivers using information about the time-varying decision-making habits of uninformed drivers. These within-day route suggestions cause some informed users to detour from their initially proposed routes in order to minimize network congestion and delays, pushing the system toward DSO equilibrium, while uninformed drivers make day-to-day (DTD) decisions which push the system toward DUE. Simulations considering varying fractions of informed drivers show that congestion is reduced by approximately 59.2% when 20% of drivers are informed, and is nearly eliminated when 80% of drivers are informed. The computational efficiency of this approach is also improved using shared memory multi-core parallelization.

Plan for Advanced Technology Data Readiness

Presenter: Michael Clamann, University of North Carolina Chapel Hill

State DOTs use large amounts of data for a variety of reasons, including tracking crashes, recording roadway and driver characteristics, cataloguing vehicles, and making data-driven decisions about mobility and safety. These activities are performed using existing tools that collect, store, and analyze data from multiple sources. The arrival of connected and automated vehicles (CAV) will undoubtedly disrupt these systems; so, it is important to prepare for the changes in data requirements that will occur as a result of CAV deployment in North Carolina by understanding how our data will be affected and to prioritize our responses. This presentation will describe a framework for cataloging an inventory of connected and automated vehicle data elements developed for the TSAP project, Plan for Advanced Technology Data Readiness.

10:30 a.m. – 11:45am.   Breakouts 4

NCDOT Technology / Innovation

Facilitator: Alyson Tamer, NCDOT

NCDOT's Low Speed Automated Shuttle Deployment

Presenter: Stephanie Sudano, North Carolina Department of Transportation
(presented in collaboration with Thomas Chase, NCSU)

In 2020, the NCDOT Integrated Mobility Division (IMD) led the state in autonomous shuttle technology by launching the Connected Autonomous Shuttle Supporting Innovation (CASSI) pilot project. After a deployment interruption due to COVID, CASSI redeployed in summer 2021. The goal of the CASSI project is to pilot a small microtransit size shuttle to test/study: autonomous and connected vehicle technologies, suitability as a first/last mile solution, service to limited mobility individuals, and performance in various environments with a focus on rural. The pilot project is also designed to inform rule making decisions, learn what changes to infrastructure are needed to accommodate autonomous vehicle technology, and to introduce AV technology to the public. Since our presentation at the 2019 Research & Innovation Summit, we have switched to a different low speed shuttle and deployed it into three use case environments. We propose to report on those experiences as well as lessons learned.

ARTVAL: Arterial Evaluation Software

Presenters: Thomas Chase – North Carolina State University
Mike Reese, North Carolina Department of Transportation

ARTVAL: ARTerial EVALuation Software is a newly created online software program developed by North Carolina State University under a recent NCDOT Research Project. In ARTVAL, a user inputs arterial road traffic, road geometry, signal control, and work zone information to generate travel time reliability and work zone analyses based on the Highway Capacity Manual (6th ed.). The ARTVAL software tool, to be fully released in 2021, provides capacity analysis practitioners a free and streamlined alternative to commercial software that provides customized reports of performance measures.

Railroad Incidents & Trespass

Facilitator: Roger Smock, NCDOT

Innovative Data Collection and Analysis of Pedestrian Trespassing along Railroad ROW in North Carolina

Presenter: Sarah Searcy, North Carolina State University

The Institute for Transportation Research and Education (ITRE) at NC State University completed research funded by the North Carolina Department of Transportation (NCDOT) that sought to develop a more complete understanding of the extent of pedestrian trespassing along the rail network in

North Carolina. This research quantified and described pedestrian trespassing events within the 174-mile Piedmont corridor from Raleigh to Charlotte, NC and the broader statewide rail network through the development and testing of thermal video camera systems. Motion-activated thermal video camera systems were strategically mounted beyond the railroad right-of-way to record 24/7 for at least one week during each season of the year at 11 different locations across NC (Charlotte, Durham, Elon, Gastonia, Greensboro, Lumberton, Mebane, Raleigh, Rocky Mount, Salisbury, Shelby). These sites were selected based on review of the most recent five years of Federal Railroad Administration (FRA) incident data representing trespasser injuries or deaths on railroad property, train crew surveys, input from NCDOT Rail Division staff, analysis of U.S. Census Bureau population data, and evaluation of desire lines and pedestrian attractors near the railroad track using GIS. Using the trespassing event data collected by the thermal video camera systems, preliminary models for estimating and predicting trespassing across the rail network were developed. The data were also used to develop profiles of trespassing activity by season of year, month of year, day of week, and hour of day for each study location that can inform local-level intervention strategies.

Using Machine Learning to Detect Rail Trespassing Events in North Carolina
Presenter: Yuhan Chen, North Carolina State University
This effort focused on the development of a working prototype train-mounted camera system that will capture trespassing events in the nearby vicinity of moving or stopped trains. This dynamic system captures real-time trespassing data along any rail line, which will be used to better define trespassing issues. In the short term, the tools explored as part of this project will allow rail personnel to explain the extent of trespassing to municipal and law enforcement personnel, as well as the public.
Prototype machine learning algorithms, sometimes referred to as artificial intelligence, were developed as a part of this project. The algorithms developed showed a lot of promise, even with a very limited library of thermal imagery in its database. Future research efforts should look to increase the image database to continue to increase the confidence in the algorithms ability to capture pedestrian events. Even with such a limited database, the team was able to capture a significant number of events on its test track.

Making Safety Count: Estimating the comprehensive Cost of Rail Incidents with the new NCDOT Cost Tool
Presenter: Presenter: Steven Bert, Planning Communities
Unlike highway crashes and incidents, rail related incidents incur a host of industry-specific impacts can be exponentially more costly. There has been a growing need for an accurate measure of rail incident costs that reflects the broad spectrum of events that occur on the railway, including highway-rail grade crossing crashes, rail trespassing crashes, and non-crash delay incidents.
The Institute for Transportation Research and Education, under the leadership of the North Carolina Rail Division, has developed a user-friendly cost tool that can estimate the comprehensive set of costs that result from a rail incident. The tool evaluates costs stemming from property damage, injuries and fatalities, delay, rerouting, and supply chain events, as well as emergency responder costs.
The NCDOT Research and Innovation Summit provides a perfect venue to share this newly minted

and publicly available tool with an audience that would fully benefit from its use. Policymakers often underestimate the costs of rail events and are thus less inclined to allocate scarce resources to safety countermeasures. At the Research and Innovation Summit, Steve Bert (ITRE), in collaboration with Roger Smock (NCDOT Rail Division), will demonstrate how the cost tool can be used to illuminate the economic and social impacts resulting from rail incidents and discuss how the tool can be used to generate support for countermeasures and expanded safety training.

Hydraulics & Structures

Facilitator: Brian Radakovic, NCDOT

Scour Monitoring of Hydraulic Structures using Unmanned Aerial System and Sonar
Presenter: Tarini Shukla, University of North Carolina Charlotte
Scouring is one of the major causes of hydraulic structures failure all over the world. The risk of scouring amplifies in, for example, hurricanes or other extreme events, which can endanger the hydraulic structures. It is thus important to analyze the geomorphology of streams/rivers for the monitoring and assessment of scours. Remote sensing techniques such as unmanned aerial systems and sonar can provide a cost-effective solution for scour assessment in the submerged bathymetry. However, a problem exists in the collection, processing and analytics of data using these remote sensors, which is the handling of different spatial resolutions from a variety of sensors. A data fusion approach is often required to merge multi-sensor data including GPS, UAS, and single beam echosounder. Through-water photogrammetry can provide reasonably accurate measurements of clear water channel beds, while sonar can be used for turbid deep water. In this study, a single beam echosounder was used to collect sonar data on geomorphology in turbid deep water. The accuracy of this sonar data is then compared to ground truthing data. Here we present the results and demonstrate the potential of Structure from Motion (SfM) photogrammetry and sonar for quantifying submerged fluvial geomorphology at the mesoscale to monitor the scour development near the hydraulic structures. We developed a framework for data fusion of sonar and UAS data which can be integrated into the hydraulic structures modeling.

Estimating Live-bed Local Scour Around Bridge Piers: Assessment of Select Models
Presenter: Azmayeen Shahriar, North Carolina State University
Scour, defined by the loss of geomaterials surrounding the foundation support system, is a primary cause of bridge failure in the United States and worldwide. At present, there are more than 20 pier-scour models available in the literature. These models are developed in most cases from extensive laboratory testing data or from field data. However, under identical hydraulic and geometric conditions, different equations provide vastly different scour estimates that can be conservative or unconservative. Accordingly, the conclusion about the criticality of a given bridge pier is dependent on the model being used in the analysis. Five bridge scour prediction models are assessed in terms of Mean Absolute Percentage Error (MAPE, as a measure of accuracy of the prediction) and Reliability (as a measure of conservativeness of the model) using live bed laboratory and field scour measurements. Reliability is defined as the extent to which prediction from a given model is unlikely to yield a scour depth that is less than the measured scour depth in the field. A statistical model to adjust models' prediction is proposed, the statistical parameters are presented, and applicability of

the model is described. Of the models assessed, the South Carolina Scour Assessment Envelope (2018) model provided the highest reliability factor but also demonstrated a MAPE of 218%. Other considered models MAPE ranged from 205.6% to 322%. A method utilizing a modification factor to achieve a desired reliability level for any of the considered models is also presented.

Mechanically Fastened CFRP to Retrofit Existing Prestressed Concrete and Steel Bridge Beams
Presenter: Rudolf Seracino, North Carolina State University
An efficient and rapid repair technique has been developed, that does not require specialized equipment or training to install, to address deterioration and prestress loss of prestressed concrete bridge beams. The technique uses a mechanically fastened prestressed fiber-reinforced polymer (MF-FRP) system that can extend the useful service life before replacement can be scheduled. It has been demonstrated experimentally and analytically that load-postings can be removed, or bridges reopened, resulting in significant direct and indirect benefit to the community relying on the bridge. The system has already been applied to three in-service bridges in North Carolina. Details of the system, the installation, and the current performance on a repaired bridge will be presented.

Research Grant Writing Session
Facilitator: J. Neil Mastin, NCDOT

Research and Development Grant Writing
Presenters:
Stephanie Bolyard – NCDOT
John Kirby – NCDOT
Mustan Kadibhai – NCDOT
J. Neil Mastin – NCDOT
The North Carolina Department of Transportation Research & Development Unit currently manages over 100 active researcher projects. Each year, the agency begins between 20 and 25 new projects. NCDOT has updated its research program development process with a goal of engaging new researchers, improving project selection and pushing projects to implementation. Participants of this session can expect to learn about how NCDOT evaluates Research Ideas and Proposals, understand the research selection process and to gain insight into how NCDOT implements NCDOT sponsored research.

11:45 a.m. – 12:15 p.m.   *Break for Lunch*

12:15 p.m. – 1:15 p.m.   Plenary Address / Continued Lunch:
                              Unpacking Safe Systems concepts to inform our research and practice

Curtis T. Bradley, NCDOT – Research & Development Unit, will open the session.

The Collaborative Sciences Center for Road Safety, a USDOT-funded University Transportation Center headquartered at UNC, recently featured the Safe Systems Summer Learning Series to unpack what's still needed for Safe Systems approaches to be successful in meeting community safety, health, and

equity needs. Researchers from CSCRS will explore these key themes of the series during interactive this panel discussion:

- How we define road safety
- Framing Safe Systems
- Authentic community engagement
- How we can do better

Panelists:
Elyse Keefe – University of North Carolina Chapel Hill
Seth LaJeunesse – University of North Carolina Chapel Hill
Noreen McDonald – University of North Carolina Chapel Hill
Becky Naumann – University of North Carolina Chapel Hill

1:15 p.m. – 1:30 p.m.   *Break*

1:30 p.m. – 3:00 p.m.   Breakouts 5

Traffic Safety
Facilitator: Brian Murphy, NCDOT

North Carolina Crash Data Modernization
Presenter: Nancy Lefler, University of North Carolina Chapel Hill
The North Carolina Department of Transportation (NCDOT) has initiated a project that will improve the process for recording and utilizing crash data. NCDOT engaged the University of North Carolina at Chapel Hill Highway Safety Research Center (HSRC) to develop and deploy a modern solution to collect and report quality crash data; formally named the North Carolina Crash Reporting Information System NC CRIS. The goal of the project is to create a system that records crash data efficiently and effectively while producing quality reports that help improve highway safety. The purpose of this presentation will be to provide an overview of the project, update on the progress, status, and next steps. The presentation will also discuss the challenges faced and successes so far in the project.

Detecting and Classifying Congestion Onset on Freeways using Probe Data
Presenter: Ishtiak Ahmed, North Carolina State University
The mobility and safety of freeways largely depends on how quickly and effectively the onset of congestion can be detected. This study proposes a tool for highway system managers to identify the onset of demand-induced congestion (DIC) and to detect incident-induced congestion (IIC) on freeways. The distribution of travel rates (travel time per unit distance traversed) of (probe) vehicles were investigated for trends that suggest system performance is changing.
The probe data used in this research were derived from Bluetooth sensors that were deployed by Caltrans on Interstate 5 southbound near Sacramento, CA. It was found that for a group of consecutive probes, the faster vehicles tend to slow down sooner than the rest as traffic density gradually increases before a DIC. At the beginning of a disruptive incident, travel rate increases

abruptly for some vehicles, while the rest can still maintain their speed. Analyses showed that the 5th percentile travel rate (representing the faster probes) for 30 successive probes exceeding 0.9 minutes/mile indicates the onset of a DIC. The spread between the 95th (representing the slower vehicles) and 5th percentile travel rates exceeding 0.4 minutes/mile indicates an IIC. If both conditions satisfy, it indicates that an incident happened during a DIC. This algorithm detected most reported incidents that seemingly caused congestion. It also detected the onset of most DICs 15-30 minutes before those were distinguishable from the raw data. Ongoing research includes assessing the performance of this algorithm by comparing the outputs against ground truth information on congestion onsets.

As Seen on TV: Media Coverage of Traffic Crashes and Opportunities to Reshape the Dialogue Around Road User Injury
Presenter: Stephen Heiny, University of North Carolina Chapel Hill
The way TV news stations cover traffic crashes and injuries both shape and are shaped by public perceptions about what is normal, right, and just about our transportation systems. News media frames outline who was involved in traffic crashes, who is responsible for them, and often imply what might be done to address road user injury. Research Associate with the UNC Highway Safety Research Center, Stephen Heiny worked closely with transportation safety and journalism colleagues at UNC to analyze more than 1,000 crash-featuring TV news stories in the U.S., spanning the years 2012-2019. Findings reveal clear patterns of reporting, such as focusing on traffic congestion, placing responsibility solely on road users, and treating most crashes as isolated from other crashes. Stephen will share details on the study's, methods, findings, and the team's development of a Media Framing Guide designed to motivate transportation and public health professionals to work with news journalists to help shape the narrative around traffic injury.

Transportation Resiliency
Facilitator: Colin Mellor, NCDOT

Discussion with NCDOT's Resiliency Team
Panelists:
Introduction
Colin Mellor, NCDOT

Long Range Transportation Plans/NCMOVES 2050/Strategic Transportation Corridors Vulnerabilities
Natasha Earle-Young, NCDOT

Flood Inundation Mapping and Alert Network for Transportation/BRIDGEWATCH
Matthew Lauffer, NCDOT

Improving resilience to riverine flooding using integrated approaches
Barbara Doll, North Carolina State University

It is essential that the North Carolina Department of Transportation (NCDOT) plan and prepare North Carolina's transportation system to adapt to and recover from a wide array of potential disruptions

and stressors. A Resiliency Program has been developed to aid NCDOT in integrating resiliency into its everyday practices. This session will go over background information and concepts, NCDOT's resiliency policy, projects and programs currently underway, and available products and tools. Over the last 18 months NCDOT's Resiliency Team has endeavored to catalog current efforts, increase internal and external coordination, and define a path forward. Join us in a panel discussion following the presentation discussing planning for resilience, storm response, and designing for the future.

