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## Traffic Signal Guidance for Diverging Diamond Interchanges

ITRE Highway Systems researchers are improving the national transportation guidance for practitioners who work with traffic signals at diverging diamond interchanges (DDIs). Institute staff, funded by the National Cooperative Highway Research Program (NCHRP), are leading the NCHRP 03-113 project which focuses on the operational analysis and traffic signal design at DDIs and adjacent intersections.

A DDI is a relatively recent interchange innovation in the United States for designing safer, more efficient intersections between freeways and arterial roads. ITRE has been studying the performance and effectiveness of DDIs since 2010. In August 2014, the Federal Highway Administration (FHWA) published earlier ITRE research findings in the second edition of its *FHWA Diverging Diamond Interchange Information Guide*.

The research team is nearing completion on a new guidebook for DDI signalization. The new guide should be useful to (1) traffic modelers working with roadway engineers to optimize geometric design, (2) signal designers implementing operational strategies, (3) signal technicians when wiring and programming the controllers, and (4) operators when fine-tuning the interchange and adjacent intersection signals in real-time.

The NCHRP project focuses specifically on signalization in two areas of a DDI—the “influence” area and overall corridor improvements—where bottlenecks often occur. The new guidance will provide four basic phasing schemes along with variations based on specific project needs. Several levels of corridor strategies will be introduced along with the expected benefits based on volume and geometric combinations. Although the guidebook will provide a range of strategies to be considered, it is not meant to be prescriptive. Instead, the guidance will provide engineers and technicians with a set of tools and strategies to consider, along with the anticipated benefits based on each site-specific conditions.

Another phase of the project is slated to begin in spring of 2016 and will focus on updating geometric strategies and safety findings at DDIs for the third edition of the FHWA guide. These findings should be available in the summer of 2018. Please contact **Chris Cunningham** ([cmcunnin@ncsu.edu](mailto:cmcunnin@ncsu.edu)) at ITRE for more information about this research and training offerings to support activities in your region.

The current edition of the *FHWA Diverging Diamond Interchange Information Guide* is available online at [http://safety.fhwa.dot.gov/intersection/alter\\_design/pdf/fhwasa14067\\_ddi\\_infoguide.pdf](http://safety.fhwa.dot.gov/intersection/alter_design/pdf/fhwasa14067_ddi_infoguide.pdf).



Traffic stopped at a diverging diamond interchange (DDI) in Cornelius, NC. ITRE researchers are developing a national guidebook for engineers and technicians on traffic signal design and operation at DDIs and adjacent intersections.



**Institute for Transportation  
Research and Education**

909 Capability Drive, Suite 3600

Research Building IV

Raleigh, North Carolina 27606

[itre-information@ncsu.edu](mailto:itre-information@ncsu.edu)

[itre.ncsu.edu](http://itre.ncsu.edu)

## RESEARCH Spotlight

### Considerations for Effective LiDAR Deployment by Transportation Agencies

Light Detection and Ranging (LiDAR) is becoming increasingly popular with surveyors, engineers, and technicians across the United States, and state transportation agencies are adopting practical use of the technology. LiDAR can provide transportation agencies with the benefits of safety, data collection productivity, cost effectiveness, applicability, high levels of detail, and technologic advancement.

A **research paper** by ITRE provides guidance on how agencies may determine if LiDAR can be practically utilized within their organizations. The research recommends that interested parties systematically consider the aspects and performance measures outlined for effective deployment of LiDAR equipment or contracted services.

To **view/download** this paper, and to learn more about ITRE Research, visit our website at [itre.ncsu.edu/research](http://itre.ncsu.edu/research).

## ITRE Director Roupail Stepping Down Following Fifteen Years of Service

ITRE Director **Dr. Nagui M. Roupail** has announced that he will step down from his position beginning in August of this year, fulfilling fifteen years of leadership at the Institute. Dr. Roupail will be returning to his home Department of Civil, Construction, and Environmental Engineering and resume his teaching, research, and service activities as an NC State faculty member.

