

LIST OF RESEARCH NEED STATEMENTS FOR FY-2013

RNS #	Research Need Statement (RNS) Title	Submitted By	Affiliation
<u>Planning and Environment</u>			
3101	Arch Culvert Construction and Stream Stability/Equilibrium	R. Maycock	Roadside Environmental
3102	Evaluation of Small Stream Crossing Culverts to Assess Impacts on Stream Morphology and Aquatic Passage – Part II	R. Maycock	Roadside Environmental
3103	Beneficial Reuse of Diamond Grinding Slurry Wastewater	R. Maycock	Roadside Environmental
3104	GIS Trout Inventory	R. Maycock	Roadside Environmental
3105	Noise Attenuation to Minimize Impacts to Aquatic Migration	R. Maycock	Roadside Environmental
3106	Reduced Project Costs by using Speculatively Accumulated Sugar Products for Enhanced Anaerobic Bioremediation at Contaminated Asphalt Sites.	T. Niver	Roadside Environmental
3107	The effects of contaminated soil and ground water on right of way, subsurface utilities, surface water drainage, and the environment.	C. Parker	GeoEnvironmental
3108	Defining North Carolina's Transportation Disadvantaged Populations	Dickens & Emptage	Office of Civil Rights
3109	Tools to Quantify and Manage Hydromodification from Stormwater Runoff	M. Lauffer	Hydraulics
3110	Map markets for construction and demolition waste materials in NC	J. Sharp	General Services
3111	Rights of Way Canola – An Economic Evaluation	D. Smith	Roadside Environmental
3112	Improving Brush Control Practices.	D. Smith	Roadside Environmental
3113	Asset Management Aided Through Vegetation Management	D. Smith	Roadside Environmental
3114	Zoysiagrass along NC roadsides	D. Smith	Roadside Environmental
3115	Improvements to NCDOT's Wetland Prediction Model	M. Weatherford	PDEA
3201	Out-of-Pavement Vehicle Detection for Four-Quadrant Gated Highway-Rail Crossings	R. Mullinax	Rail Division
3202	Practices To Improve Visualization of Transportation Projects: Access Management	M. Al-Ghandour	Project Management
3203	Determining of Best Practices to Improve on Time on Budget Delivery Hwy Projects	M. Al-Ghandour	Project Management
3204	Camera Applications for Construction Management Tool	R. Taylor	Facilities Design
3205	Trip Making Patterns of NC's University Students	D. Thomas	Transportation Planning
<u>Pavement and Maintenance</u>			
3301	Mobile Roads	E. Pope	Location & Surveys
3302	Seasonal changes in Pavement Friction in NC	J. Corley-Lay	Pavement Management
3303	Inclusion of Maintenance in Life Cycle Costs of Flexible and Rigid Pavements	J. Corley-Lay	Pavement Management
3304	Surface Layer Bond Stresses and Strength	C. Morrison, et al.	Pavement Management
3305	Development of IRI Limits and Targets for Network Management and Construction Approval Purposes	N. Mastin	Pavement Management
3306	Visual guide to identifying and treating oxidation just prior to cracking	J. Corley-Lay	Pavement Management
3307	Field Calibration and Implementation of the Performance-Based Chip Seal Mix Design Method	D. Wofford	State Road Maintenance
3308	Impact of WMA Technology on the Use of RAP Mixtures in North Carolina	Whittington & Morrison	M&T and Pavement Management
<u>Structures and Construction</u>			
3401	Alternate Bridge Rails for Low Impact Bridge Replacements	P. Garrett	Bridge Management
3402	Design of Temporary Slopes and Excavations in NC Residual Soils	K. J. Kim	Engineering
3403	Innovative Approaches for the Prevention of Bridge Deck Freezing	D. Holderman	Bridge Management
3404	Assessment of In Situ Scour Profile Using A Jet Probe	Beard & Wainaina	Geotechnical
3405	The Use of Waste and/or Recycled Materials in Highway Construction	K. J. Kim	Engineering
<u>Traffic and Safety</u>			
3501	Monolithic Concrete Island Delineation with RPM's and/or Pavement Markings	P. Hart	Div.6 / Traffic Services
3502	Improvement of the Conventional Diverging Diamond (DDI) Interchange and Diverging Double Roundabout Interchange (DDR)	M. Al-Ghandour	Program Development
3503	Safety Visibility Enhancement	T. Alston	Division 1 / Safety Dept.
3504	Effectiveness of Elongated Shield Pavement Markings	R. King	Signing & Delineation
3505	Effectiveness of Wide Dotted Line Pavement Markings	R. King	Signing & Delineation
3506	Evaluation of Truck Lane and Speed Restrictions on Multi-lane Highways	E. Morrison	Research
3507	Evaluation of Red Light Camera Enforcement in North Carolina	E. Morrison	Research
3508	Assessment of Automated Sign Retroreflectivity Measurement Tools	C. Howard	Standards
3509	Delay and User Cost Estimation for Work Zones on Urban Arterials	J. Ishak	Mobility & Safety

PLANNING AND ENVIRONMENT RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Robin L. Maycock

DATE: 7/25/11

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Arch Culvert Construction and Stream Stability/Equilibrium

Background:

The US Army Corps of Engineers and NCDENR Division of Water Quality authorize construction in waters of the US with permit conditions requiring that stream impacts be avoided and minimized, and that stream stability and equilibrium be maintained. Arch culverts were initially viewed as a means of avoiding stream impacts but the lack of light beneath them prevented vegetative growth, and resulted in destabilized stream channels. The stream channels would erode and migrate, contributing to water quality problems and potentially undermining the arch culvert foundations. The use of rip rap under the arch culverts also constitutes an impact.

What is the Specific Problem or Issue?

Recently a business park was permitted as having no impacts based on the use of arch culverts. However, stream stability and equilibrium was not maintained due to a lack of vegetation. Research on this site could allow for the development of ways to minimize impacts and to protect the existing arch culverts from being undermined by stream channel incision or migration. Lighting under the arch culverts could allow vegetation to grow, resulting in improved stream channel stability. Solar panels could be used to provide light if utility poles are not accessible.

List Research Objectives and Tasks:

Review existing literature to determine research findings on use of artificial lighting under culverts.
 Perform cost/benefit analysis on various options to solve the problem at the business park.
 Perform research study on effect of lighting on vegetative growth and stream stability under the culverts.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")
 Literature review, cost-benefit analysis, research results to support existing permit conditions.

How Will You or Others Use the Product[s]?

Facilitate impact avoidance and minimization of stream channel impacts with the use of arch culverts and artificial lighting.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
 Long term: Provide data on effectiveness of artificial lighting under arch culverts
 Short term: Provide cost-effective solution to compliance issue with arch culverts.

Other Comments:

Existing problematic situation at a business park could be resolved through research based approach.

Approval (Division official or Unit Head)

Don Lee

 Print Name

 Signature

State Roadside Environmental Engineer

 Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research
 104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549
 FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Robin L. Maycock

DATE: 8/18/10

Branch / Unit: NCDOT/DOH/REU

TITLE of your Research Idea: Evaluation of Small Stream Crossing Culverts to Assess Impacts on Stream Morphology and Aquatic Passage – Part II

Background:

In August 2005, the final report was submitted on: Evaluation of Small Stream Crossing Culverts to Assess Impacts on Stream Morphology and Aquatic Passage by BAE/NCSU. It was funded by a Technical Assistance Agreement with the intent to measure stream crossing morphology before and after the installation of culverts, and the repeat the measurements five years later, in order to assess the changes in stream morphology.

What is the Specific Problem or Issue?

Permit conditions by the USACE and DWQ require burial of culverts 12 inches or 20% in order to prevent “perched” pipes which could hinder aquatic organism passage. Permit conditions also require an assessment of stream equilibrium. Burying the pipes was observed to cause stream instability and “headcutting” downstream, so the research project was conducted to get baseline elevation and stream dimension data on selected stream crossings, then to return to repeat the measurements to determine the stream equilibrium at the same sites.

List Research Objectives and Tasks:

Revisit the same 11 culverts surveyed in 2005 in Divisions 5 and 11, repeat the same measurements, and determine if stream equilibrium was achieved or if culvert installation had an adverse impact on stream stability and aquatic passage.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a “product,” but “deliverables.”)*
 Results would influence the culvert installation methodology, permit conditions and training.

How Will You or Others Use the Product[s]?

Depending on the results, culvert installation methodology may be affected.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
 Short term: Decrease permit delays, influence culvert installation protocols.
 Long term: Increase water quality due to reduced stream instability, increase aquatic organism passage for ecological benefits. Increase credibility with regulatory agencies.

Other Comments:

Approval (Division official or Unit Head)

Done Lee

 Print Name

 Signature

State Roadside Environmental Engineer

 Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research
 104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549

FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Robin L. Maycock

DATE: 7/25/11

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Beneficial Reuse of Diamond Grinding Slurry Wastewater

Background:

Disposal of industrial process waste water generated during NCDOT operations requires hauling to a WWTP, or permitted land application. Beneficial reuse of this water for irrigation and as a liming application will save money and promote reuse of the water. Permitting agencies (NCDENR/DWQ/APU) have allowed land application of a similar wastewater stream on NCDOT ROW and research is needed to obtain a General Permit for land application of other industrial process wastewaters such as diamond grinding slurries, as generated by NCDOT.