Equity / Social Impacts in Transportation
Facilitator: Majed Al-Ghandour, NCDOT

Enhancing Equity Considerations in NCDOT Project Funding with Socioeconomic Geospatial Analysis
Presenter: Joy Davis, North Carolina State University
(video presentation with co-presenters Jason Coupet and Chase Nicholas, both of NCSU)
Public transportation access is critical to many dimensions of public life and social well-being, including nutrition, education, and healthcare. However, prioritization and scoring processes that transportation planning agencies use to select projects and their locations typically emphasize only cost and other dimensions that do not account for community-level impacts. This often leaves consideration for socioeconomic indicators, which have been historically challenging to integrate, out of the project funding prioritization process. However, measuring socioeconomic outcomes is critical to building transportation systems that promote both equity and efficiency. We propose a raster suitability analysis (RSA) approach, an innovative method that transportation planners and managers can use to establish impact factors (data-driven socio-economic indices) that can be applied to augment the scoring process for non-highway projects. This RSA approach will include combining multiple layers of quantitative data, standardizing it into a scoring system, and aggregating the data to produce a raster layer containing values representing the suitability of each area or project in a geospatial context. The resulting map can then be used to evaluate different proposed projects for each mode of transportation (i.e., bicycle/pedestrian, public transportation, etc.) and, by adjusting the parameters appropriately, between different transportation modes. The map can be utilized to generate data-driven metrics that augment or supplement a scoring process for comparing transportation project options. The approach is well-suited for incorporating readily available data related to connecting communities to healthcare facilities, healthy food, and other spaces that can influence socioeconomic outcomes. The results of this study can be used by NCDOT to compare projects of many types of transportation modes and to provide evidence-based support for selecting projects that more equitabilies distribute the benefits of transposition projects.

Evaluating the Framing of Safety, Equity, and Policing in Active Transportation: Responses to the Murder of George Floyd, BLM, and Calls to Defund the Police
Speaker: Sarah Brown, Kittelson & Associates, Inc.
This project aimed to construct a narrative to explore how the framing of safety, equity, and policing is changing in the active transportation profession following the murder of George Floyd on May 25, 2020, by Minneapolis Police Department officer Derek Chauvin. This study uses relational content analysis to study the nuances of how organizational leadership is talking about safety, equity, and policing in response to his death and the following calls for Black Lives Matter and defunding the

police. Ten active transportation organizations studied had racial equity-imbued rhetoric in response to this intense and emotional time in U.S. history. Findings show that the definition of safety in transportation is expanding to include safety from police. Additionally, mentions of condemning acts of racism, human rights, alternatives to policing, and addressing ways to decrease interactions with police in transportation are explored. There is also an emerging support for questioning the reliance on the framework, specifically Enforcement, and looking toward Safe Systems approaches within transportation. This project hopes to contribute to the conversation around the definition of safety, the use of police, and the framework in active transportation policies, programs, and research.

Examining the Disparities in Activity-Travel Behavior Adaptation among Socio-Economic Groups during the COVID-19 Pandemic
Presenter: Olivia (Jueyu) Wang, University of North Carolina Chapel Hill
The onset of COVID-19 has disrupted many aspects of human life, which has, directly and indirectly, changed people's mobility patterns. Numerous studies have revealed significant disparities in mobility reduction among different socio-economic groups during the lockdown; more advantageous neighborhoods with higher percentages of whites and people with higher income and a high education degree tend to have more mobility reduction (Dasgupta, 2020; Pepe, et al., 2020). However, how activity-travel behavior has changed during the lockdown is yet unclear. Moreover, limited is known about whether the changes persisted afterward or bounced back to the pre-pandemic level. The knowledge will be useful to guide health policymakers to make public health policy. It would be also important for planning policymakers to develop more equitable, sustainable, and resilient transportation systems.
This research aims at investigating how and to what extent people's activity-travel behavior has changed in North Carolina during and after the lockdown and how these changes are associated with the socio-economic status (SES) at the block group level. Via using the mobile phone data from SafeGraph, we derived the travel demand to the eight types of destinations and then constructing econometric models to examine the correlation between activity-travel behavior and the SES of block groups. The analysis reveals significant changes in people's travel behavior and disparities in these changes by block groups with different socio-demographic characteristics.

NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology
Facilitator: J. Neil Mastin, NCDOT

NC – CAV Overview
Presenter: Ali Karimoddini, North Carolina A&T State University
The NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV) was initially funded by the North Carolina Department of Transportation in 2020. The NC-CAV Center brings together a strong and diverse team of researchers from North Carolina A&T State University (NCAT), North Carolina State University (NCSU), and the University of North Carolina at Charlotte (UNCC) with the goal of "establishing a multidisciplinary Center of Excellence in "Advanced Transportation Technologies" to investigate the adoption, utilization, and deployment of CAVs and

their impacts on the transportation system in North Carolina and the nation." This talk will provide a brief overview of planned activities and achievements under the NC-CAV Center.

Overview of Thrust 1: CAV Impacts on Traffic Intersection Capacity and Transportation Revenue
Wei Fan – University of North Carolina Charlotte
Thrust 1 of NC-CAV investigates the impacts of CAV technologies on the current transportation system's performance, in particular on intersection capacity adjustments considering different levels of CAV adoption under different traffic situations. Thrust 1 also assesses the fiscal revenue impacts of the transition to CAVs on North Carolina's cities, towns, and households. This talk will provide a brief overview of planned activities and achievements under Thrust 1 of NC-CAV Center.

CAV Revenue Impact Analysis
Daniel Findley – North Carolina State University
Thrust 1 of NC-CAV will investigate CAVs' impacts on North Carolina's transportation system as well as associated revenue impacts of CAV deployment. In particular, this thrust will assess the transportation revenue impacts of the transition to CAVs on North Carolina's cities, towns, and households and will advise on the adoption of new or better ways that can ensure the availability of critical financial resources in the future.

Overview of Thrust 2: Assessing North Carolina Readiness for CAVs in Traditional and Emerging Infrastructure Needs
Thomas Chase – North Carolina State University
Thrust 2 of NC-CAV analyzes the readiness of the existing transportation infrastructure and maintenance programs to support CAV deployment and investigate the emerging infrastructure required for the adoption of future CAV technologies. Further Thrust 2 develops and tests a 5G architecture for secure V2I applications for communication between CAVs and the transportation infrastructure. The findings from this implementation effort are directly related to NCDOT expansion in this area for multimodal adoption of CAVs in the near future. This talk will provide a brief overview of planned activities and achievements under the Thrust 2 of NC-CAV Center.

Next-Generation Wireless Networking Architecture for CAVs
Chia-Hung Lin – North Carolina State University
Thrust 2 of NC-CAV proposes a new wireless networking architecture to serve vehicular communications. To be more specific, the new architecture can better work with edge computing and artificial intelligence solutions, reducing latency to serve latency-important vehicular communication applications. To validate our architecture and solutions, we build a platform by integrating SUMO traffic simulator and communication system based on the latest 5G&B standards. Moreover, novel deep learning-based solutions are also developed in the platform to aid vehicular communications.

Overview of Thrust 3: Developing and Implementing CAV Applications for Advancing the Transportation Systems
Abdollah Homaifar – North Carolina A&T State University
Thrust 3 of NC-CAV Center develops and experimentally validates CAV applications such as cooperative control techniques for CAVs and UAVs. In particular, Thrust 3 researchers develop cooperative control techniques for On-Demand mobility applications, prototype a testbed of a

network of CAVs to implement emergent applications of CAVs, and explore the application of UAVs for transportation systems such as aerial traffic monitoring and accident or emergency management. This talk will provide a brief overview of planned activities and achievements under the Thrust 3 of NC-CAV Center.

Micro-simulation based model for traffic condition analysis and predictions for an on-demand-mobility CAV application
Benjamin Lartey – North Carolina A&T State University
This talk will present our developed a microscopic simulation model of a specific area using Aimsun Next traffic simulation software and calibrated it with the actual collected data. Running this model, we extracted the simulation data which comprises the travel time, travel delay time and speed (collected every 15 minutes). Also, to find an alternative and more efficient approach to predicting these traffic variables, we developed a hybrid machine learning (ML) model for predicting the travel time, travel delay time, and speed over some time interval. Finally, we evaluated and compared the performance of the hybrid model with other ML models. Prediction of these traffic variables can help traffic managers to take appropriate measures to mitigate traffic congestion and its related negative effects on the environment. Proper traffic congestion relief policies will lead to an efficient and smooth operation of mobility on demand (MOD) systems such as ridesharing.

3:00 p.m. – 3:15 p.m.   Break

3:15 p.m. – 4:45 p.m.   Breakouts 6

Interactive Poster Session
Facilitator: Sarah O'Brien, University of North Carolina Chapel Hill

Visit this online interactive poster hall discussion to learn about exciting new transportation research. Poster authors will host their own virtual breakout discussions to answer questions about their posters. Visit the poster gallery in advance of this session: Virtual Poster Gallery - HSRC (unc.edu)

Poster presenters:
Ishtiak Ahmed, North Carolina State University
Abdullah Alsharef, North Carolina State University
Matthew Carroll, East Carolina University
Sarvani Duvvuri, University of North Carolina Charlotte
Hardik Gajera, University of North Carolina Charlotte
Benjamin Lartey, North Carolina A&T State University
Jinkun Lee, East Carolina University
Chia-Hung Lin, North Carolina State University
Shaojie Liu, University of North Carolina Charlotte
Raunak Mishra, University of North Carolina Charlotte
Kai Monast, North Carolina State University

Xiuli Qu, North Carolina A&T State University
Li Song, University of North Carolina Charlotte
Trung Tran, Fayetteville State University
Michael Uduebor, University of North Carolina Charlotte
Morgan Westbrook, North Carolina State University
Rachael Yuan, University of North Carolina Charlotte
Lei Zhu, University of North Carolina Charlotte

National Cooperative Highway Research Program
Facilitator: Joseph Hummer, NCDOT

Impact and Outcomes of NCHRP Research in North Carolina
This session will highlight some of the remarkable research being conducted for NCHRP in North Carolina in traffic engineering, including capacity, safety, and design. The speakers will discuss ten ongoing research projects that will eventually result in revisions and additions to the Highway Capacity Manual, the Highway Safety Manual, and the AASHTO Green Book. They will also update us on advances in crash modification factors, safe systems applications, and intersection control evaluation procedures. We will see what the new products will look like and hear when they will be released. Audience members will also gain an appreciation for the research traditions and capabilities in our state and see again why North Carolina is a leader in transportation.

Overviews of six NCHRP projects
R.J. Porter, VHB, Inc.
Bastian Schroeder, Kittleson Associates
This presentation will cover these six projects:
- NCHRP 17-81, Proposed Macro-Level Safety Planning Analysis Chapter for the Highway Safety Manual
- NCHRP 17-86, Estimating Effectiveness of Safety Treatments in the Absence of Crash Data
- Brief Overview of just starting NCHRP 7-29, Development of the 8th Edition of AASHTO's A Policy on the Geometric Design of Highways and Streets (Green Book)
- Pooled Fund Study on Connected and Automated Vehicles in the HCM
- Other updated in HCM 6.1 (Systems Method, two-lane highways, pedestrian methods)
- Preview of NCHRP 07-26 on new methods for merge, diverge, and weaving segments in the HCM (post Version 6.1)

Update of Crash Modification Factors for the Highway Safety Manual
Raghavan Srinivasan, University of North Carolina Chapel Hill
This presentation will give an overview of NCHRP 17-72: Update of Crash Modification Factors for the Highway Safety Manual. The overall objective of this effort was to establish rating/inclusion criteria for CMFs and guidelines on how CMFs could be incorporated into the next edition of the HSM. The

second part of my presentation will provide a very overview of other NCHRP projects being led by UNC's Highway Safety Research Center.

Transportation Equity

Facilitator: Curtis T. Bradley, NCDOT

NCDOT's Diverse, Equitable, and Inclusive Policies
Presenters:
Aldean Coleman, North Carolina Department of Transportation
Jamille Robbins, North Carolina Department of Transportation
Tunya Smith, North Carolina Department of Transportation

NCDOT is committed to providing diverse, equitable, and inclusive (DEI) policies and practices that improve transportation access, services, and projects. This commitment to transportation equity impacts NCDOT's business practices and citizens of North Carolina who are impacted by transportation every day. In this session, NCDOT will present ongoing projects, initiatives, and strategies focused on public involvement, environmental justice, and internal DEI strategies. Within this presentation there will be discussions that highlight the context of these initiatives and potential research needs.

Participants can expect to learn the following:

- Receive an overview of the Strategic Equity Agenda (SEA – Change), a living document that provides a set of forward-looking strategies for increasing equity, from NCDOT divisions that directly report to the Chief Operating Officer.
- Understand what agency-wide initiatives are being created to embed DEI in all Transportation Programs and Services.
  - Learn the benefits of having a DEI perspective in the decisions and services provided by the entire NCDOT organization from planning and operations to construction and design.
- Learn about how public engagement methods can move the Department beyond geographic based equity considerations to a more needs based (age, minority, gender, low income, disability, accessibility) evaluation.
- Discuss potential research needs and opportunities to support NCDOT's commitment to DEI initiatives and strategies.

NC Transportation Center of Excellence on Mobility and Reducing Congestion

Facilitator: J. Neil Mastin, NCDOT

Introduction
Presenter: Billy Williams, North Carolina State University

The North Carolina Center of Excellence on Mobility and Congestion is a consortium of the three Triangle universities along with Fayetteville State University and North Carolina Agricultural and Technical University. Researchers and students at the five universities are forging synergistic collaborations through research projects spanning three focus areas aimed at improving transportation access and mobility and reducing congestion. In the presentations that follow, the project leaders will highlight the progress and anticipated outcomes of the research and also discuss

how the collaborative relationships fostered by the center of excellence activities will continue to provide value to the state in future research and development.

Deep Learning Software for Traffic State Prediction
Presenter: Sambit Bhattacharya, Fayetteville State University
This project is pushing the forefront of applying the Sim2Real concept to advanced traffic control system design. Sim2Real grew out of the robotics field from the desire to create realistic simulation of robotic systems that would allow rapid transfer of simulated skills to actual robotic systems. The need for realistic simulation for design and testing of traffic control systems is great because the acquisition of real-world data at the scale required for robust system design and testing is not possible. The project team is creating a first-of-its-kind joint simulation integrating PTV's Vissim microsimulation program with the CARLA open-source autonomous driving simulator.

Smart Connected and Automated Vehicle Fleet Management: Developing Regional Dispatch Decision Support for Congestion Mitigation
Presenter: Missy Cummings, Duke University
With the arrival of enhanced vehicle and infrastructure connectivity, as well as potentially new technologies like self-driving vehicles, the workload of regional dispatchers will increase for both routine and unusual congestion-management tasks. In-vehicle technologies like GPS-enabled navigation software applications theoretically aid drivers in reducing the impact of congestion on their travel times, but resulting emergent behavior can cause new areas of congestion that cause safety problems. Moreover, not all drivers use such alerting tools so it is not clear how and when to push communications to traditional vehicles in order to mitigate negative congestion consequences. To this end, Duke University's Humans and Autonomy Laboratory has developed the CADS (Congestion Alerting Decision Support) tool that allows transportation planners the ability to see the impact of congestion-caused rerouting apps on local communities (including hospitals, schools, and first responders). It also provides the ability to determine when and where to communicate with both connected and conventional vehicles to minimize congestion impact both in advance of known traffic disruptions (like construction), but also for real-time incidents.