"ITRE has indeed made great strides towards becoming one of the elite transportation research and education centers in this country," said Dr. Roupail in his message to Institute stakeholders for the recent annual activity report. During his tenure as director that began in 2001, ITRE's annual funding and expenditures on program activities increased 91.3% to \$8.19 million in 2015—the highest level in the Institute's history. ITRE has grown significantly under Dr. Roupail's direction in its support of graduate and undergraduate students, in journal publications, in presentations at industry conferences, and in its winning rate of nationally competitive research projects. "And ITRE continues to be a great investment by the state of North Carolina," said Dr. Roupail, "generating nearly \$16.5 dollars for every dollar of state support."

In addition to resuming his NC State faculty activities, Dr. Roupail also will be conducting research on 'Big Data and Transportation' at RTI International as a newly selected RTI University Scholar. Headquartered in North Carolina's Research Triangle Park, RTI is a nonprofit organization providing research and technical services to government and commercial clients. Its University Scholar program supports distinguished academic researchers to partner with RTI experts, helping foster collaboration and develop opportunities for future joint projects.

The NC State Office of Research, Innovation and Economic Development is currently leading a search for the next ITRE Director. Candidates for the position will be interviewed on campus in March and April. The new director is expected to be announced and in place by mid-August.

"I am fortunate to have been associated from day one with an incredibly dedicated staff at ITRE," said Dr. Roupail. "As a result of their accomplishments, the future of this Institute will remain in good hands and will indeed thrive going forward."



ITRE Director  
Dr. Nagui M. Roupail



Photo Credit: Transportation and Infrastructure Daily

## North Carolina AirTAP Takes Off

This spring ITRE launched **NC AirTAP**—the **North Carolina Airport Technical Assistance Program**—a new initiative to support the state's public- and private-sector airport professionals. The program will help North Carolina airports improve the safety, quality and efficiency of their operations and increase the use of new aviation materials, practices and technology. NC AirTAP will also help airport staff build a community network for exchanging best practices.

NC AirTAP is a joint effort of ITRE, the NC Department of Transportation (NCDOT) Division of Aviation, and the North Carolina Airports Association (NCAA). Representatives from these organizations, and from consulting firms which support the state's aviation industry, will serve on a steering committee to provide oversight and guidance to the program.

ITRE staff are attending NCAA regional and annual meetings this spring to promote the program, present information, and gather input from airport operators and consultants. The NC AirTAP website will launch later this year to announce upcoming training offerings, share related resources from the NCAA and NCDOT Division of Aviation, and provide links to other helpful airport industry websites and publications.

Please contact **James Martin** ([jbm@ncsu.edu](mailto:jbm@ncsu.edu)) at ITRE for more information about NC AirTAP.

## Highlights from the 2016 TRB Annual Meeting

ITRE research staff and students joined NC State University civil engineering faculty at the 95th annual Transportation Research Board (TRB) meeting held January 10-14, 2016 in Washington, DC. A seminal event for transportation practitioners in the U.S. and around the world, the TRB Annual Meeting brings together leaders in research and innovation to exchange information for improving transportation across multiple modes and disciplines. This year's meeting attracted more than 14,000 participants and disseminated over 5,600 research papers through nearly 900 sessions and workshops.

More than twenty ITRE staff, students, and affiliated faculty from the NC State Department of Civil, Construction, and Environmental Engineering (CCEE) were invited to attend the annual meeting and present sixteen papers and posters. These were among a total of 33 papers presented at TRB this year by NC State researchers. Thirteen of the 33 papers were identified by TRB as "practice-ready," a special designation given only to papers for "which the research results presented and discussed make a contribution to the solution of current or future transportation problems or issues for practitioners." This prestigious designation demonstrates the relevance and value of NC State's transportation research being conducted by ITRE and CCEE.