What is the Specific Problem or Issue?

Diamond Grinding is used to resurface concrete on roads, and creates large volumes of industrial process wastewater which has a high pH, high turbidity and high liming potential for soils. Other pollutants or contaminants are relatively low. Land application on NCDOT ROW could provide a viable disposal option and save money for lime application to enhance grass growth on the ROW.

List Research Objectives and Tasks:

Literature Review
 Cost/Benefit Analysis
 Collect data on effects of land application on soil properties, water quality and plant growth.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Research results to support the use of industrial process waste water for land application.

How Will You or Others Use the Product[s]?

Contractors/Sub-contractors will have reduced costs in waste disposal, which will be passed on the NCDOT.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
 NCDOT will have reduced costs in liming and irrigation.

Other Comments:

Existing problematic situation at a business park could be resolved through research based approach.

Approval (Division official or Unit Head)

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research
 104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549
 FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Robin L. Maycock

DATE: 7/25/11

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: GIS Trout Inventory

Background:

Trout county and trout stream designations protect the habitat of native and stocked trout by requiring buffers, water quality protection BMPs and moratoriums for construction. Many older timber bridges now need to be replaced with culverts, and an inventory of existing trout habitat and existing trout passage obstacles could be identified to allow screening for permitting of culverts or provide mitigation opportunities where access is currently blocked.

What is the Specific Problem or Issue?

Trout county and trout stream designations dictate construction moratoriums and the type of structures preferred by regulatory agencies. A GIS inventory of specific streams and existing obstacles to aquatic passage would help facilitate screening for permitting associated with replacement of old timber bridges with culverts.

List Research Objectives and Tasks:

Literature Review

Cost/Benefit Analysis

Collect data on existing aquatic organism passage obstacles and on existing trout habitat versus trout county designation.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

.GIS mapping inventory with user access/interface for permit screening and review

How Will You or Others Use the Product[s]?

Project screening and permit review by NCDOT and regulatory agencies.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Increase efficiency in prioritization/screening of bridge replacement projects

Other Comments:

Approval (Division official or Unit Head)

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217

1549 Mail Service Center

Raleigh, NC 27699-1549

FAX: (919) 715-0137

Phone: (919) 508-1790

email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Robin L. Maycock

DATE: 7/25/11

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Noise Attenuation to Minimize Impacts to Aquatic Migration

Background:

The US Army Corps of Engineers and NCDENR Division of Water Quality authorize construction in waters of the US with permit conditions limiting in-water construction during moratoriums to protect anadromous fish migration and trout spawning season. Review and approval by the USFWS, NMFS and NCWRC are also required for permit approval. Bridge replacement projects have been funded by the recent legislature and will require an intensive effort to complete work within allotted timeframes. The existing moratoriums will impede project delivery and so finding a way to waive the moratoriums by reducing the impacts of construction noise is needed.

What is the Specific Problem or Issue?

The protections of anadromous fish migration and trout during spawning seasons limit the work that can be done by NCDOT in the rivers and streams of North Carolina. Moratoriums on in-water work severely limit bridge work that is allowed during several months of the year. Noise attenuation can reduce adverse impacts by the use of bubble curtains around pile driving activities, allowing certain construction activities to proceed during the moratoriums without adversely impacting protected fish species.

List Research Objectives and Tasks:

Review existing literature to determine research findings on use of hydro-acoustic measures to attenuate noise during bridge construction. Interview NMFS, USFWS, NCWRC staff to determine possibility of lifting moratoriums and conducting pilot studies. Determine cost/benefit of use of noise curtains to allow work during moratoriums. Perform research in-situ to determine effectiveness of noise attenuation methods.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

Literature review, cost-benefit analysis, research results to support permit variance on construction moratoriums.

How Will You or Others Use the Product[s]?

Facilitate bridge program completion by getting agency approval to waive moratoriums when using noise attenuation. Determine the cost effectiveness of when to use noise attenuation.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Long term: Increase program delivery and efficiency

Short term: Open dialogue on noise attenuation options

Other Comments:

Approval (Division official or Unit Head)

Don Lee

 Print Name

 Signature

State Roadside Environmental Engineer

 Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549

FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Thomas C. Niver, P.G., CHMM**DATE:** July 2011**Branch / Unit:** Environmental Operations Section**TITLE of your Research Idea:** Reduced Project Costs by using Speculatively Accumulated Sugar Products for Enhanced Anaerobic Bioremediation at Contaminated Asphalt Sites.**Background:**

By the 1960's, the NC DOT implemented a state -wide quality assurance/control program requiring certification of the privately owned and operated asphalt plants. The various asphalt suppliers/contractors, as part of an ongoing certification process, constructed and maintained onsite asphalt testing laboratories (ATLs), at each asphalt plant. The several parties that performed testing used chlorinated aliphatic compounds (e.g., carbon tetrachloride, trichloroethene, and 1,1,1-trichloroethane) in the testing process. On site disposal of waste solvents related to the ATLs has contaminated soil and groundwater scores of sites throughout North Carolina. By legislative mandate, NC DOT and NC DENR have been tasked with the investigation and cleanup of these properties.

What is the Specific Problem or Issue?

Chlorinated aliphatic compounds are recalcitrant contaminants in the environment. Engineered mechanical extraction technologies have proven marginally effective. In situ stimulation of indigenous microbial populations with various energy substrates (e.g., sugars) has proven to be the best technical remedial alternative, but the cost of commercially available products is prohibitive for the scale of the ATL remediation program. NCDOT needs a lower cost alternative sugar. Commercial soft drink bottlers, confectionaries, and other food processors, use High Fructose Corn Syrup (HFCS) in their formulations. The sugar concentrations in their products are comparable to those injected in bioremediation programs. HFCS has been used successfully for bioremediation around the country. We propose to secure speculatively accumulated sugar solutions from commercial ventures that would otherwise be disposed of at the local POTWs.

List Research Objectives and Tasks:

The objective of this research is to demonstrate that speculatively accumulated and low cost HFCS-rich solutions from the food processing industry are a low cost substitute for commercially available products now being used by the NC DOT. We will substitute the recovered HFCS product in a bioremediation program to demonstrate efficacy. The NC DOT will secure underground injection control permits, install monitor wells, perform solution injections, and monitor the progress of the remediation through a combination of groundwater sampling, field and laboratory analytical testing, and detailed chemical thermodynamic analyses.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

The final product of the research will be a low cost remedial alternative that is proven as effective as commercially available green chemistry products. Current funding levels are grossly insufficient to remediate all sites using commercially available products. Therefore, successful application of our research will save the NC DOT Millions of dollars in material and labor costs, while allowing us to address the legislatures mandate without seeking additional funding. In addition, the commercial manufactures currently pay a premium to their local POTW to dispose of HFCS containing materials.

How Will You or Others Use the Product[s]?

NC DOT will use the product of this research to remediate up to ?? former ATL sites. We anticipate a cost savings of ??. NC DENR manages a program to remediate Dry Cleaner sites with similar contaminants, In addition, there are thousands of other sites around the state where this technology could be applicable for private industrial cleanups.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The product of this research will reduce NC DOT costs by Millions of dollars. It will also accelerate site cleanups, help meet the legislative mandate more economically, and ultimately reduce the human health and environmental risks posed by the former ATLs, and NC DOT's long term exposure to future regulatory and litigation costs.

Approval (Division official or Unit Head)

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Cyrus Parker**DATE:** July 1, 2011**Branch / Unit:** Highway Design Branch/Geotechnical Engineering Unit**TITLE of your Research Idea:** The effects of contaminated soil and ground water on right of way, subsurface utilities, surface water drainage, and the environment.**Background:**

Transportation projects are often constructed and maintained in the presence of soil and ground water contaminated with petroleum, solvents, and other toxic and hazardous substances. These contaminants have the ability to impact all phases of a transportation project including planning, design, right of way, construction and maintenance. This research is intended to update the Department's policies regarding the impact of contaminants on three areas of interest which are right of way acquisition, utility and drainage installation, and soil and ground water remediation before and during construction or maintenance.

Transportation projects often require the acquisition of property known or presumed to be contaminated with hazardous and non-hazardous chemicals. Acquisition of such properties poses the risk of future remediation liability and additional costs for curing the site of contaminants in conflict with the proposed transportation project. Properties of concern are investigated for contaminants and if found, the offer is reduced by a portion of the cleanup costs.

Subsurface utilities and drainage structures are often installed in areas where these contaminants are present. The utilities and structures may or may not be hardened against the contaminants depending on the information available during the planning and design phases of the project.

Transportation projects routinely encounter petroleum contaminated soil during construction and maintenance. The current approach to addressing contaminated soil is to excavate the contaminated soil and truck it to a permitted disposal or treatment facility. Another option, which has fallen out of favor with the regulators and is no longer available, was to obtain an onsite disposal permit from the NCDENR Division of Waste Management's Underground Storage Tank Section to dispose of the soil in an embankment within the Department's right of way.