Transit and MaaS Role in Improving Economic and Healthcare Access for Underserved Populations
Presenter: Kai Monast, North Carolina State University
Changes in healthcare policy such as Medicaid Transformation combined with deployment of new ridesharing technologies and occurring during a global pandemic are shifting the landscape of transport in NC, especially for historically underserved populations. This project documents how these shifts are impacting how North Carolinians access healthcare and other destinations. To accomplish these goals, surveys, interviews and transportation network modeling are combined with spatial and tabular data for the Inter County Public Transportation Authority in northeastern North Carolina to analyze five distinct transition periods centered around COVID-19, Medicaid Transformation, and Mobility as a Service, which all occur during a 2-year timespan.

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Appendix F: Presenter Bios

2021 North Carolina Department of Transportation Research & Innovation Summit Presenter/Facilitator Bios (as of 10/3/2021)

Ishtiak Ahmed, Ph.D.
Dr. Ahmed is a postdoctoral research scholar at Institute for Transportation Research and Education, NC State University. From 2015 to 2020, he worked as a research assistant at NC State University. He completed his MS in 2017 and PhD in 2020, both from the civil engineering department of NC State University. He completed his bachelor's degree in 2013 from the civil engineering department of Bangladesh University of Engineering and Technology.

Majed Al-Ghandour, Ph.D., PE, CPM, MCSD, MCT
Majed Al-Ghandour serves as a Director of the Project Management and Powell Bill Program and the Assistant Director with NCDOT Planning and Program Division. He has over 26 years of work experience in the areas of planning, modeling, analysis, program management, state and federal policies, project funding, and scheduling. Majed received a Ph.D. in Civil Engineering from NCSU. He is a registered Professional Engineer in North Carolina and Virginia. He serves on many National Cooperative Highway Research Program (NCHRP) panels and committees and has published more than 34 papers. Majed also serves as the Chair of the American Society of Civil Engineers (ASCE) Transportation and Development Institute (T&DI) Street and Highway Operations Committee. He is an Adjunct Professor at NCSU and FSU. Al-Ghandour received the 2020 ASCE Government Civil Engineer of the Year Award in September 2020.

Alex Albert, Ph.D.
Dr. Alex Albert is an Associate Professor in the Department of Civil, Construction, and Environmental Engineering at NC State University. He earned his Ph.D. in Civil Engineering from the University of Colorado at Boulder in 2013. He also received a master's degree in Structural Engineering from Lehigh University, Pennsylvania in 2010. Dr. Albert's research focuses on addressing the safety challenges experienced in the transportation and construction industry.

Abdullah Alsharef, Ph.D. Candidate
Abdullah Alsharef is a Ph.D. candidate in Civil Engineering (major) and Statistics (minor) at NC State University (NCSU). He earned his master's degree at NCSU by investigating factors that affect let date and designed model approaches to predict construction expenditures for transportation megaprojects. His current research interests include construction and traffic safety management, payout curves prediction, and developing best practices in construction.

Chandra Asthana, Ph.D.
Dr. Chandra B. Asthana completed undergraduate education in aeronautical engineering at the Indian Institute of Technology, Kharagpur, the postgraduate education in aeronautical engineering and Ph. D. in control systems design at Indian Institute of Science, Bangalore. He has worked at Air India, Defense Research and Development, Hyderabad, India, at CAE Inc. Montreal Canada and Lockheed Martin, Netherlands. He has taught at McGill and Concordia University, Canada. He is currently an Associate Professor at Elizabeth City State University. His research interests are in the area of aviation, aerodynamics, control system design, modeling, simulation, aircraft, and unmanned aerial vehicles, teaching and mentoring undergraduate and graduate students.

Siddharth Banerjee, Ph.D. Candidate
Siddharth is a PhD Candidate in the Civil, Construction, and Environmental Engineering department at

NC State University. Originally hailing from India, he obtained his BS in Civil Engineering from India and master's in construction management from Arizona State University. He is a construction data analytics enthusiast with a graduate minor in Statistics from NCSU and is seeking to address numerous construction management related issues using artificial intelligence. At NCSU, he serves as the President of Construction Management Association of America (CMAA) and Treasurer of the Associated General Contractors (AGC) student organizations.

Steven Bert
Steve Bert is the Chief Strategy Officer and Principal Economist at Planning Communities, LLC. Steve's professional career has included both academic and consultant services in the areas of economic, geospatial, and data analysis, tool development, policy evaluation, and transportation planning. During Steve's time at ITRE, he developed the publicly available Comprehensive Cost of Rail Incident's Tool, which can be used to estimate the economic and social costs that result from rail collisions and other safety events. Steve takes an active role in professional service activities in the industry serving as the Communications Coordinator for the Economic Development and Land Use Committee (AMS50) and member of the Standing Committee on Transportation Economics, Revenue, and Finance (AJE50) of the Transportation Research Board.

Sambit Bhattacharya, Ph.D.
Dr. Sambit Bhattacharya is a Professor of Computer Science at Fayetteville State University, North Carolina, USA. He specializes in teaching Computer Systems & Artificial Intelligence (AI) courses, and he works on AI research with a broad range of techniques and applications, and with multidisciplinary teams. He has published many research articles, and has directed projects funded by federal agencies and private industry.

Minerva Bonilla, Ph.D. Candidate
Minerva earned her B.S. in Civil engineering from Texas Tech University and completed her M.S. in Civil Engineering with an emphasis in Construction Engineering from North Carolina State University. She is currently working on her Ph.D. in both Construction and Transportation Engineering at NCSU under the direction of Dr. William Rasdorf. Minerva's research areas include constructability, modern unconventional intersections and interchanges, and funding for transportation infrastructure.

J. Eric Boyette
Eric Boyette was named secretary for the N.C. Department of Transportation by Governor Roy Cooper in February 2020. As transportation secretary, Boyette oversees one of the largest state-maintained highway systems in the nation, and all modes of transportation, including aviation, ferries, rail, public transit and bicycle and pedestrian transportation, as well as the Office of Civil Rights and Division of Motor Vehicles. He is the chairman of the N.C. Turnpike Authority Board of Directors and serves on the State Ports Authority Board of Directors and State Emergency Response Commission. Boyette earned a Bachelor of Science from Barton College.

Curtis T. Bradley, Ph.D.
Dr. Curtis T. Bradley is a member of the NCDOT Research & Development Unit, where he serves as the Research Implementation Manager. He is responsible for assisting with the implementation of research, technology transfer as well as evaluating the results of research projects. He is also the Project Manager for the Planning, Programming, Policy, & Multi-Modal Sub-Committee and conducts internal research and statistical analysis to guide internal practices and methodologies.

Sarah Brown
Brown is currently a transportation analyst at Kittelson & Associates. She received her Master of City and Regional Planning at UNC Chapel Hill and has bachelor's degrees in Civil Engineering and Professional Writing from Worcester Polytechnic Institute. Sarah was a research assistant at the UNC Highway Safety Research Center and worked closely with the Health and Community Sciences team as well as the Collaborative Sciences Center for Road Safety on a variety of projects exploring transportation safety. Sarah was a recipient of the 2020 Dwight D. Eisenhower Transportation Fellowship, and she focused her work on exploring the nuances of messaging and framing around safety, equity, and police enforcement within active transportation. Her interests lie in mobility justice and exploring connections between safety, design, power, and human rights.

Gregory Carlton, Ph.D. Candidate
Gregory Carlton is a PhD Candidate in the Department of Geography, Environment, and Sustainability (GES) at UNCG. His focus is on studying emerging transportation modes through the use of geospatial techniques, network analysis, and big data analytics. His current research emphasis is on identifying distributional inequalities in Electric Vehicle Supply Equipment (EVSE) using areal and space-time accessibility frameworks.

Matthew Carroll
Matthew is a graduate student at East Carolina University studying Software Engineering. He received his B.S. in Engineering with concentration in Electrical Engineering from E.C.U. in 2020. His recent research work focuses on applying machine learning techniques to traffic simulation.

Tara Cavalline, Ph.D.
Dr. Cavalline is an Associate Professor in the Department of Engineering Technology and Construction Management at UNC Charlotte. She and her team perform research on cementitious materials, concrete recycling, quality assurance, asset management for pavements and bridges, and forensic engineering. Engaged in research to support NCDOT for over 10 years, her team has completed and active projects in the areas of bridges, pavements, and asset management. She serves as a member of TRB's Transportation Infrastructure Group and on several TRB committees, as well as on several ACI committees. She is a member of several NCHRP panels and FHWA's EDC-6 Targeted Overlay Pavement Solutions Team.

Thomas Chase, Ph.D.
Mr. Thomas Chase is a Research Scholar with ITRE and is the NC State University lead for the NCCAV Center. Thomas leads ITRE's ITS and CAV Research Areas which focus on deployment evaluation, benefit cost analysis, simulation, and human factors. He specializes in freeway operations, pedestrian behavior and simulation, big data and visualization, advanced signal control, travel time reliability, and network modeling and monitoring.

Tianyang Chen, Ph.D. candidate
A Ph.D. candidate in Geography from the University of North Carolina at Charlotte. He serves as a research assistant in the Center for Applied Geographic Information Science. His research interests are around GeoAI, 3D GIS, and geocomputation.

Yuhan Chen, Ph.D. candidate
Yuhan Chen is a Ph.D. student advised by Dr. Lobaton in the Active Robotic Sensing (ARoS) Lab at North

Carolina State University. She received her B.S. degree in Electrical and Communication Engineering from the South China Normal University and her current research interests include machine learning, bio-signal processing, and computer vision.

Michael Clamann, PhD
Michael Clamann joined HSRC as a senior human factors engineer in 2018. He researches how technology can help reduce human error on our roadways, and his areas of expertise include human-automation interaction and autonomous vehicle technology. For more than 17 years Michael has worked in industry and academia studying how people can effectively team with highly automated and autonomous systems in a variety of domains including transportation, aerospace, defense, and telecommunications. He also represents HSRC as a member of the North Carolina Department of Transportation's Fully Autonomous Vehicle Committee, where he leads the Autonomous Vehicle Research Group. Michael received a Ph.D. in Industrial and Systems Engineering with a Psychology minor at North Carolina State University in 2014. He received a M.I.E. in Industrial and Systems Engineering and a M.S. in Experimental Psychology from North Carolina State University in 2011 and 2002, respectively. He is a Certified Human Factors Professional (CHFP) and a member of HFES.

Daniel Coble
Daniel has been with the Institute for Transportation Research and Education at NC State for 7 years, over 3 years as staff. He is currently working towards 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 sound studies on rumble strips and sound walls, effectiveness of radar vehicle-detection systems at rail crossings, and plane-tracking technology for airports.

Abigail Cochran, Ph.D.
Dr. Abigail Cochran holds a Master of City Planning and Ph.D. in City and Regional Planning from the University of California, Berkeley. She is broadly interested in travel behavior, transportation policy, disability, aging, and health. She is presently working as a postdoctoral research associate at the University of North Carolina at Chapel Hill, researching barriers to accessing transportation to health care and new models for providing non-emergency medical transportation.

Aldea Coleman
Aldea Coleman is the Policy Director for North Carolina's Department of Transportation (NCDOT). Aldea is responsible for managing strategic initiatives and policies within the agency. Aldea joined NCDOT after many years of national transportation and urban planning work. Her experience includes advocacy programming that resulted in safer street design for communities, and outreach initiatives that advocated for more culturally sensitive community design.

Jason Coupet, Ph.D.
Jason Coupet is a University Faculty Scholar and Associate Professor of Public Administration in the School of Public and International Affairs at NC State. Jason's Ph.D. is in Strategic Management from the University of Illinois at Chicago, and his BA in Economics from the University of Michigan. His research interests include strategic management, Data Envelopment Analysis, performance measurement, organizational economics, research methods, and the political economy of organizations. He was also a National Science Foundation Mentoring Fellow in Economics (DITE) at Duke University.

Mary (Missy) Cummings, Ph.D.

Professor Mary (Missy) Cummings received her B.S. in Mathematics from the US Naval Academy in 1988, her M.S. in Space Systems Engineering from the Naval Postgraduate School in 1994, and her Ph.D. in Systems Engineering from the University of Virginia in 2004. She is currently a Professor in the Duke University Electrical and Computer Engineering Department and the Director of the Humans and Autonomy Laboratory.

Chris Cunningham, Ph.D.

Chris is currently Director of Systems Design and Operations at ITRE (Institute for Transportation Research and Education) at North Carolina State University. He has been with ITRE for 20 years. Mr. Cunningham's areas of expertise include traffic signals, bike and pedestrian safety and operations, and general traffic operations. In addition, Mr. Cunningham manages the Traffic Systems Innovation Program (TSIP) at ITRE, which regularly deploys specialized data collection applications and traffic systems that require innovative data collection techniques. Mr. Cunningham's past research sponsors include NCHRP, the FHWA, the FMCSA, NCDOT, ITE, NIH, NC Governor's Highway Safety (NCGHSP) program, and 3M Traffic Safety Solutions. He has assisted or led in over 60 projects with these clients.

Joy Davis, MPA, PMP

Joy Davis, MPA, PMP, is a Research Coordinator at the Institute for Transportation Research and Education. She has more than 15 years of experience managing international and domestic projects focused on improving public sector processes and project outcomes. She is a member of the Transportation Research Board (TRB) Standing Committee on Access Management (ACP60), the incoming chair for ANB10(6) Subcommittee on School Transportation, and serves as a panel member for multiple National Academies of Sciences, Engineering, and Medicine Research projects.

Barbara Doll, Ph.D.

Barbara Doll is an Extension Associate Professor in the Biological & Agricultural Engineering Department and Extension Specialist for NC Sea Grant based at North Carolina State University located in Raleigh, North Carolina. Barbara holds a Ph.D. in Biological and Agricultural Engineering and is a licensed professional engineer. Barbara leads the Stream Restoration Program at NC State University, which carries out research, trains students, conducts numerous training workshops for professionals and organizes EcoStream, the Southeast Regional Stream Restoration Conference. Doll is the principal investigator for more than $1 million in grant funds and leads a team of engineers and students that conduct outreach and research projects focused on evaluating the performance of stream restoration efforts, developing new techniques for ecological restoration, and assisting communities with flooding and water quality challenges.

Monica Duval

Monica Duval is the Assistant Locating Engineering for NCDOT Division 3 Location and Survey's Unit. Monica has over 30 years of engineering and surveying experience in both the private and public sector. Her career includes surveying, roadway design, bridge management and utility coordination.

Sarvani Duvvuri, Ph.D.

Ms. Sarvani Duvvuri is pursuing her Ph.D. in Infrastructure and Environmental Systems with emphasis on Transportation Engineering at the University of North Carolina at Charlotte. She received her master's degree in Transportation Engineering from the University of North Carolina at Charlotte in May 2020 and bachelor's degree in Civil Engineering from GITAM Deemed to be University, India in May 2017. Her

research interests are traffic safety, traffic operations, intelligent transportation systems and transportation planning.

Nastasha Earle-Young

Nastasha Earle-Young is a graduate of North Carolina A&T State University Class of 2012, with a bachelor's in civil engineering. She began her career with NCDOT in 2012 through the Transportation Engineering Associate Program. After completing NCDOT rotational program, she joined NCDOT Transportation Planning Division (TPD) in 2014. In TPD, she has gained experience in developing comprehensive transportation plans and travel demand models, as well as working with Rural Planning Organizations throughout the state. Nastasha joined the Statewide Initiatives team in 2017, and currently oversees development of the Strategic Transportation Corridors (STC) Master Plans and NC Moves 2050 (North Carolina Statewide Multimodal Transportation Plan), and joined the NCDOT Resilience Program Team in 2020.