For the fourth consecutive year at TRB, a Best Paper award was earned by ITRE researchers. The Work Zone Traffic Control committee's 2016 best paper award went to "Innovative Work Zone Capacity Models from Nationwide Field and Archival Sources" co-authored by **Dr. Chunho Yeom, Dr. Ali Hajbabaie, Dr. Bastian Schroeder, Chris Vaughan, Xingyu Xuan, and Dr. Nagui Roupail.**

As is the tradition at the TRB Annual Meeting, ITRE, CCEE and the NC State Engineering Foundation co-hosted a networking reception for alumni and friends of the civil engineering program. Held on January 12 and attended by more than 200 persons including ITRE Advisory Council members, the annual reception provides an opportunity for staff, faculty and students to say "thank you" to the supporters of ITRE and CCEE's integrated education and research mission.

The reception was made possible through the generous contributions from nearly twenty corporate sponsors. See **Page 4** for a listing of the sponsors and photos from the reception and TRB presentations.



ITRE researchers Dr. Bastian Schroeder (left) and Dr. Ali Hajbabaie (right) represented their co-authors at the 2016 TRB Annual Meeting to receive the Best Paper Award from the Work Zone Traffic Control committee. Wesley Zech of Auburn University (center) organized the panel that chose the ITRE research paper as the best of 28 papers submitted.

## TRAINING Spotlight

### North Carolina Local Technical Assistance Program (NC LTAP)

NC LTAP at ITRE offers a variety of road maintenance, traffic control, and safety training courses at a reasonable cost.

NC LTAP courses address topics of interest to local transportation and public works agencies, as well as to NC Department of Transportation employees. Training courses available from the program include:

- › Work zone safety,
- › Pavement maintenance,
- › Erosion control,
- › Utility cuts,
- › Traffic calming,
- › Sign retroreflectivity,
- › Heavy equipment operator safety,
- › OSHA training, and
- › Supervisory skills.

NC LTAP training classes are held at ITRE offices in Raleigh, NC and in various locations across the state.

For more information on ITRE Training offerings including a calendar of upcoming courses, visit our website at [itre.ncsu.edu/training](http://itre.ncsu.edu/training).



## TECHNICAL SERVICES Spotlight

### Bicycle and Pedestrian Program Services

ITRE Bicycle and Pedestrian program staff have experience in a wide variety of tasks to assist clients with technical expertise necessary to administer and develop programs and projects. In many instances, ITRE works closely with the NCDOT Division of Bicycle and Pedestrian Transportation.

Bike & Ped services include:

- › Establishment of a Vision Zero program at the state level,
- › Creating bicycle maps for local communities,
- › Development of educational and informational brochures,
- › Stakeholder facilitation,
- › Online surveys,
- › Website content development and organization, and
- › Installation of short- and long-term bicycle and pedestrian count equipment.

For more information on ITRE Technical Services, visit our website at [itre.ncsu.edu/technical-services](http://itre.ncsu.edu/technical-services).

## 2016 TRB Annual Meeting Highlights continued from Page 3

The 2016 NC State reception at the TRB Annual Meeting was sponsored by these generous organizations:

- › Platinum level – Kittelson & Associates, Inc.
- › Gold level – AECOM, Kimley-Horn, McKim & Creed, Q-Free Open Roads, Ramey Kemp & Associates, and Transpo Group
- › Silver level – Atkins, DigiWest, Forum 8, HNTB, HW Lochner, IEM, Mulkey Engineers & Consultants, Troxler Electronic Labs, and WSP Parsons Brinkerhoff
- › Bronze level – Assets Management Associates, ETC Institute, Metropia, and UNC Charlotte

Photos from the event were contributed by ITRE staff and students Ishtiaq Ahmed, Tracy Anderson, Tim Baughman, Sangkey Kim, Sarah O'Brien, Briana Phillips, Mary Rawls, Nagui Roupail, Andy Wagner, and Elizabeth Williams. **Thank you** to everyone who represented and supported ITRE at this year's TRB event.