Transportation projects in areas with a high water table or substantial grade changes routinely encounter petroleum contaminated ground water while dewatering excavations for various tasks associated with the construction and maintenance of transportation facilities. The contaminated water is currently containerized and transported offsite for disposal. Some projects provide an opportunity to discharge the contaminated ground water to a municipal waste water treatment plant at a greatly reduced cost but this option is often not available.

What is the Specific Problem or Issue?

The appraisal, negotiation, and acquisition of these contaminated properties may not always occur in such a manner as to protect the Department from future liability and cost while preserving the liability of the party responsible for the contamination.

Subsurface utilities and drainage are routinely installed by the Department and others in areas of soil and ground water contamination. In addition to construction delays, these utilities and structures may provide lower quality service, shorten life spans, and pathways for contaminants to migrate.

Management and disposal of petroleum contaminated soil and ground water can add significant costs to a project. Stockpiling contaminated soil or staging water containment vessels onsite is often challenging and a hindrance to contractors.

List Research Objectives and Tasks:

The research should investigate private market comparable real estate sales to determine procedures used in private industry to acquire contaminated property. Investigate private industry procedures related to the appraisal, negotiation, and acquisition. Also, investigate current real estate and environmental regulations and historical Department right of way acquisitions of contaminated property and compare the findings of these investigations to current Department right of way procedures.

The research should determine the effect contaminated soil and ground water have on subsurface utilities and drainage structures for both hardened and unhardened systems. The research should address the change in quality of service, service life and determine the effect on the environment due to the installation of these systems in contaminated areas. The research should also determine how best to harden each system against the most common contaminants found on transportation projects and how best to mitigate any adverse effects on the environment.

Determine the most cost effective and environmentally beneficial methods of addressing petroleum contaminated soil and ground water encountered during the construction and maintenance of transportation projects. Develop onsite and offsite treatment and disposal options for petroleum contaminated soil and ground water. Develop a matrix as to when each treatment option should be deployed based on site specific details, contaminant concentrations, and available resources. Determine if reuse options are available that are cost effective and environmentally beneficial.

What Would be the Product[s] of the Research?

Provide a comparison of the private market sales against Department acquisitions with consideration for the current real estate and environmental laws. Provide recommendations on how the Department could improve our policies and procedures to better protect the Department against future environmental liability and cost.

Provide material descriptions and techniques to harden various subsurface utilities and drainage structures against various chemical attacks and to prevent preferential pathways for contaminant migration. Provide a description of adverse effects on the environment of installing utilities and drainage with and without hardening. Provide a description of adverse effects on the utilities and drainage structures installed with and without hardening. Provide best management practices for installing subsurface utilities and drainage in contaminated soil and ground water.

Provide a list of tools and techniques to address petroleum contaminated soil and ground water encountered on construction and maintenance projects. The tools and techniques should consider avoidance, minimization, recycling, reuse, onsite treatment and disposal, and offsite disposal.

How Will You or Others Use the Product[s]?

These tools, techniques, and recommendations will be used to update current Department policies for acquiring contaminated properties, installing utilities and drainage structures, and addressing contaminated soil and ground water on maintenance and construction projects.

How Will the Product Benefit the Department?

These updates will reduce the Departments environmental liability, ensure utilities and structures installed in contaminated areas perform as designed, and reduce costs and delays associated with managing contaminated soil and water.

The Department will benefit by having better protection against future environmental liability and cost associated with acquiring contaminated properties.

The Department will benefit by not having to harden utilities and drainage unless the conditions warrant hardening; more options will be available in the event hardening is necessary; the environment will not be harmed further as a result of the installation.

The Department will benefit by having additional tools and techniques to reduce the cost, schedule conflicts, and waste associated with petroleum contaminated soil and ground water.

Approval (Division official or Unit Head)

Njoroge Wainaina

Print Name

State Geotechnical Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Shantray Dickens and Aketa Emptage

DATE: 8/10/11

Branch / Unit: Office of Civil Rights, Title VI Section

TITLE of your Research Idea: Defining North Carolina's Transportation Disadvantaged Populations

Background:

Reliable transportation options enhance quality of life by connecting people to desired places and resources. These connections are vital to ensuring equal opportunity and access for all individuals. However, many North Carolinians lack the ability to provide their own transportation or the ability to access it. Further, some live in areas without adequate public transportation services or cannot adequately access them due to language barriers or lack of reasonable accommodations. A 2003 US GAO report defines these persons as "transportation disadvantaged". These populations include several 'protected populations' under USDOT Title VI programs, such as low-income, disabled, and some elderly persons, that have been traditionally underserved by transportation systems. Thus, these groups are more sensitive to the effects of transportation decision-making in North Carolina, which may prove to be more disadvantageous for them without appropriate identification and analysis by program officials.

What is the Specific Problem or Issue?

There is no comprehensive data available that identifies North Carolina's transportation disadvantaged populations. Therefore, transportation decision-makers run the risk of taking a one-size fits all approach, or worse, implementing policies and practices that disproportionately impact members of this group. To ameliorate this risk, these groups need to be identified, have their needs assessed and be given the opportunity to fully participate in the decision-making process.

List Research Objectives and Tasks:

- To identify transportation disadvantaged communities across North Carolina. The goal is to identify these groups by specific boundaries, characteristics, cohesion, where applicable, etc.
- To identify the standards of transportation disadvantaged communities in NC. These standards include an examination of transportation patterns, modes available, type of facilities and amenities, etc. An appropriate measure for comparison would be to determine the ideal transportation networks in the state, making sure to consider how standards vary in rural vs. urban locations.
- To highlight the general causes or factors that make these groups or persons transportation disadvantaged. Also identify existing and potential barriers to access; mobility; decision-making, etc.
- To examine how impacts from past government transportation-related actions benefitted or burdened them. This will require a thorough examination of positive and negative impacts.

What Would be the Product[s] of the Research?

Statewide Transportation Disadvantaged Community Inventory and Needs Assessment
2-3 NC case studies that take into account an overlay of transportation improvements carried out in transportation disadvantaged communities over a given time period. What was the methodology used to determine impacts? How were proposed impacts and benefits realized?
Methodology for Quantifying Transportation Impacts on Quality of Life

How Will You or Others Use the Product[s]?

The primary beneficiaries of this research would be the following areas:

- OCR – a resource to better target required community outreach and public education efforts; to provide technical assistance to other business units; to determine whether impacts are disproportionately high and adverse
- All NCDOT modal units – a tool in strategic planning and public involvement
- Communications – a tool to use in public relations

How Will the Product Benefit the Department?

Whereas federal protections exist for potential groups or persons that are transportation disadvantaged in our state, the products of this research will benefit the Department in the following ways:

- Provide for operational efficiency between OCR and other business units.
- Decrease the time and potential cost associated with community impact assessment in project development and environmental analysis.
- Enhance overall ability to communicate effectively with the public.
- Assist the Department in meeting federal requirements.
- Create opportunities for collaboration and coordination with other state agencies that serve such groups.

Approval (Division official or Unit Head)

Sharon Lipscomb

Print Name

Signature

Title VI/EO Contract Compliance Manager

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Matt Lauffer

DATE: August 19, 2011

Branch / Unit: Hydraulics Unit

TITLE of your Research Idea: Tools to Quantify and Manage Hydromodification from Stormwater Runoff

Background:

Traditional hydraulic drainage design has focused on collection and conveyance of stormwater runoff by managing the rate or discharge. While managing rate is important, studies by NCHRP the National Academies of Sciences and other DOTs have shown that other parameters such as flow duration, volume, and water quality need to be considered when changing the hydrologic conditions of a site. Streambank and channel erosion result when flow duration and volume are not incorporated in the design process and increase the number of Tort claims and required maintenance on the highway facility. There is a need to understand the impacts of discharges on the health of streams, and manage stormwater in a manner that is consistent with social, economic and environmental goals.

What is the Specific Problem or Issue?

While traditional hydraulic drainage design is focused on conveying peak flows to extents of the right-of-way, design must incorporate other parameters such as flow duration, volume and water quality. This is necessary to avoid Tort claims, preserve the integrity of the highway facility and meet requirements of the Departments NPDES Stormwater Permit. Currently hydraulic design practices do not include the tools or the analysis to provide guidance on how to address flow duration, and volume. There is a need to develop tools to allow design engineers to identify the impacts of flow duration and volume on downstream channels and streams.

List Research Objectives and Tasks:

- The research should provide design guidance to managing stormwater discharge based on social, economic and environmental goals. Possible research tasks include (but not limited to)
- studying reference streams across a variety of stream types and designated uses or goals and evaluating the performance of existing stormwater control measures;
 - providing consulting services in a design of a retrofit or new roadway construction project, including runoff quantity and quality monitoring as appropriate;
 - applying stream stability research to developing guidance on the design of stormwater conveyance channels to reduce degradation of channels and streams;
 - providing training to NCDOT design staff on the design guidance.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")
Design guidance on rate, flow duration and volume that are appropriate for the context of the project.

How Will You or Others Use the Product[s]?