Montana Eck, Ph.D. candidate

Montana Eck is from Old Fort, North Carolina, and is a PhD candidate in the Department of Geography at the University of North Carolina at Chapel Hill. Born and raised in the heart of the southern Appalachian Mountains, Montana's research interests have been shaped by his personal experiences with extreme weather and climatic change in his own community. Currently, his dissertation research seeks to provide novel insights into how precipitation events can influence car crash risk in the Carolinas. In particular, he hopes to bring attention to the significant disparities in risk between our rural and urban communities.

Bryan Edwards

Mr. Edwards is a native of North Carolina and a Professional Engineer with over 27 years of experience, both in the private and public sector. His 20 year past experience with NCDOT includes Rail design, CADD standards and automation and DocuSign administration. Edwards now serves as the Electronic Construction Systems Engineer where he is focused on introducing, implementing and maximizing technology and innovation in construction practices and processes.

Charles Edwards

Edwards has over 50 years in the transportation, distribution, and logistics industry. He began his career as a truck driver in Toronto. Since then, he has worked in international freight forwarding in Canada and the UAE, numerous sectors of the airline industry, aviation design and manufacturing in Germany and the United States, ocean freight, rail management, economic development, and education. Mr. Edwards is a Professor of the Practice at the University of North Carolina at Chapel Hill in the Department of City and Regional Planning. He is a Scholar Fellow of the beta chapter of Sigma Chi Mu Tau (Supply Chain).

Wei Fan, Ph.D.

Dr. Wei (David) Fan currently serves as a full professor in the Department of Civil and Environmental Engineering (CEE) at The University of North Carolina at Charlotte (UNCC). He is the Director of the USDOT University Transportation Center for Advanced Multimodal Mobility Solutions and Education (CAMMSE). Dr. Fan holds a Ph.D. (May 2004) in Civil Engineering & Transportation from the University of Texas at Austin (Hook 'em Horns!).

Daniel Findley, Ph.D.

Dr. Daniel Findley is the Program Manager of ITRE's Economic Analysis and Policy Assessment Group and

has 15 years of experience in economic impact analysis, multi-modal transportation studies, human behavior research, and transportation engineering studies, collectively. He holds a Ph.D. in Civil Engineering from North Carolina State University and is a licensed Professional Engineer (PE) in North Carolina.

Clare Fullerton, PE
Clare Fullerton, PE is a Value Management Program Engineer in the Construction Unit and is the CLEAR program manager for NCDOT. Clare chairs multiple research projects for the Department. She has been with NCDOT for over four years and previously worked in construction management for various EPC firms. She is a Civil Engineer and a graduate of the Georgia Institute of Technology.

Hardik Gajera, Ph.D. student
Mr. Gajera is a research assistant and Ph.D. student in civil engineering program at UNC Charlotte. He completed his Master's degree in highway and transportation engineering. He holds bachelor's degree in civil engineering and master's degree specialization in highway and transportation engineering from India. He also worked as a project engineer at SVNIT, Surat, India.

Richard Greene, Ph.D., PE, PLS
Dr. Richard Greene is the Unit Head for NCDOT Photogrammetry Unit. Dr. Greene is a Professional Engineer and Professional Land Surveyor in the State of North Carolina. The Photogrammetry Unit acquires aerial imagery and aerial LiDAR elevation data and generates geospatial information products used for transportation planning, design, and construction.

Andy Ham, Ph.D.
Andy Ham received Ph.D. in industrial engineering from Arizona State University in 2009, and M.S. in OR/IE from University of Texas at Austin in 2000. He is currently working as an associate professor in Applied Engineering Technology, North Carolina A&T State University. Prior to the current position, he worked for Samsung Electronics, Samsung Austin Semiconductor, GlobalFoundries, AMD, IBM/ILOG, and Berkshire Grey (Robotics). His research is currently focusing on real-time scheduling of vehicles, drones and robots in smart factories, smart warehouses, and logistics industry.

Katherine (Katie) Harmon, Ph.D.
Dr. Katie Harmon is a Research Associate at the University of North Carolina (UNC) Highway Safety Research Center. She received her doctorate in Epidemiology from UNC-Chapel Hill in 2018. She also holds a Master of Public Health with a joint concentration in Epidemiology and Environmental and Occupational Health from Saint Louis University and a Bachelor of Science in Environmental Health Science from The University of Georgia. In addition, she is a graduate of the CDC/Council of State and Territorial Epidemiologists (CSTE) Applied Epidemiology Fellowship program. Her current focus is the study and prevention of injuries among vulnerable road users.

J.R. Hayes
Hayes has an Associate Degree in Surveying Technology with 17 years' experience in roadway construction between the NCDOT and the City of Greensboro. He spent the first 14 years in Surveying and the last 3 as an Assistant Resident Engineer. Hayes became a licensed drone pilot in 2020.

Stephen Heiny
Stephen Heiny joined the Highway Safety Research Center in 2016 as a Junior Research Associate. He

primarily works with the National Center for Safe Routes to School providing support for Walk and Bike to School Day planning and registration, research into youth active travel safety, and efforts to promote youth safety as part of Vision Zero. He also provides technical assistance, supporting the websites for both Walk and Bike to School Day and the National Center for Safe Routes to School. Stephen holds a master's degree in City and Regional Planning from the University of North Carolina – Chapel Hill where he specialized in transportation planning. He completed his bachelor's degree in psychology and sociology at the University of Notre Dame.

Matt Hilderbran, PE, CPM
Mr. Matt R. Hilderbran, PE, CPM is the Field Operations Manager of NCDOT's Materials and Tests Unit. Mr. Hilderbran oversees Technician Certifications and Field Assessments, Facility Approvals and Audits, FHWA Material Project Certifications, along with overseeing inspection and approvals on various manufactured products such as pipe, concrete precast/prestressed members, guardrail, steel structural members, etc. Mr. Hilderbran also manages the State Data Collection Section which handles various non-destructive and destructive testing and investigations on in place material along our highways.

Abdollah Homaifar, Ph.D.
Dr. Abdollah Homaifar is the Duke Energy Eminent professor in the Department of Electrical and Computer Engineering at North Carolina A&T State University. He is also the director of the Autonomous Control and Information Technology Institute and the Testing, Evaluation, and Control of Heterogeneous Large-scale Systems of Autonomous Vehicles. Dr. Homaifar's research interests include Machine Learning, Approximate Reasoning, Soft Computing, Evolutionary Computations, Stochastic Control and Estimation, Modelling and Control of Systems of Systems, Robotics.

Rodney Hough
Rodney Hough is a member of the NCDOT Photogrammetry Unit, where he serves as an Engineer II. He is responsible for the planning, acquisition, and processing of UAS imagery and data that is used for mapping projects such as construction earthwork quantity calculations, survey grade data for disaster response, and construction monitoring. In addition, he is working on the development of the procedures and requirements necessary for optimal collection of UAS imagery and data for various survey grade mapping products that can be derived from UAS imagery.

Trace Howell
Trace Howell is a professional engineer and Project Engineer with HNTB. For the last five years he has been working as an embedded Project Manager with NCDOT Division. Prior to working in Division 3, he was on the NCDOT Transportation Engineering Associates Program (TEA), and later began working for HNTB in their Raleigh office developing roadway, traffic control, and pavement marking plans.

Joseph E. Hummer, Ph.D., P.E.
Joseph E. Hummer 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. He was on the civil engineering faculty at UNC Charlotte, NC State, and Wayne State before joining NCDOT in 2016 in part to see if he could get more research implemented.

Elyse Keefe
As a Project Manager at the Injury Prevention Research Center, Elyse contributes to a variety of projects

and programs focused on advancing Safe Systems approaches to road safety using a public health framework. She currently coordinates technical assistance and leadership development efforts for Vision Zero communities across North Carolina as well as a number of other projects to advance systems thinking for a variety of audiences. Elyse holds master's degrees in Public Health and Social Work from UNC-Chapel Hill.

Mohammad Khalid
Mohammad Khalid is a Graduate Research Assistant in the Department of Construction Management at East Carolina University. Khalid received his Bachelor of Science degree in Civil Engineering with a research focus on Structural Engineering. He has versatile industry experience with international exposure to multiple heavy civil infrastructure projects as a civil engineer, responsible for administrating design, coordination, safety-risk management, and overall technical supervision. Khalid's research interest includes construction safety performance, UAV applications, human-technology interaction, structural analysis, damage evaluation, and critical off-shore constructability methods.

Christina Kranz, Ph.D.
Christina is a postdoctoral scholar at North Carolina State University in the Department of Crop and Soil Sciences. She is working in the Sediment and Erosion Control Laboratory on a DOT funded project looking at differences in compost amendment rate on roadsides post-construction to help reduce runoff and erosion, and to increase vegetation establishment.

Seth LaJeunesse
Seth LaJeunesse is a Senior Research Associate with the University of North Carolina Highway Safety Research Center (UNC HSRC). He designs studies that draw from psychology, sociology, and systems science to explore ways of accelerating the diffusion of travel mode shift and safety innovations. Seth is a member of the American Planning Association and the Transportation Research Board's Pedestrians Committee and Transportation Safety Management Systems Committee. Formerly a school psychologist, he holds a masters in School Psychology and City and Regional Planning.

Benjamin Lartey, Ph. D. candidate
Lartey is currently pursuing his PhD in Electrical Engineering at the aforementioned university. His research interest is in transportation specifically mobility on demand applications.

Matthew (Matt) Lauffer
Matthew (Matt) Lauffer is an Assistant State Hydraulics Engineer for North Carolina Department of Transportation Hydraulics Unit and has been with the Department for 22 years. Matt manages the Hydraulic Design and Highway Floodplain Program and takes an active role in the Department's Flood Resilience activities. He is a member of the Transportation Research Board Committee on Hydrology, Hydraulics and Stormwater and is a member of the AASHTO Technical Committee on Hydrology and Hydraulics.

Jinkun Lee, Ph.D.
Dr. Lee is an assistant professor of engineering department at East Carolina University. His recent research focuses on the analysis of road traffic network performance based on agent-based simulation.

Nancy Lefler
Nancy Lefler is a Senior Research Associate at the UNC Highway Safety Research Center. She has over

fifteen years of experience in the transportation field specializing in transportation data collection and management, state data systems, data analysis, program evaluations, and information dissemination. Nancy serves as Secretary for the TRB ABJ20 Statewide Transportation Data and Information Systems Committee and Chair for the ABJ20(1) Roadway Safety Data Subcommittee.

Chia-Hung Lin, PhD candidate
Mr. Lin is a PhD student at North Carolina State University ECE department under the supervision of Prof. Shih-Chun Lin. His research interest are the development of deep learning-based algorithms and communication systems design.

Shaojie Liu, Ph.D. candidate
Shaojie Liu is a Ph.D. Candidate in the Department of Civil Engineering, UNC Charlotte, interested in transportation safety and CAV.

Yajie Liu, Ph.D. candidate
Yajie Liu is a second-year Ph.D. student and research assistant in the Department of Civil, Construction, and Environmental Engineering at NC State University. Yajie's research mainly focuses on the utilization of advanced technologies with techniques in infrastructure engineering. These technologies and techniques include unmanned aircraft system (UAS), photogrammetry and 3D mapping, surveying and measurement, GIS, remote sensing, computer vision, LiDAR, and laser scanning. Applications include data collection, condition assessment, deterioration, sustainability and resilience, the likelihood of failure, and risk evaluation and management.

Matthew Macon
Matthew Macon is an Engineer I and an UAS pilot with North Carolina Department of Transportation Photogrammetry Unit. He has flown over 30 UAS Missions ranging from borrow pits to new locations corridors. His responsibilities are planning, acquisition, and processing of UAS data. Creating various geospatial products to calculate volumetric soil quantities for construction estimates.

Michael Madsen
Michael Madsen is the GIS Analyst/Manager for Division 3 of the NCDOT. Michael has worked for NCDOT for a little over 2 years and have over 5 years' experience in the transportation industry as a GIS expert. GIS is an amazing field which opens the doors to many transportation-related solutions yet to be discovered.

Dana Magliola
Magliola leads NCDOT's Logistics + Freight program as a part of the NCDOT Rail Division. Connecting the economy to infrastructure investment, Magliola is active across the spectrum of NCDOT project delivery from planning through construction. Magliola joined NCDOT in 2018 from NC State University where he led the Supply Chain Resource Cooperative, and served as the Supply Chain Management subject matter expert for NC State's Industrial Extension Service. A graduate of the University of Virginia, Magliola began his career in transportation with Danish container shipping giant Maersk and later worked for the freight forwarding division of UPS Logistics.

Neil Mastin, P.E.
Neil Mastin is the Research and Development Manager for the North Carolina Department of Transportation. As R&D Manager, he oversees a program with a research portfolio of more than 100

active projects. The NCDOT research program provides the agency access to cutting edge university research and national resources in addition to providing internal services to NCDOT. Prior to this role, Mr. Mastin spent more than 15 years in Pavement Engineering and Asset Management roles at the agency.

Kenny McCourt

Kenny McCourt is an Assistant Resident Engineer in Div. 14 construction office for the NCDOT. Kenny oversees many bridge and roadway projects. He has been with the Department for 8 years and previously worked as a construction surveyor on multiple projects including vertical and roadway projects. He is a veteran of the USAF and a graduate of Southwestern Community College with a Civil engineer technology and Surveying technology degree.

Noreen McDonald, Ph.D.

Dr. McDonald is the chair of the department of city and regional planning at UNC Chapel Hill and holds the Thomas Willis Lambeth Distinguished Chair in Public Policy. She also serve as Associate Director of the Collaborative Sciences Center for Road Safety and Southeastern Transportation Research, Innovation, Education and Development Center. Dr. McDonald's work is at the intersection of planning and public health. Currently, she is studying how changes in transport technology and policy impact road safety and access to healthcare. Her previous work focused on how infrastructure such as schools, roads, and bike lanes impact road safety and physical activity especially for children and young adults. Dr. McDonald received her undergraduate degree from Harvard in engineering and chemistry and her Ph.D. in city planning from UC Berkeley. Prior to becoming a professor, she worked as a consultant for Cambridge Systematics and Mercer Management Consulting (now Oliver Wyman).

Colin Mellor

Colin began his career at NCDOT in 1994. Since then, he has worked as a public servant and in private industry as a geologist and a geophysicist, gradually changing paths through environmental coordination and permitting roles to NEPA analysis and environmental policy. Currently with NCDOT's Environmental Policy Unit he oversees NEPA project compliance for the eastern half of the state and is one of NCDOT's technical leads on Governor Coopers Climate Change-focused Executive Order 80. He earned a bachelor's degree in Geology from the University of Wollongong, Australia, and a master's degree in Geology from UNC Chapel Hill. He is a North Carolina Licensed Geologist.

Raunak Mishra, Ph.D. student

Mr. Mishra is currently a Ph.D. student of Infrastructure and Environmental Systems (INES) program at the University of North Carolina at Charlotte. Mr. Mishra holds a bachelor's degree in Civil Engineering, and master's degree specialization in Transportation Engineering from India. He worked as a consultant in technical advisory support at National Rural Infrastructure Development Agency, Ministry of Rural Development, Govt of India.

Kai Monast, MRP

As the Director of the Public Transportation Group and Interim Director of the School Planning and Transportation Group at the Institute for Transportation Research and Education, Kai Monast works closely with public and pupil transportation systems, NCDOT, NCDPI, and other industry stakeholders to provide policy analysis, training, assistance with technology implementations, and advice for operations and improvements in efficiency. Kai was trained in urban and transportation planning at the University

of North Carolina at Chapel Hill, where he attended both undergraduate and graduate school and is currently a part-time doctoral student.

Brina Montoya, Ph.D.

Brina Montoya is an Associate Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. Her expertise is in geotechnical engineering, and research interests are in assessment and mitigation of soil behavior subjected to natural and anthropogenic hazards. Dr. Montoya received her Ph.D. from the University of California, Davis in 2012. Prior to entering graduate school, Dr. Montoya worked for a geotechnical engineering consulting company in the San Francisco Bay Area, focusing on foundation design and liquefaction mitigation. She is a licensed engineer in the state of California.