The results of this work will improve post-construction hydraulic and hydrologic design and be incorporated into the Hydraulic Guidelines.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
The product will lessen potential Tort claims, reduce infrastructure maintenance due to erosion, and provide compliance with the Departments NPDES Stormwater Permit.

Other Comments:

Approval (Division official or Unit Head)

----- Print Name	----- Signature	----- State Hydraulics Engineer Title
---------------------	--------------------	---

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** John Sharp**DATE:** 6/29/2011**Branch / Unit:** General Services**TITLE of your Research Idea:** Map markets for construction and demolition waste materials in NC**Background:**

In Keeping with NCDOT Mission of Connecting people and places in N.C.-safely and efficiently, with accountability and **environmental sensitivity**, NCDOT has started a new program of recycling and reusing waste materials from construction and demolition of building materials. Construction and demolition (C&D) materials consist of the debris generated during the construction, renovation, and demolition of buildings, roads, and bridges. C&D materials often contain bulky, heavy materials, such as concrete, wood, metals, glass, and salvaged building components. Reducing and recycling C&D materials conserves natural resources and landfill space, reduces the environmental impact of producing new materials, creates jobs, and can reduce overall building project expenses through avoided purchase/disposal costs.

In an effort to expand this program, it is necessary to identify all the locations in N.C. where construction and demolition material can go in all 100 counties.

What is the Specific Problem or Issue?

There are no state wide maps showing locations where these materials can go and what materials are accepted.

Would like research done to identify places to take this C&D waste material to and place on a state map showing all 100 counties and these sites locations..

List Research Objectives and Tasks:

Identify Public(County/City), Not for Profit(Habitat for Humanity), and Private Markets in N.C. that except C&D waste which include any of the following:

- Wood
- Concrete
- Brick & Block
- Sheetrock / Gypsum Wallboard
- Metals
- Asphalt Shingle
- Yard debris
- Land Clearing Debris
- Clean Dimensional
- Lumber & Pallets

Map these sites State wide listing all 100 Counties with contact information.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

How Will You or Others Use the Product[s]?

This would be distributed to all 14 Division Operations Engineers to reference, as well as, it will be incorporated in our RFPs to private contractors that do business with us in construction and demolition projects.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The Department Benefits from this by recycling/reuse these C&D waste materials from our projects state wide and it shows our continual commitment to sustaining the environment in N.C., conserving natural resources and landfill space, reduces the environmental impact of producing new materials, creates and supports jobs, and assisting us in reduce overall building project expenses through avoided purchase/disposal costs.

Other Comments:

This is a key element in ensuring the success of the C&D recycling/reuse program and will foster greater participation by all.

Approval (Division official or Unit Head)

John Sharp

Print Name

Signature

Environmental Specialist

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Derek Smith**DATE:** June 29, 2011**Branch / Unit:** Roadside Environmental Unit**TITLE of your Research Idea:** Rights of Way Canola – An Economic Evaluation**Background:**

Several States including Tennessee and Utah have investigated the feasibility of growing grain crops along their roadsides to determine biofuel production potential. Since 2008, Dr. Matthew Veal, NCSU researcher, has been evaluating biofuel production along North Carolina's roadsides. To date, canola, sunflower and safflower seed have been investigated by Dr. Veal. Canola production has far exceeded that of sunflowers and safflower in this multi-year research effort. NC has become the first State to harvest a rights of way canola crop and complete the process of converting B-100 (canola oil) into B-20 biofuel. As a further accomplishment, in 2010, NCDOT completed the production cycle by producing 600 gallons of B-20 and using it to fuel state maintained vehicles.

What is the Specific Problem or Issue?

The next logical step is to evaluate the economics of biofuel production along the roadsides. A comparison of roadside production costs to current NCDOT's Fleet and Material Management Unit biofuel costs are warranted. Costs shall include an evaluation of the value of a secondary product, canola meal, to offset production costs. Canola meal is the protein rich biomass that remains after the canola seed have been pressed to release their oil.

List Research Objectives and Tasks:

Develop a private - public partnership (PPP or P-3) between NCDOT and a North Carolina based company willing to manage a biofuel production fields along our rights of way. The company and NCDOT will cooperate to establish a zone of effective production and areas within that zone will be selected for canola production. The private company will then manage the selected rights-of-way to produce canola seed for processing into B-100. Further, the company will then convert the B-100 into B-20 for use in NCDOT equipment. The private company will share the financial records of its inputs and NCDOT will purchase the B-20 based upon an evaluation of these records. Additionally, the researcher will explore the effects of canola production on rights of way erosion.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Development of a document outlining the parameters of large scale, cost-effective canola production along the roadsides of North Carolina.

How Will You or Others Use the Product[s]?

NCDOT will use the information to determine the likelihood of a sustainable biofuel production operation along the roadsides. The results of this two year production project will be utilized to determine a cost comparison of B-20 produced under the parameters of this research project and B-20 purchased on the open market. This project will also serve as a model for similar private-public partnerships within NCDOT.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

With a positive outcome, we will be able to produce B-20 biofuel that will be less expensive than conventionally purchased B-20. The independent, fiscal records from the private company will help us determine the long-range potential of bio-fuel production along NC roadsides.

Other Comments:**Approval (Division official or Unit Head)**

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217

FAX: (919) 715-0137

1549 Mail Service Center, Raleigh, NC 27699-1549

Phone: (919) 508-1790, email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Derek Smith

DATE: June 29, 2011

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Improving Brush Control Practices.

Background:

Since January 2010, NCDOT has spent \$46.7 million dollars performing rights of way brush control to improve lines of sight, allow sunlight to reach paved surfaces to aide in snow and ice removal, maintain infrastructure health and improve general safety. In many cases, the long-term impact of these operations could have been sustained with improved brush control practices. Initially, stumps were not treated following tree felling. Subsequently, the resulting stump regrowth (coppice or suckers) consisting of multiple weak stems were not treated. Coppice stems are characteristically curved at the base. This curve occurs as the competing stems grow out from the stump and upward. In subsequent growth years, many new shoots will emerge, and the value of the initial brush control operation will be lost.

What is the Specific Problem or Issue?

After a tree felling, the resulting tree stump is usually a remnant of the initial trunk with an intact root system that is capable of regenerating into a new tree. Often, a deciduous tree that has been cut will re-sprout in multiple places around the edge of the stump or from the roots. Stump sprouts can grow very quickly and sometimes become viable trees themselves due to the existing root structure. The cut portion of the trunk may weaken the sprouts and introduce disease into the coppice.

List Research Objectives and Tasks:

Provide a uniform set of objectives and goals for brush management that include stump treatments, plant growth product recommendations, and dormant stem applications. Consideration should be given to tree species (pine or hardwood), seasonality of operation, equipment (chain saw, equipment with power head, side-arm mower, or herbicide application) utilized during the removal operation and follow-up treatment recommendations.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

The creation of a document outlining NCDOT's preferred operations perspective.

How Will You or Others Use the Product[s]?

The manual will be used for training purposes, to unify the Department's objectives concerning brush management and offer real time solutions for brush management. These recommendations will be used to facilitate the installation of Clear Zone Improvement Program (C-ZIP) sites statewide. The C-ZIP program initiative establishes low-growing, low-maintenance colorful tree and native plant sites to improve roadside aesthetics.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The manual will be used by several Division departments: Roadside, Maintenance (County and Districts), and Bridge Maintenance to improve program delivery, infrastructure health and fiscal accountability.

Other Comments:

Approval (Division official or Unit Head)

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217

1549 Mail Service Center, Raleigh, NC 27699-1549

FAX: (919) 715-0137

Phone: (919) 508-1790, email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Derek Smith**DATE:** July 22, 2011**Branch / Unit:** Roadside Environmental Unit**TITLE of your Research Idea:** Asset Management Aided Through Vegetation Management**Background:**

New vegetation management products have been released over the last few years that can potentially improve program proficiency, reduce rights of way vegetation management costs, and improve infrastructure health. These products have been examined through peer reviewed research and have been released for label-specific utilization by the EPA. The next logical step is to evaluate these products for inclusion in the Department's vegetation management program.

What is the Specific Problem or Issue?

With minor alterations, our current vegetation management treatments have remained virtually unchanged since 1998. In light of potential NPDES restrictions that will affect rights of way management, an urgent need exists to evaluate our current treatments and determine if program alterations are warranted.

List Research Objectives and Tasks:

To evaluate the effectiveness of our current treatments, control plots will be installed statewide on routes treated by NCDOT to evaluate changes over time in vegetation as a result of environmental conditions, mowing, and treatment applications. To determine those economic components that ultimately influence 'units accomplished', a comparison between Division programs shall be conducted and cost effectiveness rankings shall be assigned to the Divisions. In addition, product treatments shall be raked according to off-target damage potential.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

A guidance document shall be written that provides regional specifications for various vegetation management programs including turf management, aquatic vegetation and brush control. A comprehensive economic analysis of treatments shall be included.

How Will You or Others Use the Product[s]?

The guidance document will be used for training purposes and as prescriptive recommendations to manage turf, noxious/exotic/invasive plant species, brush, and aquatic plants. The document will be used to demonstrate NCDOT's compliance with NPDES regulations and other federal mandates as necessary.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Based upon published research, the guidance document will provide specific vegetation management recommendations that support NCDOT's commitment to the Integrated Roadside Vegetation Management philosophy developed by the National Roadside Vegetation Management Association. Development of the guidance document will represent a proactive approach to securing independent program review, support of product selections and third-party documentation of results.

Other Comments:**Approval (Division official or Unit Head)**-----
Print Name-----
Signature-----
State Roadside Environmental Engineer-----
Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS

Your Name: Derek Smith

DATE: June 29, 2011

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Zoysiagrass along NC roadsides

Background:

During the mid 1980's, researchers at NC State University determined that bermudagrass sod could be successfully transplanted during the non-traditional installation time of September through March. Researchers assessed the impact of installation timing, and chemical and cultural treatments on the survival of two varieties of bermudagrass sod. Despite exposure to record low temperatures (-8 degrees Fahrenheit, January 1985), all sod survived dormant transplanting. As a result of this research, transplanting dormant bermudagrass sod is now considered an industry standard practice. Similar research has not been conducted on zoysiagrass sod – a similar warm-season turf. Zoysiagrass is an ideal highway turf because it requires infrequent mowing, reduced fertilization, and is drought tolerant and cold-hardy.

What is the Specific Problem or Issue?

Traditionally, zoysia sod is harvested and transplanted between April and August. During this time, climatic conditions such as increased humidity and temperature as well as rainfall deficits can negatively impact the sod. Until the sod has recovered from transplant shock and regenerated a new root system, supplemental irrigation is required to offset the negative impacts of these climatic conditions. Transplanting dormant zoysia would virtually eliminate the need for supplemental irrigation and thus save a considerable expense to the Department. As well as, expand the potential installation period by seven (7) months.

During April through June 2011, Meyer Zoysia sod was transplanted beside guardrail in Division 11. Approximately 1.6 million gallons of supplemental irrigation was used to establish approximately 80 miles of sod.

List Research Objectives and Task:

Two varieties of zoysia sod (Meyer and Emerald) should be transplanted between September and March to determine the survival of dormant sod along our rights of way. Replicated installation experiments in Buncombe, Wilkes, Iredell and Guilford Counties should be conducted to evaluate regional climatic conditions. As a supplemental component to this work, two, improved cultivars of zoysiagrass: 'Zenith', and 'Compadre' are readily available as seed and should be sown monthly and evaluated in replicated plots beside the zoysia sod. Zoysia seed has been available commercially for a number of years but until recently it has been cost prohibitive.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Zoysia would add a new dimension to our turfgrass management program. Once established, zoysia develops above ground stems (stolons) and below ground stems (rhizomes) that allow this grass to spread into areas where it was not initially installed. Additional characteristics of zoysiagrass include: recover from damage caused by errant vehicles, disease, and insects.

How Will You or Others Use the Product[s]?

The results of this research will allow us to evaluate the incorporation of zoysia in to our vegetation management program. If determined to be seedable between September and April, this would allow us the flexibility to add a warm-season turfgrass to our special provisions for turfgrass establishment in western NC.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Approximately one-third (1/3) of our rights of way could be established in zoysiagrass. Reductions in routine management (mowing, and fertilization) will save enough money to offset the initial installation costs. Once established, worker exposure to perform manual cutting under rails could be virtually eliminated. Zoysiagrass could be added to our list of turf species used for statewide erosion control.

Other Comments:

Approval (Division official or Unit Head)

Don Lee

Print Name

Signature

State Roadside Environmental Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Morgan Weatherford**DATE:** 8/8/2011**Branch / Unit:** PDEA/Natural Environment Unit**TITLE of your Research Idea:** Improvements to NCDOT's Wetland Prediction Model**Background:**

NCDOT began researching/implementing a Lidar based wetland/stream prediction model to supplant the majority of field-based wetland delineations as part of a major streamlining initiative during the NEPA process. The model utilizes digital elevation models and subsequent terrain derivatives originated from bare-earth Lidar data. SAS software is used for data exploration, analysis and model development. The models are then run and layers are created and analyzed in ArcGIS.

What is the Specific Problem or Issue?

While NCDOT has made significant advances with the concept, the process and tools of predicting wetlands using Lidar is under-developed. Additional research needs to be undertaken to improve the reliability and performance of the model across the various wetland types within the state. Further, procedures to identify wetland type and characteristics as part of NCDOT's modeling efforts do not exist but would be highly valuable information to obtain.

List Research Objectives and Tasks:

Improve reliability/automate/establish appropriate procedures for mapping riparian areas with remote sensing technology.
 Identify type of wetland (using NC WAM wetland types) of predicted wetlands using remote sensing technology.
 Characterize/develop high-level functional assessment (using NC WAM) of predicted wetlands using remote sensing technology.
 Develop models to predict tidal/marsh wetlands on a regional scale.
 Additional objectives can be determined/refined as needed.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Statistical relationships and models and any procedures to incorporate the conclusions into NCDOT's current modeling efforts.

How Will You or Others Use the Product[s]?

The products will ultimately be used to help make more informed decisions during the NEPA process with regards to avoiding and minimizing natural resource impacts.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The current benefits of NCDOT's wetland models are significant cost and time savings during the planning phase of road projects with regards to natural resource impacts. It is anticipated at some point, NCDOT's regulatory agencies will expect the models to improve so that the models can provide additional information than what is currently produced. This will lead to more informed decisions and a higher confidence in NCDOT's modeling efforts.

Other Comments:

Many ideas and concepts have emerged as a result of NCDOT's modeling program however, due to constraints of time and resources, these ideas have yet to be developed.

Approval (Division official or Unit Head)

Phil Harris

 Print Name

 Signature

Unit Head – Natural Environment

 Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research
 104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549

FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Richard Mullinax, PE, PTOE, CPM DATE: 10 August 2011
Branch / Unit: Rail Division / Engineering and Safety Branch

TITLE of your Research Idea: Out-of-Pavement Vehicle Detection for Four-Quadrant Gated Highway-Rail Crossings

Background:

Since the mid-1990s on the designated high speed rail corridor between Raleigh and Charlotte, NCDOT's Rail Division has incrementally implemented its "Sealed Corridor Initiative." This initiative has made significant strides in providing safety enhancements through the use of four-quadrant gated highway-rail crossing systems which employ exit gates along a vehicular approach in conjunction with the more traditional two quadrant gated systems. Current design parameters adopted by the Rail Division for four-quadrant gated highway-rail crossing systems require that descent of an exit gate to be delayed from descent of the entry gate in order to decrease the potential of vehicles becoming trapped between the gates. However, these design parameters may not fully utilize all the safety potential of these vital traffic control warning devices as vehicle operators may still attempt to circumvent and violate the devices.

The proposed research project will evaluate the use of out-of-pavement vehicle detection systems for dynamic exit gate clearance timing at four-quadrant gated highway-rail crossings in North Carolina. Such vehicle detection systems currently utilize various technologies with some requiring in-pavement detection devices. However, an out-of-pavement detection method is preferred over in-pavement detection due to improved ease of addressing disruptions and replacement of system components in the event of crossing rehabilitation, construction, or maintenance. Out-of-pavement vehicle detection systems should further decrease exposure to traffic, both rail and vehicular, for personnel repairing and maintaining the system.

What is the Specific Problem or Issue?

Highway-rail at-grade crossings present significant safety risks for freight and passenger train operations as well as the development of high-speed and intercity passenger rail corridors and thus are a major issue for North Carolina which averages about one crossing per rail mile. Though four-quadrant gated highway-rail crossings provide enhanced safety by significantly reducing the probability of vehicles running around crossing gates, there is a potential for vehicles to become trapped between the entry gate and the exit gate at these crossings despite the delay in the exit gate descent. A vehicle detection system will detect vehicles traversing the crossing in order to further delay or reverse the descent of exit gates thus creating exit paths for vehicles that may otherwise be trapped on the crossing.

Successful deployment of a vehicle detection system at four-quadrant gated highway-rail crossings should also provide for improved operation of the entry and exit gates by allowing for the simultaneous descent of both gates unless a vehicle is detected on the crossing in which case the exit gate descent would be delayed. By descending the entry and exit gates simultaneously, a vehicle operator is less like to violate highway-rail crossing warning devices due to the appearance of a decreased probability of successfully traversing the crossing along with the psychological impact of an increased awareness of the approach of a train and its related hazards.

List Research Objectives and Tasks:

Tasks and objectives associated with the proposed research project are primarily associated with establishing recommendations and justifications for use of vehicle detection systems at four-quadrant gated highway-rail crossings. Major milestone tasks with objectives are:

- 1) Research and investigate availability and cost of different out-of-pavement vehicle detection systems for potential use at four-quadrant gated highway-rail crossings.
- 2) In conjunction with Rail Division personnel, select a final out-of-pavement detection system for field installation and evaluation.
- 3) In conjunction with Rail Division and Rail Agency personnel, coordinate implementation of recommended out-of-pavement detection system at one or more highway-rail grade crossings.
- 4) Evaluate operational effectiveness and efficiencies, impact on safety, and durability of chosen technology.
- 5) Prepare a final report which documents all aspects of the research with recommended criteria for future use of vehicle detection systems at four-quadrant gated highway-rail crossings in North Carolina including a cost – benefit analysis for justification of recommendations

What Would be the Product[s] of the Research?