Gichuru Muchane

Gichuru Muchane is the Assistant State Structures Engineer. He oversees NCDOT – Structures Management Unit's Program and Policy Development, and Bridge Inspections. He holds graduate degrees in Civil Engineering from Duke University. He is a North Carolina registered Professional Engineer, and has over 26 years engineering experience, of which 21 years have been with the Structures Management Unit.

Becky Naumann, Ph.D.

Dr. Becky Naumann is a research assistant professor in the Department of Epidemiology and core faculty at UNC's Injury Prevention Research Center. Dr. Naumann's main area of research is injury prevention. Her work is focused on understanding risk factors and trends of unintentional injuries and evaluating injury prevention interventions, largely in the areas of road traffic injury and opioid overdose. Methodologically, Dr. Naumann has experience and interest in applying complex systems science methods to injury prevention.

Jaimie Nevins

Jaimie Nevins is the mobile GIS architect for NC Department of Information Technology-Transportation, GIS Unit. Nevins holds a part 107 and assists the UAS group with GIS products like imagery viewers, dashboards, and surveys, as well as helps support the program during natural disasters.

D. Chase Nicholas

D. Chase Nicholas earned his Master of Geospatial Information Science and Technology (MGIST) from North Carolina State University and holds a Master of City and Regional Planning (MCRP) from the University of North Carolina at Chapel Hill. Chase currently serves as a Geospatial Information Systems Analyst at the NC State Institute for Transportation Research and Education. His skills and experience in planning and GIS uniquely equip him to bring this perspective to bear on problems in urban and regional issues like land use, transportation, economics, and policy.

Sarah O'Brien

Sarah O'Brien joined the UNC Highway Safety Research Center in 2018. She has over ten years of experience in non-motorized planning, education, policy, design, and research. Her primary focus is conducting research and providing technical assistance to practitioners to improve walking and bicycling within communities. She has experience collecting field data such as volume, speed, and user profiles and behaviors and has conducted controlled and naturalistic observational studies. Sarah is a certified National Highway Institute (NHI) instructor and led the development of the North Carolina Department

of Transportation (NCDOT) Let's Go NC! Curriculum. Sarah began her career developing and administering NCDOT's Planning Grant Initiative. She also served two stints as the state's acting SRTS coordinator and as one of the original core group members of the Watch for Me NC campaign. She also launched and led NCDOT's Non-Motorized Volume Data Program for five years. Sarah has a Master of Environmental Science and Management (MESM) from the University of California, Santa Barbara's (UCSB) Bren School of Environmental Science and Management. Her undergraduate degree in Biology is from UNC-Asheville.

Smritee Pokharel, Ph.D.
Dr. Smritee Pokharel is a NSF Postdoctoral Fellow who is currently working with Dr. John Bang at North Carolina Central University. She received her Ph.D. degree in the field of medical microbiology from YoungNam University in South Korea. Her research has been focused on neurodegenerative diseases secondary to environmental factors. She also has a high interest in health disparity studies related to minority groups. Currently she is working on understanding the roles of free radical and ROS on beta amyloid aggregation in Alzheimer's Disease by using quantum dots and spin trap/anti-DMPO antibody method with Bang's group.

Dr. R.J. Porter, Ph.D.
Dr. R.J. Porter, PE is a Highway Safety Engineer at VHB in Raleigh, NC. He has more than 20 years of experience leading and supporting research spanning performance-based planning, programming, and design; road safety; traffic operations; safety data systems; and user performance and behavior.

Moe Pour-Ghaz, Ph.D.
Dr. Pour-Ghaz earned his MS degree in 2007 from Carleton University, Canada, and his Ph.D. from Purdue University in 2011.Before pursuing his MS in Civil Engineering, he practiced as a research engineer in the area of nondestructive testing of composites and concrete in Concord, Canada. He is currently an Associate Professor of Structural Engineering and Mechanics at NC State University.

Narcisa Pricope, **Ph.D.**
Dr. Narcisa Pricope is a professor of geography and the director of the GEOINT Certificate in the Department of Earth and Ocean Sciences at the University of North Carolina Wilmington. She received a PhD from the University of Florida in Geography and Environmental Engineering in 2011, a Master's of Science degree in Geoscience from Western Kentucky University in 2006 and a double bachelor's degree in Geography and English from Romania's flagship research university, Babes-Bolyai Cluj-Napoca. To date, Dr. Pricope has published over 35 peer-reviewed articles on the various aspects of integrating earth observation, remote sensing, and drone photogrammetry with spatio-temporal modeling to advance ecosystem modeling.

Giorgio Proestos, Ph.D.
Giorgio T. Proestos is an Assistant Professor at North Carolina State University, Raleigh, NC. He received his B.A.Sc. in Engineering Science, M.A.Sc. and Ph.D. from the University of Toronto, Toronto, ON, Canada, in 2012, 2014 and 2018, respectively. He is a voting member of Joint ACI-ASCE 445 Shear and Torsion and its Subcommittee on Torsion 445-E. He received the ACI Chester Paul Seiss Award in 2018 and the ACI Design Award in 2017. His research interests include large-scale experimental testing, development of new modelling techniques and the development of direct crack-based assessment tools for concrete structures.

Brian M. Radakovic, PE, CFM
Radakovic has a BSCE and MSCE degrees from University of Florida and has over 13 years of experience in the NCDOT Hydraulics Unit. He is currently an advanced engineer in the Highway Floodplain Program involved in coordinating FEMA NFIP compliance for NCDOT projects. He also works with a multidisciplinary team including geotechnical and structural engineers to maintain FHWA Bridge Scour Program compliance statewide for all NCDOT bridges over streams. He also coordinates development and maintenance of the Hydraulics Unit's various data resources.

Stephen Robinson, P.E.
Robinson is the Division Planning Engineer at NCDOT in Division 7. He recently became a Certified Drone Pilot and is learning to use Drones for Earthwork along with traditional project documentation and visual reporting. Robinson has also worked in District and Construction offices.

Raghavan "Srini" Srinivasan, Ph.D.
Raghavan "Srini" Srinivasan is a senior transportation research engineer at the UNC Highway Safety Research Center. His areas of interest include traffic engineering and safety, human factors, and the application of statistics and econometric methods. Srini has more than 20 years of experience conducting research for federal agencies including the National Cooperative Highway Research Program, Federal Highway Administration and National Highway Traffic Safety Administration and state departments of transportation including Virginia, New Jersey, New York, California, and North Carolina. Srini earned a Ph.D. in civil engineering (transportation) with a minor in probability and statistics, from the University of California at Davis and an M.S. in civil engineering (transportation) from the University of Virginia at Charlottesville. He is currently actively involved in several TRB committees.

Xiuli Qu, Ph.D.
Dr. Xiuli Qu is an associate professor in the Department of Industrial and Systems Engineering at North Carolina A&T State University. She received her MS and Ph.D. degrees in Industrial Engineering from Purdue University. She has expertise in optimization modeling and data mining, and experience in the development of simulation and optimization models for planning and scheduling in transportation system restoration, emergency response systems, and healthcare delivery systems. Her recent research focuses on developing decision-making models for road protection and restoration and emergency evacuation during a hurricane. Dr. Qu has authored/co-authored over 50 peer-reviewed journal or conference papers.

Randa Radwan, Ph.D., PMP
Randa Radwan holds a Ph.D. in Civil and Environmental Engineering from The George Washington University, as well as a B.S. and Master of Electrical Engineering from Rice University. She has close to 30 years of directing and performing transportation safety research projects. These include real world crash data analyses, new crash test procedure and criteria development, component testing, baseline and countermeasure crash testing, and computer simulations supporting Federal Motor Vehicle Safety Standards (FMVSS) upgrades, and FHWA and NHTSA sponsored research projects.

Michael P. Reese, P.E., C.P.M.
After receiving his Bachelor of Science degree in Civil Engineering from North Carolina State University, Mike Reese joined the NCDOT Traffic Engineering Branch (now Mobility and Safety Division), where he has worked for more than twenty years in the Congestion Management & Traffic Analysis Section, the Signing Section, the Traffic Control & Pavement Marking Section, the Signals and

Geometrics Section and Construction Units. Mike is a registered Professional Engineer and Certified Public Manager in North Carolina. Since 2007, Mr. Reese has also instructed statewide Site Development and Highway Access training classes through North Carolina State University. He is currently serving on the TRB Performance Effects of Geometric Design Committee, the TRB Access Management Committee, and the International ITE Public Agency Council Executive Board, is co-chair of the TRB Subcommittee on Performance-Based Approaches and Applications, served as an appointed TRB Traffic Control Devices Committee Member for eleven years and currently serves on or has served on multiple ITE and TRB technical committees and task forces.

Jamille Robbins

Mr. Robbins is the Public Involvement, Community Studies, & Visualization Group Leader at NCDOT. He coordinates and supervises public outreach efforts throughout the department. His job duties also include overseeing the review and approval of all Community Impact Assessments, and Indirect and Cumulative Effects reports, which are used in the preparation of Environmental Documents, and during project permitting. Mr. Robbins is also a member of the Transportation Research Board's Committee (AJE40) on Public Engagement & Communications and currently serving on the core team for FHWA's Every Day Counts 6 Virtual Public Involvement Initiative.

Sepehr Sabeti, Ph.D. candidate

Sepehr is a Ph.D. candidate at The William States Lee College of Engineering of UNC Charlotte. His research focus is centered around designing and developing new safety systems leveraging the-state-of-the-art technologies such as Augmented Reality, Artificial Intelligence, and Wearable Technology for securing the safety of workforce, especially highway labors.

Shoaib Samandar, Ph.D.

Dr. Samandar is a Fulbright Scholar and research associate at ITRE. He earned both the masters and PhD degrees in Civil Engineering from NC State University. Prior to joining NC State, he worked on behalf of the Army Corps of Engineers for 3 years. Dr. Samandar is interested in application of artificial intelligence to transportation sciences, intelligent transportation systems, travel time reliability, and connected-autonomous vehicles research.

Bastian Schroeder, PE, Ph.D.

Bastian is a Principal Engineer in Kittelson's Wilmington, NC office. He has a passion for developing solutions to complex problems across all areas of transportation with a focus on advancing agency processes and integrating research into standard practices. Bastian has led or co-led over 75 state and federal projects for NCDOT, FHWA, and NCHRP and others, and has authored or co-authored nearly 100 journal papers and conference proceedings.

Sarah Searcy

Searcy is the Bicycle and Pedestrian Program Manager at the Institute for Transportation Research and Education (ITRE) at North Carolina State University. As an applied research professional, Sarah has 10 years of progressive experience in the public sector serving federal, state, municipal, and private sector clients. Her research areas include: non-motorized (bicycle and pedestrian) count program development; non-motorized counting technologies; occupant protection; pedestrian rail trespassing; and the economic, health, and safety benefits of shared use paths (greenways and trails).

Azmayeen Shahriar

Azmayeen Shahriar is currently serving as a graduate research and teaching assistant in the Department of Civil, Construction, and Environmental Engineering of North Carolina State University. He completed master's from the Department of Civil Engineering, Bangladesh University of Engineering and Technology. Azmayeen does research in bridge scour, anchored retaining wall, and soil stabilization. He wants to pursue a dynamic career as a successful educator.

Elizabeth Shay, Ph.D., AICP

Dr. Shay is an associate professor in the Department of Geography and Planning at Appalachian State University. Shay's teaching and research in community and regional planning focus on transportation and land use, travel behavior, active travel, transportation equity, and rural community development.

Nicholas Short

Nicholas Short is the Assistant Unit Head for NCDOT Photogrammetry Unit. Mr. Short is a Professional Engineer in the State of North Carolina. The Photogrammetry Unit acquires aerial imagery and aerial LiDAR elevation data and generates geospatial information products used for transportation planning, design, and construction.

Tarini Shukla, Ph.D. student

Shukla is a Ph.D. student and Graduate research assistant. My research area includes application of remote sensing in hydrology.

Zachery Slocum, Ph.D. student

Zachery Slocum is a Ph.D. student at the University of North Carolina at Charlotte working as a graduate research assistant in the Center for Applied GIScience.

Tunya Smith

As the director of the N.C. Department of Transportation's Office of Civil Rights, Tunya Smith aims to leverage best practices and resources to promote civil rights programming, advance transportation diversity programs, drive economic development and build a culture of equity and inclusion across the department.

Roger Smock

Roger Smock is a rail safety consultant for NCDOT and manages the BeRailSafe rail safety outreach program. BeRailSafe provides rail safety education for public safety professionals (police, fire, 911), general public, and transportation stakeholders. Roger champions railroad trespassing research, conducts case studies, and undertakes follow-up investigations of highway-crossing crashes and trespasser fatalities.

Li Song, Ph.D. candidate

Li Song is a Ph.D. candidate major in Transportation at the University of North Carolina at Charlotte. Currently, I focus on analyzing the influence of intelligent vehicles on transportation systems and exploring the transportation big data with statistics and emerging technologies. In respect of methodologies, my research on intelligent vehicle technologies mainly includes control strategy, simulation, and optimization methods. Meanwhile, my research on data analysis mainly includes statistics and machine learning approaches. Moreover, I also interest in emerging technologies that would change the future transportation systems.

Stephanie Sudano, PE
Stephanie is the Multimodal Special Projects Engineer for NCDOT, working on projects across all non-highway modes. Her experience includes 25 years on management and leadership teams in local and state government. She is presently the Project Manager for NCDOT IMD's Autonomous Vehicle Shuttle Project CASSI, working closely with many other divisions and units of NCDOT to permit and deploy the state's first low speed autonomous shuttle (CASSI) into multiple locations across the state. Sudano, a registered PE, holds a BS in civil engineering from NCSU, also completing IOG Municipal Administration Program and Public Executive Leadership Academy at UNC-CH.

Nathan Tanner, PE
Nathan Tanner is a Resident Engineer in District two of Division 14 for NCDOT. He has worked as both an Assistant District Engineer and Assistant Resident Engineer. He has been with NCDOT for over eight years. He is a Civil Engineer and a graduate of North Carolina State University.

Luke Templeton
Luke Templeton is an embedded contract engineer inspector with RK&K who has been working as a Division 14 office technician since 2018. Luke has an associate's degree in general education from Southwestern Community College, a bachelor's in science from Western Carolina University, and is currently on track to receive an additional associate's from Southwestern Community College for information technologies. Luke has been provided valuable insight for the e-ticketing solutions from the perspectives of office techs as well as field inspectors. He then acted as liaison between the private industry and the NCDOT to facilitate the development of QR Code software from the producer side.

Trung Tran, Ph.D.
Dr. Trung Tran is an Assistant Professor in Geospatial Science, a GIS Professional (GISP), FAA Part 107 certified remote pilot, and coordinator of the B.A. in Geospatial Science and USGIF-accredited GEOINT certificate program in the Department of Intelligence Studies, Geospatial Science, Political Science, and History at Fayetteville State University. His teaching and research interest includes applications of geospatial technologies including GIS, drone, GPS, and remote sensing in investigating spatio-temporal patterns of transportation, transit, and land changes, especially in the built environments.

Michael Uduebor, Ph.D. candidate
He is currently a graduate (Ph.D.) research student at The University of North Carolina at Charlotte (UNCC) in the Department of Civil and Environmental Engineering. He has spent the last decade working on hydrocarbon contamination remediation and landfill emission mitigation projects for developing countries, engaging local communities with tested sustainable ideas. He currently works on a National Science Foundation (NSF) funded project seeking to mitigate the challenges of frost action using engineered water repellency.