The final product will be a recommended practice for adoption by the Rail Division for use of vehicle detection systems at four-quadrant gated highway-rail crossings in North Carolina. Note that deliverables, as outline in the tasks and objectives section of this research proposal, will provide justification for the practice.

How Will You or Others Use the Product[s]?

The final product will potentially have a major impact on Rail Divisions design parameters and requirements for four-quadrant gated highway-rail crossing warning devices and will be used to justify expenditures and document benefits associated with their use to customers not only in the NCDOT, but also external customers such as railroad agencies, Federal agencies, rail transportation network supporters, and politicians.

How Will the Product Benefit the Department?

The successful evaluation of an out-of-pavement vehicle-detection system will improve safety which will enable increased train speeds that promote safety, efficiency, and utilization of freight and passenger rail transportation to enhance environmental and economic benefits vital for the growth of commerce and prosperity throughout North Carolina for all citizens.

Other Comments:

Because the NCDOT does not own the track infrastructure where the deployment of out-of-pavement vehicle detection devices will be installed, the proposed research project may be long term in nature and require several sessions with others outside of NCDOT to solicit support of the system. It should be noted that though the NCDOT does not own the track infrastructure, statutory requirements associated with safety responsibilities at highway-rail grade crossings place the responsibility primarily with the highway agency. *FHWA has provided funding for the demonstration design, materials, and construction. Tasks included in this project should include data collection, report development, research, reporting, etc.*

Approval (Division official or Unit Head)

Paul Worley

Print Name

Signature

Director – Rail Division Engineering & Safety Branch

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Majed Al-Ghandour, Ph.D., P.E.**DATE:** 8/8/2011**Branch / Unit:** Program Development Branch**TITLE of your Research Idea:** Practices to Improve Visualization of Transportation Projects: Access Management**Background:**

Visualization of transportation projects has been shown to be a very effective way of communicating information between interested project parties, citizens, policy makers, and stakeholders. Visualization has been used largely for communicating information on the preliminary geometric design, or as photorealistic representations that place transportation projects within their existing or envisioned built or natural context. Visualizing assesses the project before implementation or constructing the project, for example, how roadway, toll, and bridge will look and options (i.e. see it before built it). NCHRP Synthesis 361 (2006), Visualization for Project Development, summarizes the growth of visualization in transportation as well as outlining related issues and research needs. With access management concepts it provides safety, mobility for users (vehicles, bicycles, pedestrians), TRB Access Management Manual.

What is the Specific Problem or Issue?

Visualizing supports developers, engineers, and planners to enable focus on accessibility to help users (vehicles, bicycles, pedestrians) gain access to their destination at a low cost per trip in terms of operational and safety. There is a lack of visualization of accessibility tools for project (access and mobility) are found. This may increase the project costs after built if there are misunderstandings in project scope. For example, no practical method has emerged to include accessibility visualization outcomes within the project alternatives or corridor selection process and to estimate the values of mobility and access for the projects.

List Research Objectives and Tasks:

- Review current literature relevant to project visualization of access management, best practices, and quality tools.
- Evaluate current standards and determine measurement of accessibility analysis.
- Communicate the methods of Access Management "The systematic control of the location, space, design, and operation of driveways and street connections, medians, median openings, turn lanes, traffic signals, interchange, and roundabout".
- Develop a conceptual framework, methodology, and tools for estimating accessibility of a highway projects.
- Investigate visualization as a tool for in terms of accessibility and ease of use for the advice seeker (access management).
- Provide new knowledge on which NCDOT engineers and practitioners can base their decisions, incorporate, and better utilize these tools for their business process.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

- Visualization tools and innovative practices.
- Real-time interactive models.
- Graphs, tools, manuals, and guidelines.
- Document analysis and report recommendations.

How Will You or Others Use the Product[s]?

- Engineers will use tools for producing, manipulating, and presenting accessibility within their projects.
- Visualization's getting more engaging and interactive for the public.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

- Bring the organization to state-of-the art standard of visualization in transportation and access management.
- Improve the practice of visualization of accessibility (access and mobility) to enhance congestion relief, improved safety, and reduced vehicle operating costs and emissions for the project.
- Increase the strategic assessment of visualization.
- Visualization tools and technologies allowed local travelers to understanding a major alternative route that will be upcoming for specific projects in addition to measuring accessibility.
- Visualization will be more attractive, detailed, and accurate for decisions to make projects look more selective and desirable.

Other Comments:**Approval (Division official or Unit Head)**

Calvin Leggett, P.E.

Print Name

Signature

Branch Manager

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS

Your Name: Majed Al-Ghandour, Ph.D., P.E.

DATE: 8/8/2011

Branch / Unit: Program Development Branch

TITLE of your Research Idea: Determining of Best Practices to Improve on Time on Budget Delivery Highway Projects

Background:

The Project Management Unit (PMU) under the Program Development Branch of the North Carolina Department of Transportation (NCDOT) is responsible for authorization of funds for various State Transportation Improvement program (STIP) projects encompassing preliminary engineering (PE), right-of-way acquisition (ROW), utility relocation, construction (CON), mitigation, and landscape development. Successful delivery of STIP projects requires comprehensive application of a broad set of program and project management business processes and tools. The Schedule Management Office (SMO) under the Technical Services Division is responsible for project scheduling not limited to setting up the networks, schedule plans and implement scheduling process. The Project STaRS is the current enterprise application tool and is used for the NCDOT to implement both financial and scheduling Managements for STIP projects (SAP/R3).

What is the Specific Problem or Issue?

The Transportation program has significant problems with scope growth, cost increases, and time design delays after a project is programmed in a STIP. For example, the problem may be due to improve the final project performance during the design phase. Some delays are related to relocating interfering utilities during construction can leads to lengthy schedule delays. Other challenges since the STIP is fiscally constrained, a cost overrun (overdraft) on one project translates into a reduction in funds allocated to another project within the STIP. Others establishing baselines for a project's scope, budget, and schedule create milestones that can be compared against future performance; a project cannot be managed in terms of scope, cost, and time if there is a change on the baseline. NCDOT staff change the schedule and networks, pre-let, and there is a lack of effects on the funding components.

List Research Objectives and Tasks:

- Review current literature relevant to project delivery based on financial and scheduling managements, best practices, and quality tools.
Evaluate current standards and determine on budget and on time analysis including the current network streamlining and integration with the costs.
Communicate and improve the method of scheduling (time) and financial (cost) integration.
Develop a conceptual framework, methodology, and tools for estimating cost and time of highway projects before PE set.
Improve a tool, what if scenarios, for a project in terms of time and cost ease of use for the advice seeker (project management).
Integrate scheduling changes with the funding components.
Develop the best practices for implementing an early project definition process for projects.
Improve when a baseline scope, cost, and schedule should be finalized for cost management of a project.
Determine the best practice what is the appropriate percent completion of engineering/design prior to programming a project in the STIP (including environmental clearance)?
Provide new knowledge on which NCDOT engineers and practitioners can base their decisions and incorporate better utilize these tools for delivery project on time and on budget.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

- Tools, models, and innovative practices.
Real-time interactive models.
Graphs, tools, manuals, and guidelines.
Document analysis and report recommendations.

How Will You or Others Use the Product[s]?

- Engineers will use supportive tools for producing, manipulating, and presenting for delivery project on time and on budget to the Project STaRS.
Time and Cost managements are getting more engaging and interactive for the policy makers, and stakeholders (MPO, RPO, etc.)
Staff will be able to send the scheduling changes after identify the funding components impact.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

- Bring the organization to state-of-the art standard of project delivery and time and cost managements.
Improve the practice of funding and scheduling of STIP to enhance reduce delays and cost of projects.
Increase the strategic assessment of Project STaRS.
Deliver project to public on time on budget as programmed in STIP.

Approval (Division official or Unit Head)

Calvin Leggett, P.E.

Branch Manager

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Randi Taylor

DATE: 8/10/11

Branch / Unit: Facilities Design

TITLE of your Research Idea: Camera Applications for Construction Management

Background:

Facilities Design covers the whole state with two Architects – this entails a great deal of driving, to cover construction administration. At this time, I have an advanced Verizon Android tablet/phone device, large but pocket size, that has the capacity to not only be an advanced jobsite tool, which is how I use it (video, phone, scan and email documents, sync calendar and email, navigate, take notes, etc.), but to be a complete construction administration tool, with a compilation of and writing of open market applications, and with coordination with BSIP/SAP. I, and most of the staff Engineers that are my clients and field assistance, have these pocket devices now, and Verizon service is all over the state...I would like to tie this together now into a jobsite/remote jobsite tool that we can all share.

What is the Specific Problem or Issue?

To create a "virtual" jobsite and construction management "tool", using available technology which our staff already have, to allow us to extend our personnel "reach" with a small staff, and to allow interactivity and conferencing from sites.

List Research Objectives and Tasks:

Objective – to compile and write the open market Android applications, and to work with BSIP to write the coordinating SAP function(s)

Tasks: Use a "focus group" of at least three staff Engineers to input ideas/needs from DOH, Ferry, and Rest Area Sections, write/compile the applications, and work with BSIP, who will write the SAP function(s), and train us in how to use them.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

A program of free Apps, with instructions, SAP function(s), and training on how to use this tool.

How Will You or Others Use the Product[s]?

To maximize our efficiency in the field

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
Greatly increase operational efficiency, enhance safety (less car travel); greater quality assurance (can access more "experts" in the field than cost would allow, and there would be a video record of the site visits). This tool will also allow a disabled veteran to participate in field inspections, since it will be able to be done remotely...this will allow for retooling and veterans preference hiring where it could not take place before.

Other Comments:

I originally was going to develop this project with a proprietary camera device, but now that there is a strong Verizon network, and most of our field staff have the devices in their pockets already, I decided to develop it with this already acquired technology instead.

Approval (Division official or Unit Head)

Priscilla Williams

Print Name

Signature

Plant Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Dan Thomas**DATE:** 8/29/2011**Branch / Unit:** Transportation Planning**TITLE of your Research Idea:** Trip Making Patterns of NC's University Students**Background:**

NC has a rich history of educational opportunities for students at the university level. The travel patterns of these students affect the roadways, the transit systems, the parking lots and weigh heavily on the system that surrounds the universities. Often the true travel patterns cannot be identified for implementation in travel demand models because university specific datasets are not in place. Since travel models require a lot of data, money is not typically allocated for "special markets" such as students so this would provide a valuable resource in the North Carolina.

What is the Specific Problem or Issue?

Travel models and long range planning efforts need to be informed by the activities of students in many of the regions. We do not have enough data to identify travel patterns of students, particularly parking location choices, transit paths typical lengths of student trips and trip purposes. We need to understand the differences of student patterns to the normal household trip making and inform our decision making tools with this information.

List Research Objectives and Tasks:

Collect trip patterns from students on campuses throughout NC.

Develop a travel survey that could be used on the web.

Development of a smart phone application to make entering and tracking of this information convenient for students.

Analyze the collected data to develop trip rates by purpose and mode for students in NC. Analyze differences of patterns by size of university, demographics and other distinguishing characteristics.

Develop a test destination and mode choice model framework using the data from the survey.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

The product of the research would be a set of trip generation rates that could be used for travel models. Additionally, the development of a smart phone software specific to university data collection would be included and a cleaned dataset that could be used by NCDOT and MPOs in NC. An additional product would be a test case for a local university to assure the data was able to accurately predict travel patterns

How Will You or Others Use the Product[s]?

We would use the data to develop a prototype model for use in one of the urban models. Additionally, the data could be used to supplement the Statewide model in later phases to improve the student purpose of the model. MPOs would use the data to fine tune the current MPO models and potentially expand the survey in their region if not enough samples were initially collected in their region.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

This would provide datasets to improve long range planning efforts in the transportation planning branch. It would also allow for more decision making data for specific projects that fell within/near universities in the state and would provide the Department with additional support data for these decisions. For New Starts projects in the state, such as the Triangle and Charlotte rail systems, this dataset will help increase the user benefits associated with the systems they are predicting forecasts for. Student ridership has proved valuable in other new starts projects across the country but most of them do not have region specific datasets-something NC would then be able to have and boast.

Approval (Division official or Unit Head)

Mike Bruff

Print Name

Signature

Transportation Plng Manager

Title

PAVEMENT AND MAINTENANCE RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Elizabeth Pope

DATE: 5 JUL 11

Branch / Unit: Location and Surveys

TITLE of your Research Idea: Mobile Roads

Background:

I was thinking about the difference between railroads and normal roads and how the systems have evolved so differently. Then I started thinking about what kind of benefits could be achieved by creating a rail-like system for tractor-trailers and passenger vehicles.

What is the Specific Problem or Issue?

Sometimes it is necessary to create a short-term detour around a construction site. This design creates a reusable detour that allows traffic to be directed away from the construction area.
 At the coast, constantly moving sand creates covered roadways and unstable alignment conditions. This design creates a raised roadway. It also creates opportunities to make adjustments in the alignment on an as-needed basis.
 If a section of the roadway becomes damaged, the concrete slab is easily replaced with another.

List Research Objectives and Tasks:

How much money can be saved on detours by using this design?
 What is the life expectancy of roadways with this design?
 What are the best methods of construction and relocation?
 What additional safety measures need to be included?
 What policy changes would need to be instituted in order to make this a viable public option?

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")
 The product is a mobile road for detours and for situations when an alignment needs to be flexible.

How Will You or Others Use the Product[s]?

The mobile road can be used in place of conventional road building techniques.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
 This project has the potential to decrease construction costs and remove traffic from work zones. The design is environmentally friendly because it is reusable. It also creates an additional potential solution for unique situations. Theoretically, it will only take a fraction of the time to construct compared to a traditional roadway.

Other Comments:

Approval (Division official or Unit Head)

Charles Brown

Print Name

Signature

State Location & Surveys Engineer

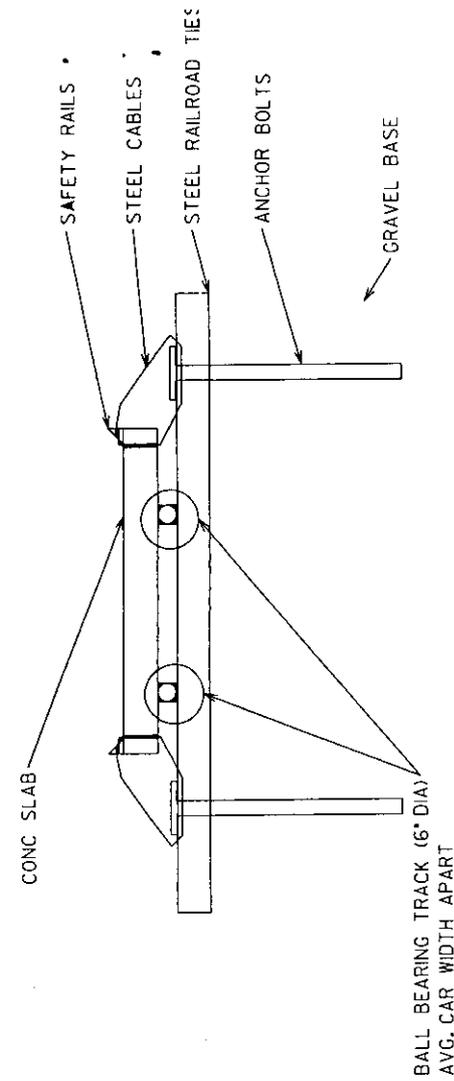
Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

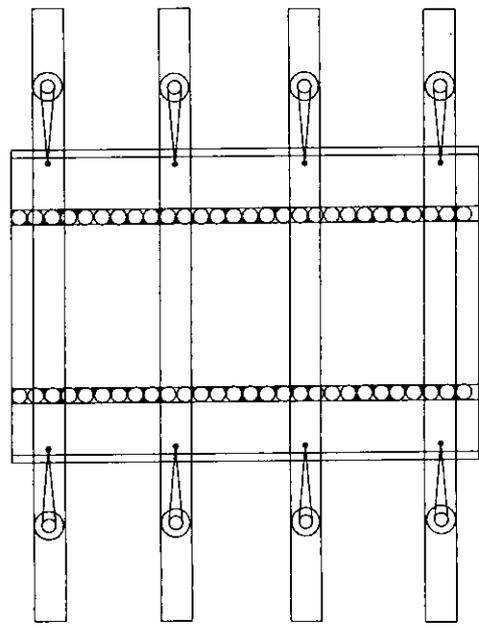
104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549

FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NOTES:
 1. SLAB IS REINFORCED WITH STEEL REBAR
 2. EACH SLAB WILL BE DESIGNED FOR ONE LANE OF TRAFFIC, WITH TRACTOR TRAILORS AND HEAVY VEHICLES HAVING THEIR OWN LANE
 3. IF THERE IS TO BE MORE THAN ONE LANE SIDE BY SIDE, THE TIES NEED TO BE PLACED ELSEWHERE.
 4. AT SUCH TIME THAT THE ROAD NEEDS TO BE MOVED, THE TIES CAN BE TAKEN OFF, THE SLAB ROLLED ON THE TRACKS, AND THEN THE RR TIES, ANCHOR BOLTS AND TRACK CAN BE LIFTED AND SHIFTED TO NEW POSITIONS. IT WOULD BE COOL IF THE GRAVEL COULD BE REUSED.



BALL BEARING TRACK (6" DIA)
 AVG. CAR WIDTH APART



•NOT DRAWN TO SCALE

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Judith Corley-Lay**DATE:** August 8, 2011**Branch / Unit:** Asset Management/Pavement Management Unit**TITLE of your Research Idea:** Seasonal changes in Pavement Friction in NC**Background:**

NCDOT has had a program of pavement friction measurement for more than 15 years. Primary routes are tested every other year, with the schedule of testing set by the local data collection technician. It is believed that skid resistance tends to increase in winter and decrease in summer and further that the winter recovery is not sufficient to balance out the friction loss of summer. If this change in friction is true, it may be necessary to set a different treatment threshold for summer and winter testing. Our current practice is to notify the division of test results with a friction number of 37 or less. This problem statement addresses our core goals in the area of infrastructure safety.