John Vine-Hodge
John Vine-Hodge serves as Deputy Director of Planning and Programming in NCDOT's Integrated Mobility Division. John has worked with NCDOT for over 15 years with a focus on multimodal planning, project development review, transit grant administration, research projects and policy development. He holds a Master's of Urban and Regional Planning from Virginia Tech and a Bachelor of Arts in Urban Studies from the University of Tennessee, Knoxville.

Olivia (Jueyu) Wang, Ph.D.
Dr. Wang is a Postdoctoral Scholar at the University of North Carolina, Chapel Hill. She holds a Ph.D. in Public Affairs from the University of Minnesota and a Master of Urban Planning from the University of Southern California. Her overall research goals are to understand the impacts of planning on travel behavior, human activities, well-being, and the corresponding equity implications of these impacts. Her research focuses on three major themes: active travel behavior and land use; impacts of new transportation technologies and shared mobility on travel behavior and activities; and health outcomes resulting from daily travel and activities.

Morgan Westbrook, Ph.D. candidate
Morgan earned her B.S. in Civil Engineering from NCSU and completed an M.S. in Architectural Engineering with an emphasis on Construction Engineering from the University of Colorado at Boulder. She worked professionally in the construction industry before returning to NCSU for a Ph.D. under the direction of Dr. William Rasdorf that focuses on public policy and transportation infrastructure sustainability in support of healthy rural and urban communities. She seeks ways to improve our national infrastructure to serve the needs of our growing population. Morgan is a recipient of NCSU's Provost Doctoral Fellowship.

Julie White
Julie White is the N.C. Department of Transportation's Deputy Secretary for Multimodal Transportation. In this role Julie oversees the Rail, Aviation, Ferry, and Integrated Mobility Division (formerly Public Transportation and Bicycle and Pedestrian Divisions) including over 800 employees and $570 million a year in state and federal funds. Julie has over two decades of public service in state and local government. She was awarded the WTS Women in Transportation Community Advocate Award, the NCDOT Road Gang Award, and the Triangle Business Journal's Forty under Forty Award. Julie earned a Master of Public Administration from N.C. State and is a graduate of the Leadership NC program and the North Carolina Institute of Political Leadership.

Billy M. Williams, Ph.D.
Dr. Billy M. Williams serves as the Director of the Institute for Transportation Research and Education and is a Professor in the Department of Civil, Construction, and Environmental Engineering at North Carolina State University. Before beginning his academic career, Dr. Williams served as a consulting engineer with the firm of Kimley-Horn and Associates and as a commissioned officer in the U.S. Navy Civil Engineer Corps. Dr. Williams's expertise lies in the areas of analytical and simulation modeling of traffic operations and transportation networks, intelligent transport systems, and the application of rigorous statistical methods to a broad range of transportation modeling applications, including traffic condition forecasting and models of fundamental traffic flow characteristics.

Sun Yi, Ph.D.
Sun Yi is professor of Mechanical Engineering at North Carolina A&T State University. He has developed new and novel methods for sensing and control algorithms for dynamic systems, which are adaptive and robust. The methods have also been applied to networked robots and UAVs/UGVs using AI, neural networks, sensor fusion, machine visions and adaptive control. He has managed research projects supported by DoD, NASA, Dept. Energy, and Dept. Transportation.

Rachael Yuan, Ph.D. candidate
Rachael Yuan is now a Ph.D. student working with Dr. Lei Zhu in Smart Mobility and Spatial Sensing Lab,

from the Department of Infrastructure and Environmental Systems at UNC Charlotte. She got her master's degree in Transportation Engineering from the University of Arizona in 2020.

Tiefu Zhao, Ph.D.

Dr. Tiefu Zhao is an Assistant Professor at UNC Charlotte. He received the Ph.D. degree in electrical engineering from NC State University in 2010. He was with Eaton Corporate Research and Technology from 2010 to 2016, where he was a technical lead of Eaton's wireless power transfer technology development for electric vehicle chargers. He was also Eaton's PI for DOE SuNLaMP project ($4 million) developing high efficiency power converters for renewable energy applications. He joined UNC Charlotte in 2016 and has been conducting research in renewable energy and power electronics areas, including wireless power transfer, ocean wave energy, and wide bandgap device power converters

Lei Zhu, Ph.D.

Dr. Lei Zhu is an Assistant Professor of System Engineering and Engineering Management at University of North Carolina at Charlotte. Before joining UNC Charlotte, he served as an Advanced Transportation Researcher at the National Renewable Energy Laboratory (NREL) and a postdoctoral fellow at the University of Nevada, Reno (UNR). Dr. Zhu is an expert on next-generation transportation systems in smart cities, with broad research interests including smart and sustainable mobility systems, spatial sensing technologies, advanced mobility system modeling and simulation, big data, and machine learning in transportation. He is a member of the TRB GIS committee (AED40), IEEE, and ASCE.

Appendix G: Poster Presenters

First name	Last name	Topic area	University/company/org name	Proposed presentation title
Chia-Hung	Lin	Innovative Technologies, Projects or Processes	NC State University	A C-V2X Platform Using Transportation Data and Spectrum-Aware Sidelink Access
Shaojie	Liu	Innovative Technologies, Projects or Processes	UNC Charlotte	Investigating Operational Performance of Connected and Autonomous Vehicles on Signalized Superstreets
Lei	Zhu	Innovative Technologies, Projects or Processes	UNC Charlotte	Design and Implement A Traffic Data Crowdsourcing Platform Using Infrastructure-based Spatial Sensors
Rachael	Yuan	Integrated Mobility / Multi-Modal	UNC Charlotte	Demand-side Cooperative Ridesharing Modeling, Simulation, and Algorithm Development
Micheal	Uduebor	Pavement & Materials / Operations & Maintenance	UNC Charlotte	Engineered Water Repellency for Frost Heave Mitigation in Road Pavements
Kai	Monast	Planning & Policy	NC State University	Locating and Costing Congestion for School and Transit Buses
Ishtiak	Ahmed	Traffic & Safety	NC State University	MODELING FRAMEWORK FOR PREDICTING LANE CHANGE INTENSITY AT FREEWAY WEAVING SEGMENTS
Abdullah	Alsharef	Traffic & Safety	NC State University	Work-related Safety Challenges experienced by driver license examiners
Matthew	Carroll	Traffic & Safety	East Carolina University	Parametric Study of Car Following Model for Traffic Simulation using Genetic Algorithm
Sarvani	Duvvuri	Traffic & Safety	UNC Charlotte	Geospatial Mapping of Truck Travel Performance Measures to Identify Areas Susceptible to Congestion
HARDIK	GAJERA	Traffic & Safety	UNC Charlotte	Effect of Level 1 and Level 2 Connected and Automated Vehicles on Fatal Crashes
Benjamin	Lartey	Traffic & Safety	NC A&T State University	Microscopic Simulation of Traffic Conditions in Raleigh
Jinkun	Lee	Traffic & Safety	East Carolina University	Road Traffic Simulation with Autonomous Vehicles
Raunak	Mishra	Traffic & Safety	UNC Charlotte	Mini-Roundabout CMF Development
Xiuli	Qu	Traffic & Safety	NC A&T State University	Traffic Analysis for Hurricane Evacuations in Eastern North Carolina: A Simulation Study
Li	Song	Traffic & Safety	UNC Charlotte	Modeling pedestrian-injury severities in pedestrian-vehicle crashes considering spatiotemporal patterns: insights from different hierarchical Bayesian random-effects models
Morgan	Westbrook	Traffic & Safety	NC State University	LED Traffic Signal Lifespan and Replacement Assessment, Preliminary Findings
Trung	Tran	Transit	Fayetteville State University	Spatio-Temporal Impact Of COVID-19 On Demand Response Transit In Northeastern North Carolina

Appendix H: Poster Guidelines

Thank you for your abstract submissions for the 2021 NCDOT Research & Innovation Summit being held Oct. 5-6. NCDOT invites you to present your abstract idea as an online poster presentation.

Attached is a spreadsheet listing the names and proposed presentation titles that are eligible for poster presentations. If you are interested in creating a poster presentation based on the abstract title in this list, please let me, Jennifer Palcher-Silliman, know no later than **Friday, September 10, 2021**.

For those who do decide to move forward with a poster presentation, here are the details you need to know:

All materials for your online poster presentation are due Friday, September 17, 2021.
The Summit online poster hall will feature a page that lists all posters along with researcher/student names, photos, associated campuses or organizations, and poster titles/topics. Each listing will link to a dedicated poster page that features the 24" x 36" poster along with the head shot and an optional three-minute video explaining the work. Your email address will be posted on your poster page so that people with questions about your research can contact you.
Please read and follow these instructions for preparing and submitting your poster presentations:
- Build your poster and submit in PDF format. Posters must be aligned vertically and no larger than 24" x 36" in size for optimal online viewing. (Posters not submitted in the proper format will not be included in the poster gallery.)

- If you are interested, also submit a video no more than three minutes long explaining the research covered in your poster. You may use your smartphone to create the video, or record it online using a service like Zoom. The video will be posted on the same page as your online poster. For additional information and guidelines on creating the video, contact Jennifer Palcher-Silliman at silliman@hsrc.unc.edu.

- Upload your poster, video, and a high-res head shot using this service: https://hsrc.wetransfer.com/
    - When uploading your materials, you will be required to enter a verification code that will be sent to you via email. If you don't see the verification code message, check your SPAM folder.

- Again, posters and videos are due **no later than Friday, September 17.**

- If you haven't already, please register for the Summit. The full preliminary agenda is now posted on the Summit website.

We look forward to working with you on the NCDOT Summit! If you have any questions about your poster, please contact Jennifer Palcher-Silliman at silliman@hsrc.unc.edu.

Note: I realize that you are receiving this the Friday before a holiday weekend, so it may be a few

days before it reaches everyone. I will check back in next week to make sure everyone has received the message.

When responding, please do not reply to all.

The NCDOT Summit Planning Committee

—————

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Appendix I: Selected Digital Materials

Save-the-Date E-Postcard

Poster Certificates

North Carolina Department of Transportation
Virtual Research & Innovation Summit
October 5-6, 2021

Second Place
Research Poster Winner

Abdullah Alsharef
North Carolina State University

"Cost Reduction of Worker Compensation Claims
Resulting from Driver License Road Test Related Injuries"

– Co-Author –
Alex Albert, Ph.D.

Hosted by:

RESEARCH & DEVELOPMENT

HIGHWAY SAFETY
RESEARCH CENTER

Neil Mastin, Manager of Research & Development

North Carolina Department of Transportation
Virtual Research & Innovation Summit
October 5-6, 2021

Third Place
Research Poster Winner

Raunak Mishra
University of North Carolina at Charlotte

"Mini Roundabout CMF Development"

– Co-Author –
Sonu Mathew, Ph.D., & Srinivas S. Pulugurtha, Ph.D., P.E., F.ASCE

Hosted by:

RESEARCH & DEVELOPMENT

HIGHWAY SAFETY
RESEARCH CENTER

Neil Mastin, Manager of Research & Development

Appendix J: Speaker Training Slide Deck

Slide 1

NORTH CAROLINA
Department of Transportation   *Research & Innovation Summit – 2021*

NCDOT Summit Speaker Training

Jennifer Palcher-Silliman, UNC Highway Safety Research Center

Event site: www.hsrc.unc.edu/ncdot-ri-summit

1

Slide 4

ncdot.gov   NCDOT Research & Innovation Summit 2021

Different roles

- Facilitator: Introduces the speakers, goes over housekeeping matters (slide provided for that), announces transitions, moderates Q&A
- Presenter: Creates and presents session content, prepares to present/field questions live (can only have one presenter for each presentation)
- Poster presenter: Creates poster, participates in live poster discussion on 10/6
- Zoom tech: Creates all the Zoom sessions on the back end, runs the Zoom technology by managing speakers, admitting attendees
- Attendee: Joins the sessions to learn, ask questions, earns CEUs

4

Slide 2

ncdot.gov   NCDOT Research & Innovation Summit 2021

What we will cover

- Important reminders
- Different roles of Summit contributors
- Maintaining Zoom security
- Preparing your presentation
- Day of your session
- Handling Q&A
- Practice time

2

Slide 5

ncdot.gov   NCDOT Research & Innovation Summit 2021

Maintaining Zoom security

- All session links on a password-protected Summit "lobby" page
- Unique links for each session
- Q&A by chat only
- Muting participants
- Using waiting room to admit attendees
- Prepared to remove disruptive attendees
- Only Zoom techs can admit attendees!

5

Slide 3

ncdot.gov   NCDOT Research & Innovation Summit 2021

First, some reminders

- Have you registered for the Summit?
- Did you read the presenter/facilitator guidelines?
- Do you know your session date and time?
- Do you know who your breakout co-presenters are?
- Do we have your bio?
- Event site: www.hsrc.unc.edu/ncdot-ri-summit
- Contact Jennifer with questions at silliman@hsrc.unc.edu

FYI – 303 registrations to date! (deadline to register is Oct. 1)

3

Slide 6

ncdot.gov   NCDOT Research & Innovation Summit 2021

Preparing your presentation

- Only one presenter for each presentation
- Prepare/practice for the correct length of time
  - Breakout presentations: 15-20 minutes max
  - Some presentations will need to be shorter – see how many speakers are in your session and work with your facilitator
- Email your PPT to Jennifer by Oct. 1
- Remember guidelines on what to wear, lighting, etc.

6

The day of your session

ncdot.gov — NCDOT Research & Innovation Summit 2021

- Close unnecessary programs on your computer
- Log on to the Zoom call 15 minutes in advance
- The Zoom tech will promote you to co-host status
    - You'll see your control panel options change when this happens
- Each presentation must start exactly on time
- Presentations go in order from the agenda
- Mute when you aren't presenting
- When it's time to present, start sharing your screen
    - The previous presenter's screen will show until you start sharing
- Use provided Zoom background if you want
- Be prepared to show your camera when you're presenting
- Multiple monitors? Make sure you're presenting from the right one
- Showing video? Make sure it works
    - If you want to play sound with your video, there's an additional step in the share process
- Each session will be recorded

7

Parting thoughts

ncdot.gov — NCDOT Research & Innovation Summit 2021

- Please help promote the Summit!
- Will send slides from this presentation
- Any questions? Ask now, or email Jennifer at silliman@hsrc.unc.edu

10

Q&A

ncdot.gov — NCDOT Research & Innovation Summit 2021

- In order to keep on time, all questions will be saved for the end
- Facilitators should keep track of questions
- Attendees will submit questions via chat
- Presenters answer verbally, so unmute!
- Provide email address so attendees can contact you after the session

8

Let's practice!

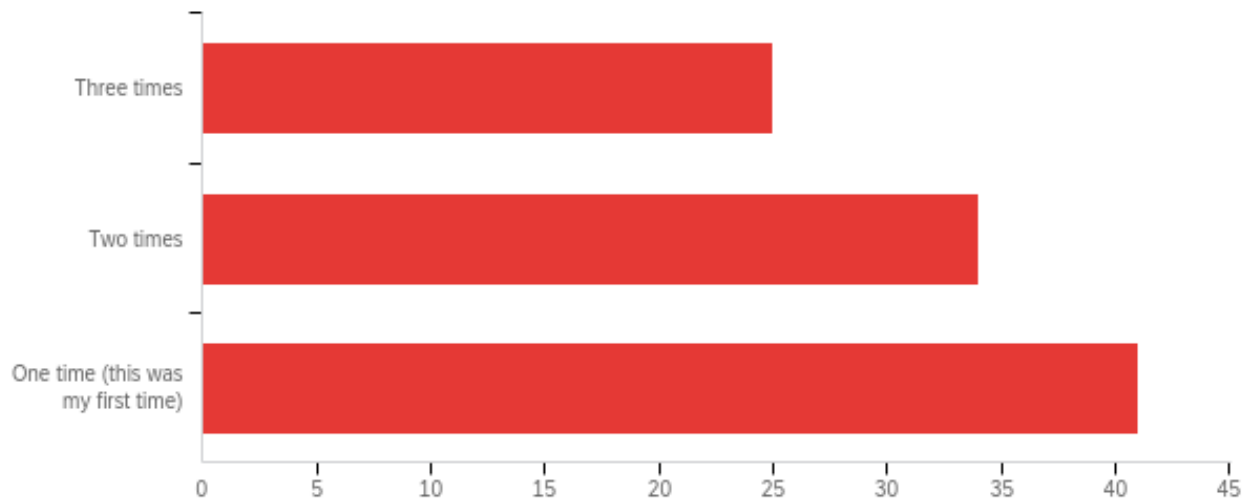ncdot.gov — NCDOT Research & Innovation Summit 2021

PRACTICE TIME!

9

2

Appendix K: Post-Event Feedback Survey

2021 NCDOT Summit Survey Results

2021 NCDOT R&I Summit Post-Event Survey
**November 29th, 2021, 9:05 am MST**

1 - How many times have you attended the NCDOT Research & Innovation Summit?

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	How many times have you attended the NCDOT Research & Innovation Summit?	1.00	3.00	2.16	0.80	0.63	100

#	Answer	%	Count
1	Three times	25.00%	25
2	Two times	34.00%	34
3	One time (this was my first time)	41.00%	41
	Total	100%	100

2 - Select the term that best describes the sector you represented as a Summit registrant:
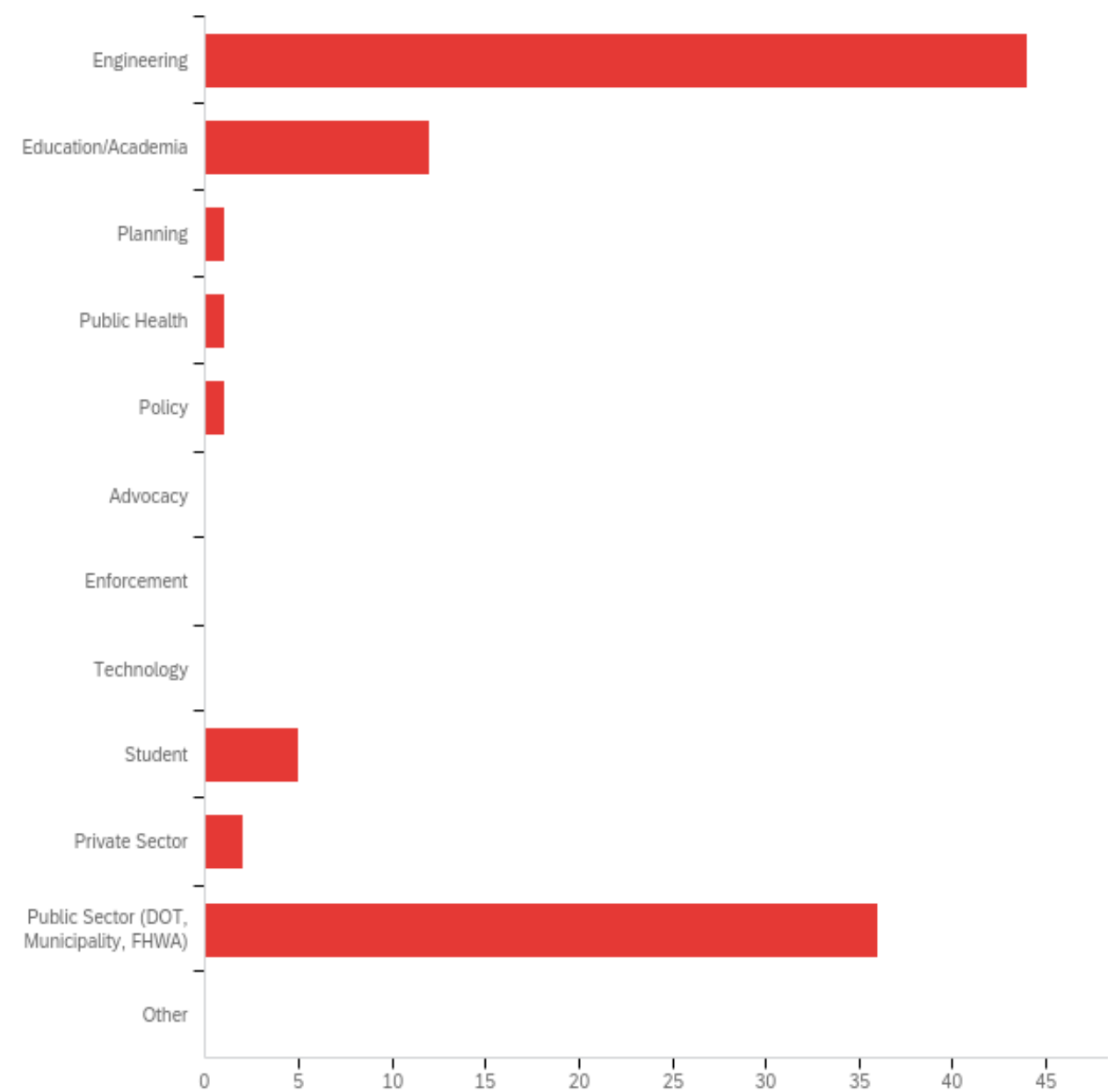
#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	Select the term that best describes the sector you represented as a Summit registrant:	1.00	11.00	5.30	4.68	21.90	102

#	Answer	%	Count
1	Engineering	43.14%	44
2	Education/Academia	11.76%	12
3	Planning	0.98%	1
4	Public Health	0.98%	1
5	Policy	0.98%	1
6	Advocacy	0.00%	0
7	Enforcement	0.00%	0
8	Technology	0.00%	0
9	Student	4.90%	5
10	Private Sector	1.96%	2
11	Public Sector (DOT, Municipality, FHWA)	35.29%	36
12	Other	0.00%	0
	Total	100%	102

3 - What did you like most about the Summit?

What did you like most about the Summit?

multidisciplinary presentations and topics

State of the art knowledge

The organization

virtual

New ideas and technology insights

many interesting topics.

learning other research projects going on outside of my unit's

Variety of topics being discussed

The equity sessions. They were great, and gave a lot of information!

Great topics

Diversity of topics

The keynote is always interesting - I like seeing the big picture, since it helps guide my research in its niche.

The wide range of topics presented

The plenary sessions

Variety of information and topics covered

Research presentations

I like the opportunity to hear about the great research and discoveries that are happening in transportation.

Well Organized

different sessions

Bike Ped

-

The ease in attending the sessions. Information presented was very good content.

Topics are very diverse and technologies are very latest.

Hearing about the research going on with UAS

The different track set up

variety of topics

New Innovations

The wide variety of topics

The freedom to pick and choice the sessions you would like to attend and having a detailed agenda of the sessions and a list of the presenters

Update on cutting edge technology such as drones

The program covers many good topics.

Multi-discipline format

Well organized with a variety of relevant topics.

Plenary sessions

Virtual

The diversity of the program. From alternate modes of transportation to highways. I work in DOH so it is great to hear what other areas of NCDOT are doing in addition to our universities.

Learning about other research outside of NCDOT research

Level of participation and variety of disciplines/topics.

Quality of the presentations and presentation material

Variety of Topics

Well managed

engineering topics

The different sessions encompassing the latest innovations in transportation R&D

Innovative studies, variety of topics

Good presentations

The sessions on drones and autonomous vehicles

The broad range of topics that brought academia and NCDOT together for dialect.

The selection of break out presentations.

A variety of topics

I learned the current focus areas that the NCDOT the research community should work on.

Ability to hear about continuing research in the field of engineering

There was a wide range of topics.

Options

The opportunity to present our research, interact with experts from DOT and private sector, and learn about the research around NC.

The summit was well-organized and well-conducted. Presentations were on topics of my interest.

The number of subject matters.

The themes and different presentations

Wide range o ftopis and subject matter expert presenters

PDH's

Focused discussions

The keynote talk on 10/5 and the technical sessions in the afternoon, especially the Transportation Resilience session

Good topics

Presentation of New ideas

I liked most of the research topics, in particular the CAV and drone topics

All of the variety of research that was presented.

The topics presented

The quality and diversity of the subjects and presentations.

Content was great.

easy to join from desktop

I enjoyed the opportunity to hear about the interesting ideas and research being done to improve transportation in NC. I liked the collaborative environment and that the topics ranged across the whole spectrum of transportation in NC and not just a few areas.

Breadth of topics

The accessibility of everything, especially being in an online format.

Good diversity of sessions

The choices in presentations

The on-line format was easy to plan on attending and adjust work requirements around presentations

All the sessions were held in very professional manner

Excellent presenters of very diverse topics

I enjoyed all of the sessions i attended

Lots of variety in information

lot of interesting topics

I appreciated the diversity in content.

the diversity of subject matters

The different topics surrounding Research in transportation.

virtual

Variety of topics

The variety of topics covered

That it was virtual

Variety of Research Topics

Diversity of topics and current ones.

I like the different perspectives and content.

4 - What did you like least about the Summit?

What did you like least about the Summit?

NA

Unfortunately because the current time the online sessions

having to pick/miss talks

the classes I wanted most were all scheduled on to pof one another

presentation times are in conflict with others. would like repeat sessions at different time/day.

virtual

some of the sessions were far shorter than planned and I was hoping to hear more about the topics that were planned

I didn't see anything wrong with the Summit.

The way the topics were paired forced me to choose one group of topics per session. If I wanted to hear a topic in more than one group I only had one opportunity so I missed hearing good material.

Being virtual!

Being online. I know that is the way it has to be right now, but looking forward to an in-person event similar to the first Summit. That was a great event!

Not able to ask presenters questions immediately after their presentations and the use of chat box for questions.

The poster sessions

Depth of information making it difficult to retain info.

topic selection

The length.

Presenter were less engaging

nothing

-

Everything was well done.

n/a

Limited time in some of the breakout sessions

As come with all virtual conferences, the challenges that come with those.

Being held virtually

A few of the presentations were long and too long with explanations of the data driven approaches. However, that is the nature of research projects. Hard to make some of the stuff interesting. It is what it is sometimes.

The problems with Zoom cause AV delays.

Not enough time allocated between sessions

Some of the presentations were highly technical, beyond the information that I personally need.

Nothing special

N/A

The few glitches of sound fade in/out in the platform selected, perhaps a back-up platform in case issues arise that could be put in chat for another option if technical glitches occur in that session.

Difficulty in generating discussion, which was actually better than I thought it would be.

It having to be virtual again (I know, I understand)

Virtual presentations seem to make the event drag for a long time

the constant push of social agenda items

number of sessions I wanted to attend were in conflicts. and some presentations were not very energetic and audience lost interest. some showed way too much calculations.

Zoom issues during Secretary's session

The session on Unpacking Safe Systems

May need to find another virtual platform in the future if necessary. Zoom meeting was horrible.

Difficult to register.

Some important sessions happening at the same time.

Some sessions did not include a topic area I was interested in, while others had multiple topics that I wanted to attend at the same time.

I wish there was more on non-automobile areas, such as vision zero implementation challenges.

Overlapping options

The lack of networking opportunity

I had time clash with my normal activity at work.

Less participation in events like poster session

I couldn't attend all sessions live. i will watch the breakout sessions i could not attend when available

It tied up 2 days.

None

I don't like the technical sessions and the poster session were scheduled at the same time. I missed one technical session because I had to present my poster.

Discussions heavy on the software and steps involved in using it.

N/A

Had one or two blimps with the internet connections but wasn't bad at all.

I appreciate that the Summit was virtual. I just look forward to being able to meet in person again!

Missed on site interaction, maybe next year.

Seem like a little overload.

Sometimes I struggled to stay engaged since it was all virtual.

Zoom glitches. I understand this was a Zoom server issue and likely unavoidable.

There are no recordings of the sessions that I missed, at least that I can find.

Sound quality

Seeing and talking with other attendees during breaks.

Nothing in particular

Few technical problems associated with Zoom

N/A

webinar style

Virtual summit means minimum interaction among participants and speakers

N/A

the issues with Zoom

Would like to see some networking or implementation sharing on how to get research utilized on projects.

virtual

nothing

Not that familiar with the Zoom interface

Remote format seems to foster low audience feedback/participation; difficult to network

Being virtual

I wish there was a better way to promote discussions.

5 - What was your favorite session, and why?

What was your favorite session, and why?
multimodal transportation
Hydraulics and Structural. Related to my research
UAV Tuesday because it gives a new kind of technology for using in Engineering
transportation resiliency, interesting/forward-looking
the bridge class where ist spoke to the analysis of the bridge over the sound that was taken down
lightning talks - Hydraulics/Pavement/Structures (2nd day)
digital tickets...using url codes for construction asphalt weight tickets, showed of an actual ncdot issue and how research help resolve it
Transportation Resiliency - Thought all the presenters did a wonderful job and were very knowledgeable about the topic. Find the topic fascinating considering my job and the increase in flooding events
Equity/Social Impacts on Transportation. I enjoyed this session the most because each speaker really addressed issues that may plague disadvantaged groups.
Transportation Resiliency - Presenters address what effects Climate Change will have on our infrastructure
I enjoyed the CSCRS panel; having a diversity of interesting and engaged speakers was quite impactful
Panel sessions that provide various perspectives and discussion on topics which is very insightful
The CLEAR session, showcasing ideas that NCDOT people developed and are using.
UAV, good information and nicely presented
NCDOT Technology/Innovation. I liked the presentation on the CASSI shuttle
Novel Arrangement of bike seat
-
Don't want to pick. Sessions attended were equal.
Grant writing workshops and plentary speak
UAS as this relates to what we are doing
Low Speed Autonomous Vehicles and ARTVAL. These are very in tune with what I do and what is at the forefront of where we are going.
UAS
Technology and Innovation - great ideas that are practical and feasible were presented
Equity / Social Impacts on Transportation - Wed. - The topics were timely and often not talked about as much as need be.

Applying Small UAS to Produce Survey Grade Geospatial Products for DOT Preconstruction & Construction Activities - This is very directly involved to the work we do in our Unit.

Unmanned Aerial Systems - wanted to see how far drones have come

Freight Application Workshop; good information.

I especially enjoyed the Hydraulics session in which the topic of drone technology was discussed and lidar imagery was displayed.

Freight Application Workshop. Discussed transportation related issues with freight delivery that I have not considered.

Introduction of traffic centers. Get to know better research activities.

Secretary Boyette, good to hear from NCDOT on initiatives

Resiliency. I am not a hydraulics person, but I learned alot in that session.

National Cooperative Highway Research Program (NCHRP) - There are a lot of changes coming for key resources and it was nice to hear about the research that has gone into the update of them to include important items we need to consider in the future such as CAV increases

Transportation resiliency because of some clarification to information I've been mostly hearing second hand.

Wireless Power Transfer for Locomotive Trains (Tiefu Zhao) - VERY interesting

Safety - had a presentation

use of drones-the future is here now

Hydraulics & Structures and Transportation Resiliency on Wednesday 10:30-11:45 AM and 1:30-3:00PM

Session that included talk on safety and the media. Included good new information.

several... as above. Most were great

For the most part, like all the sessions that I attended

Unmanned Aerial Vehicles session was informative.

Unmanned Aerial Systems

The remarks given by representative of NCDOT and research presented on traffic management and safety. They show the directions for future works.

National Cooperative Highway Research Program (NCHRP)

" Plenary Address: Unpacking Safe Systems concepts to inform our research and practice" - fascinating subject matter and speakers

Hydraulics and Structures, Overall interesting presentations

I liked the Tuesday Structures, Construction & Geotechnical session because speakers were good, and public participated

session on Unmanned Aircraft Systems (I am the coordinator for UAS program at my University (ECSU) and session on bicycle (my area of research)

Artval: Arterial Evaluation Software. It was most applicable to my work.

Rail incidents & Trespass

Innovative solution from Division 14 to go paperless by using QR codes for e-ticketing

Transportation Resilience session because my current research focuses on transportation resilience and I learned about a lot of useful information for my research.

NCDOT's Low Speed Automated Shuttle Deployment - Interesting and good lessons learned.

Flood control

Performance Eng Concrete Mixtures; and all the topics on CAV (NC trans center of excellence)

Transportation Resilience. Colin did a great job moderating and the presentations were fresh and new. Very good information.

Railroad Incidents because it was the most pertinent to what I do.

Description of NCDOT research program by Neil, Curtis and the whole team

GIS ROW map

I enjoyed the Transportation Resiliency and the Transportation Equity sessions the most because I found those topics extremely interesting and

Freight application workshop - Dana's facilitation was great. Charles Edwards and Steve Bert covered important urban and rural freight issues that don't get enough attention.

Unexpectedly, it was the Structures, Construction and Geotech session. It was well-presented and the presenters continually reinforced the importance of the research and how it applied to their respective fields.

Bicycle and Pedestrian

Presentations about FRP and the Bonner Bridge were the most interesting because they were in my field (bridge maintenance).

Secretary Boyette Plenary Address: NCDOT Update. Very informative and outstanding PowerPoint.

Transportation Resiliency. We deal with these issues in Eastern NC often and resiliency is a hot topic as a roadway project manager.

Railroad Incidents and Trespass. Very good information, well presented

Day 2 Plenary Session

Environment & Hydraulics - doing some cutting edge work with resiliency

The last one on equity facilitated by Curtis. This is a great session and I would like to see it as a stand alone in the future so there is no competition for it.

Equity

The Resiliency session because it is something that needs to be addressed

CLEAR

Equity / Social Impacts in Transportation - This is a salient topic and deserving of attention.

Grants session

Day 2 Plenary Session

6 - What was your least favorite session, and why?

What was your least favorite session, and why?

NA

All were great

breaks; i can't get enough!

the general meetings at lunch, not interesting topics

transportation equity. hard to understand, bad connection,

safety, the presenters were all over the place and did not do a good job of stay on topic.

I liked all the sessions I attended.

Unfortunately, poster sessions are difficult to do in a virtual format

Not to mention any specific session, but sessions that go too deep into details

In a virtual set-up graphic representation and less busy drawings works better

Unpacking Safe Systems concepts to inform our research and practice, I don't like the video clips used in the presentations. IT seemed out of context.

-

n/a

Wireless Power Transfer in Locomotive Trains. Not my least favorite but in my opinion, way too much time was given to mathematical equations which was not the best use of time and difficult to follow.

Structures, Construction & Geotech - One of the presenters had to leave and as a result was not available to answer questions from the participants

Enviromental & Hydraulics - Too much focus on trying to quantify tilling and compost.

Equity / Social Impacts on Transportation - Too political

Transportation Equity; the session was great, but Zoom cause speakers to drop off.

I enjoyed all sessions.

Hydraulics and Structures. Too technical for me.

Nothing special

The only thing I did not enjoy was some of the deep dive formulas. I consider this more of an "innovation" summit, not as much as a research summit (like TRB).

Plenary Address: NCDOT Update -- So much technical difficulties during this session it made it hard to obtain what was said in parts. From what was possible to hear it was a good update.

The Traffic and Roadway presentation. Really did not hear anything about the "roadway' aspect. Mostly just traffic.

Rural Freight Transport Needs (Steven Bert) - Not really sure where the presentation was leading

UNC hospital Transportation - I don't think this the correct form for this topic

Transportation Equity on Wed 3:15-4:45. could not hear

HSRC panel discussion on safe systems. Nothing new or actionable.

Unpacking Safe Systems. To attempt to show that transportation improvements are inherently racist not only shows that some people attempt to find 'racism' where there is none just to further their own racist views, it further divides us as people and a country which is dangerous for us all.

None.

Technology: Understanding the Influence of Precipitation Intensity on Car Crash Risk in North Carolina

Environmental & Hydraulics, Seemed cut short

N/A

None

Some were not applicable to what i do but they were still interesting to expand my horizons.

I do not know yet. I haven't been able to view the recorde sessions i did not attend

N/A

Panel discussion of Safety because the contents were too diverse and it didn't help me improve my understanding of transportation safety.

Presentations on software step by step.

N/A

Automated Semantic Segmentation of Point Cloud Data - hard to understand/follow

NCHRP, too much focus on the studies but not the real world applications.

The Environmental and Hydraulics session was my least favorite because the session was really short and there were not a lot of questions at the end to engage the presenters. The content was interesting though.

Lightning Talk - UAS. Presentations were good, but questioning seemed a bit harsh and was dominated by one or two questioners. The issues are probably important, but the session seemed to be highjacked by interest in minutiae not of broad interest that could have been better handled in a follow-up one-on-one.

Those that were interrupted by Zoom connection issues.

All the sessions were informative

Really did not have a least favorite

I enjoyed all that i attended

None, all were interesting

N/A

did not really have a least favorite session - all were great sessions

N/A

Didn't have a least favorite. All were good.

NA

N/A

7 - What kinds of topics would you like to see covered in future Summits?

What kinds of topics would you like to see covered in future Summits?
Battery fire and EV charging technology
Research
UAV for surveying, more focuss
more futuristic stuff
bike ped bridges and greenway concepts, new ai vehicles
construction, hydraulics, utilities, tools to help with project management
more construction or structures topics
I think the format right now makes sense.
I would like to see more topics touching on environmental and climate change issues
Great breadth of topics!
More Technology applications and uses
More internal innovations and applications of how the research has been implemented
Research on Pavements, weather impacts, research on socio economic correlation
innovative ideas
-
n/a
Artificial Intelligence and Deep Learning
Traveler Reliability and ways to report it and new updates to the Highway Capacity Manual and Trip Generation Manual
Cyber security for transportation infrastructure
More Future Transportation Tech topics
More new technology applications
More cutting edge technologies
How Equity will be addressed in future transportation projects, including any potential changes to the STI law.
In future summits, it would be helpful to discuss additional strategies to offset the effects of climate change.
I have no suggestions at this time.

Policy making issues related to artificial Intelligence, autonomous vehicles in the future traffic network.

I think you did a great job - diverse subjects, etc. Since recorded I assume we can hit up other sessions in the future on what was shared.

Continue with Multi-Modal and Autonomous vehicle presentations

Nothing new - these are a good mix

More of the same.

traffic control in construction

hydraulics, materials, erosion control

Look into the future.

The autonomous vehicles sessions were very interesting. Looking further into how that technology can be adapted to existing vehicles would be most interesting

May be the project tracking report, previous and current R&D projects result/progress report.

Innovative tools for traffic engineers, further discussion on crash reduction methods

Vision zero planning and implementation

How past research has been integrated in to NCDOT

Add a session where participants can share concerns, problems in the field, or problems that need to be addressed for future research

more on UAS

Operational Analysis.

Enhancements in different fields due to technology like Connected and Autonomous Vehicles

Not certain at this time.

More with Surveying

Autonomous vehicles, transportation resilience

More on innovation projects

New Ideas which will Impact our daily life.

Some follow up on the research from this year that is underway.

More on Resilience

Effects of Quiet Zones on Rail Safety, Innovative Rail Safety Devices

Good mix of sessions already

I would like to see more Equity and Diversity presentations and more public transportation presentations.

Nothing comes to mind. The coverage was broad and comprehensive.

Climate resiliency that focuses more on the engineering design and materials aspect, separate from the policy session.

More multimodal, bicycle and pedestrian, impacts of climate change

Latest cutting-edge solutions applied to NCDOT

Equity, Diversity, Economic Disparity

Roadway design topics, digging deeper into what design software can do for us (Microstation, ORD, AutoCAD, etc).

All topics were good this time. Keep up the good work

More real case studies

I would like to see more Training and Demonstrations

Maybe a little more from NCDOT folks and how NCDOT sees the future of transportation - maybe focuses on both local and national research topics

Applied research.

Similar topics

Not sure

I would like to see more training and demonstrations.

More demonstrations / Training

8 - What other suggestions do you have to improve future Summits?

What other suggestions do you have to improve future Summits?

NA

It's very good

None

n/a

?

repeat sessions, exciting presenters, talk slower and clear, not too much into deriving the data but showing more of what results can do for real applications in real life.

N/A

it would be interesting to see the researchers present on topics that have been implemented, and see construction/contractors or consultants give their perspective on how the topic is working

Try to follow closer to the time slots available (especially if this goes in person in the future)

I don't have any at this time.

The summit was well done.

Make the next event in-person! Make the videos available to public.

In person. :)

None at this time

If the Summit is virtual in the future, I would prefer shorter (~1 hour sessions)

Spread over 3 days? Allow access to poster sessions over a longer time period (like TRB did this past year)

make them both in-person and virtual

An hour lunch would be better for more time to eat and respond to emails. Also starting earlier (8:30 or at least 9am) and ending earlier.

Have less concurrent sessions, so one can attend more. Shorter sessions- 40min max. (30+10)

Summit was great...maybe a little less "deep in the weeds academia" would be nice.

n/a

The summit was a great way for me to learn about some topics that i do not deal with on a daily basis. Keep up this strategy.

-

Continue with how things have been going.

n/a

There seemed to be a lot of sessions focused on safety only. Maybe more on other aspects of innovation.

N/A

Make it more well advertised. I have spoken to several DOT personnel that had no idea this accord.

Allow presenters to address questions for about 5 to 10 minutes right after they finish presenting. If there are still more questions that need to be answered, they can then wait until other presenters have finished presenting.

N/A

More integration with private sector companies and how they can apply the research to new developing markets.

I would like to hear from more seasoned individuals.

End the pandemic, so we can meet in-person.

Include more information on highway construction projects that have resiliency incorporated into their design.

I like the format whether virtual or in person. Sessions are adequate length. Breaks give ample time to get refreshed, check in at the office, etc.

It is good as it is.

n/a

Love it.

Since this is my first one and I believe it was done very well considering the virtual event, I really do not have much to offer for improvement.

If the presentation is tied to a specific research project, it would be good to splice out that presentation to include on the research project page as a resource for all not just who attended the Summit. Also there was talk about a survey after each session, perhaps this is it though; if there should have been I didn't receive that so a bit confused on that process..perhaps more clarity on the process in the email sent about the session or website. Also the tips and tricks for the speaker offset from the presentation was nice at a later session, would have been great to know for an earlier session.

keep the same

Return to in person sessions

None

No major suggestions; it seemed well organized.

more engineering less social justice

Keep the poster presentations as a stand alone event, so we get more attendees

better presentation style maybe? some was very boring and lost my interest. one was showing a lot of data how it was derived (great) but it's such a short time and audience might be be interested in so much of how but more in what can we do with the data to improve or apply to real application.

Being in person again of course.

Keep the social rights activists out of it. This summit is about technology and innovation, not a platform to spout your slanted social warrior views. In doing so, you immediately alienate those that don't share the same views,

and you drive away those that may oppose those views. Social justice and politics is creeping into too much of our society such as sports. Don't let it creep into technology and innovation as well.

Continue to have topics on the social and economic impact NCDOT has had on communities of color.

None

The first day lunch speaker voice, sound was breaking up.

Great Webinar

I thought it was a good format this time.

For virtual summits, if there is an opportunity to meet stake holder/researcher on a 1 on 1 base so as to create connections/collaborations.

Provide various areas of engineering in each session, don't cluster together disciplines

Prerecorded presentations with Live Q&A

N/A

I would prefer to have it during summer break

Innovative approaches to handling traffic.

I prefer it to be more interactive with more participants

Extend the sessions or reduce the number of speakers per session to allow for more Q&A time and open discussion that includes attendees. I would carve a time (10-15 minutes) in the sesssion for a discussion topic/question relative to the session theme of the presentations which is open to the attendees to participate in.

More with Surveying, or actual guys out in the field

None

No

N/A

always virtual!

More New Ideas

I wasn't really sure what to do with the poster stuff so I didn't evaluate it. I went over to that link but didn't get anything out of it but a writeup.

n/a

Shorter sessions so that you have time to attend multiple sessions in the morning or afternoon.

In person would be lovely once we get rid of this virus.

Continue to do a great job with content

Glad to see the event was free to attend.

no

If its virtual again, have them all as morning sessions but for more days so you can still get other work done in the day.

When they return to in person, they need to be hosted at various locations across the state on a rotating basis.

Please record the sessions, or if they are already, please make it easier to find.

N/a

If virtual, allow for longer lunch break

Once in-person Summits start back, having sessions available on-line for viewing later on would make it easier to catch all the sessions that you were interested in but couldn't see live.

Great job by the team

None

None

Well run as is

None

N/A

Of course we all want the Summit to return to in-person as opposed to virtual. I think if it does turn out to be virtual again perhaps it can be spread over 3 days with 4 hours each day. 6 hours a day is a long time to sit in front of a monitor.

Have it more days but less time during the day if its going to be virtual again. More time for presentations and Q&A.

continue to have them please! it was fabulous

none. I think it went well.

None at this time

None

Perhaps question and answer segments can be formatted more as a round table to encourage dialogue between session research topics.

Technology related topics.

Not sure at the moment
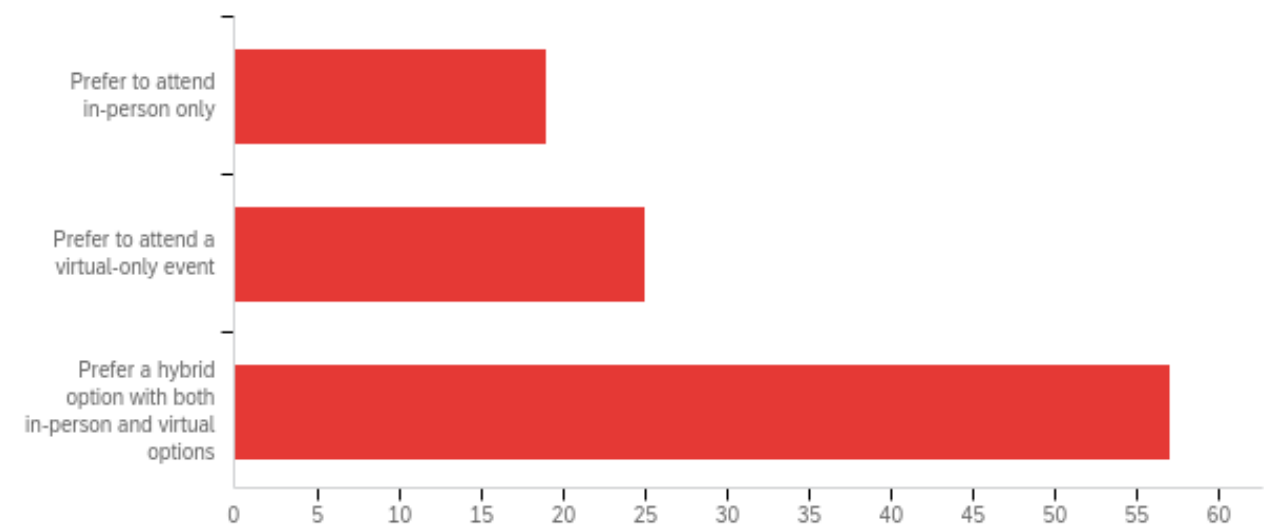
I would prefer for this to be an in person event next year.

Do a hybrid in person and virtual Summit

9 - If you were to attend the Summit in the future, would you:

#	Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
1	If you were to attend the Summit in the future, would you:	1.00	3.00	2.38	0.78	0.61	101

#	Answer	%	Count
1	Prefer to attend in-person only	18.81%	19
2	Prefer to attend a virtual-only event	24.75%	25
3	Prefer a hybrid option with both in-person and virtual options	56.44%	57
	Total	100%	101