What is the Specific Problem or Issue?

Is our current reporting threshold of 37 appropriate for both winter and summer testing and for all areas of NC? Is there a significant loss of friction in the summer that is not regained in the winter?

List Research Objectives and Tasks:

The research objectives are to develop seasonal guidelines for levels at which inadequate pavement friction should be reported to the divisions. While some specially focused testing can be done for the project, the researchers should use the existing data inasmuch as possible. Specific tasks:

1. Literature search regarding seasonal changes in pavement friction and threshold values. Practices from other agencies, including those overseas.
2. Evaluate existing data in the PMS to determine whether data is sufficient to reach objectives. If not, develop a testing plan to augment the existing data.
3. Implement the testing plan and use existing data to determine if friction measurements are significantly different seasonally and in all regions of NC.
4. Develop guidelines for recommending action to the division in the event of "below threshold" friction numbers.
5. Prepare final report outlining all findings and methods.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

This research will either affirm that our current approach to pavement friction is adequate or develop new guidelines for interpreting friction data.

How Will You or Others Use the Product[s]?

The product will be used both by Pavement Management and by Division personnel to determine whether a tested pavement must be treated or whether road signs are needed to warn citizens of "slippery pavement."

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

This project will enhance our safety program.

Other Comments:**Approval (Division official or Unit Head)**

Judith Corley-Lay

Print Name

Signature

State Pavement Management Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Judith Corley-Lay**DATE:** 8/10/2011**Branch / Unit:** Asset Management/Pavement Management Unit**TITLE of your Research Idea:** Inclusion of Maintenance in Life Cycle Costs of Flexible and Rigid Pavements**Background:**

Life Cycle Cost Analysis is a critical element in pavement type selection to assure that both initial construction costs and long term costs are considered in the selection process. NCDOT has historically not included maintenance costs in LCCA. A recent NCHRP project produced a "Guide for Pavement-Type Selection" (Hallin, et al, March 2011) that also did not include maintenance costs. The rationale of the research team was that these costs are not very high and are not substantially different between pavement types (p II-21). This statement was made without reference or support. In NC, these costs have not been included because we lacked a mechanism to collect them. Now with our MMS and SAP systems it may be possible to quantify the costs in a general sense (not mile by mile, but over broad areas) and determine if in fact the costs are small and approximately equal for flexible and rigid pavements. This information would be used to improve our pavement type selection process, impacting infrastructure health and use of limited budgets.

What is the Specific Problem or Issue?

Are maintenance costs for pavement so small that they need not be included in LCCA? Are they small throughout the pavement life? Are they approximately equal for rigid and flexible pavements?

List Research Objectives and Tasks:

The goal of this research project is to determine if and when maintenance costs should be included in the LCCA process in pavement type selection. Specific tasks:

1. Literature review and current state practice focusing on the maintenance cost consideration by agencies both in the US and abroad.
2. Evaluation of available data and develop method of synthesizing information.
3. Is sufficient data available to address the issue? If no, then what data is needed? If yes, continue.
4. Develop typical maintenance "stream" and costs for roads by road system (interstate and primary only) and for flexible and rigid pavements when appropriate.
5. For systems with both flexible and rigid pavements, determine whether maintenance costs are equal over the life cycle.
6. Develop guidelines and recommendations to improve NCDOT's LCCA with regard to maintenance.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Recommendations for inclusion (or not) of maintenance costs including timing. Quantification and statistical analysis of whether maintenance costs are equal for rigid and flexible pavements. Guidelines for this component of LCCA.

How Will You or Others Use the Product[s]?

This product may result in changes to our current LCCA process, which is used in the design and pavement type selection process for TIP projects.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The guidelines from this project could result in reduced life cycle costs and will result in more informed use of (and confidence in) our pavement type selection process. This has long term economic benefit.

Approval (Division official or Unit Head)

Judith Corley-Lay

Print Name

Signature

State Pavement Management Eng.

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS

Your Name: Clark S. Morrison, Nilesh Surti, Todd Whittington **DATE:** 8/15/2011

Branch / Unit: Pavement Management Unit, Construction Unit, Materials & Tests Unit

TITLE of your Research Idea: Surface Layer Bond Stresses and Strength

Background:

Investigation of several projects that have experienced premature cracking has indicated that debonding of the top surface layer has been involved. Both new construction and resurfacing projects have experienced this issue. Examples include I-795 in Wayne County and US 64 in Martin County. Although it is not clear whether the cracking or the debonding occurs first, the debonding is involved and contributes to the distress and failure. A better understanding of the strength of the bond between the top surface layer and the underlying asphalt, along with a better understanding of the stresses that act along the bonded interface is needed to prevent this distress from occurring in the future.

What is the Specific Problem or Issue?

Debonding of the top surface layer in asphalt pavements is contributing to premature distresses in asphalt pavement.

List Research Objectives and Tasks:

Determine what stresses typically act on the interface between the top surface layer and the underlying asphalt.
 Determine a method or test to measure the strength of the bond at this interface that preferably can be used in the field during construction.
 Determine optimum Tack Coat Application rate(s) for different conditions of underlying layers.
 Determine interface bond strength for various Tack Coat materials, including, but not limited to: Rapid-Set, Medium-Set, & Slow-set emulsions, liquid asphalt binder (PG64-22), and the so-called "trackless" or "non-tracking" emulsions. (the materials used should be ones that are readily available to the North Carolina market).
 Determine what other factors influence the bond strength: method of surface preparation (milled vs. non-milled surfaces), application process, placement temperature requirements, type of pavement marking left in place, etc.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

1. A method to determine stresses acting on the interface between the top surface layer and underlying asphalt.
2. A field test or method to measure the strength of the bond at the interface. (consideration should be given to cost-effectiveness, ease of use, and whether the method uses commercially-available equipment).
3. Recommendations on tack coat materials to be used (consideration should be given to cost-effectiveness and ease of use – including storage and application).
4. Identification of measures (that may include both design elements and revised construction procedures) to ensure the strength of the bond is adequate to prevent premature distresses.
5. Recommended tack coat application rates for certain conditions (such as oxidized pavements or new base layer).

How Will You or Others Use the Product[s]?

The research will be used to provide pavement design elements, and construction procedures or guidelines that will reduce the likelihood of debonding of the top surface layer in an asphalt pavement.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The design elements and revised construction procedures identified will reduce premature distresses, leading to savings in pavement maintenance and rehabilitation costs.

Other Comments:**Approval (Division official or Unit Head)**

Judith Corley-Lay

Print Name:

Signature

State Pavement Management Engineer

Title

Your Name: Neil Mastin, P.E.

DATE: 8/18/2011

Branch / Unit: Asset Management / Pavement Management Unit

TITLE of your Research Idea:

Development of IRI Limits and Targets for Network Management and Construction Approval Purposes

Background:

The Pavement Management Unit uses high speed inertial profilers to collect IRI (International Roughness Index) information on over 15,000 miles of primary highways for use in reporting to the Federal HPMS and for tracking and understanding the performance of our highway network. The NCDOT Construction Unit is also looking to implement IRI as an approval mechanism for new and rehabilitated roadways in North Carolina. Ride quality has consistently been ranked of the most important indicators of public satisfaction or discontent with the highway network. We have targets for network performance in our department goals, but are those valid targets?

What is the Specific Problem or Issue?

From the network perspective, the Pavement Management Unit would like to gain a better understanding of appropriate limits for classifying IRI performance. Is 145 inches/mile an appropriate indicator of poor performance or should the cutoff be 175? Is 80 acceptable for "good" performance or 60? **This is all with an eye towards perceived ride quality from a public perspective.** A combination of data analysis and the use of public surveys will likely be required. In addition, these IRI values need to be converted to an index that can be used in the Pavement Management System (PMS).

Tying construction and network performance together, it is often said that smooth pavements stay smooth and rough pavements rough over the life of the pavement. It would be interesting to explore the veracity of the statement and to understand the rates of changes of IRI based on initial IRI values while accounting for traffic levels and other variables.

This is essentially a local calibration project.

List Research Objectives and Tasks:

1. Develop a North Carolina specific correlation between IRI values and perceived ride quality. What variables influence this perception? Speed Limit? Class of road? General roughness vs. event roughness (bumps)? Etc.
2. Develop an index from 0-100 for use in the PMS based on study results.
3. Look at appropriate targets for departmental goals when it comes to ride quality. What values should we be shooting for? What satisfies public needs? Are we being too aggressive or not aggressive enough? This entails looking at both the value of IRI goals and the extent/percentage requirements for each level of service.
4. Look at the connection between new construction IRI and network performance IRI by evaluating the impact of initial smoothness (be it new construction or resurfacing) on long term smoothness.

What Would be the Product[s] of the Research?

1. Appropriate and updated IRI targets for use in PMS analysis and reporting
2. Appropriate and updated IRI indices for use in PMS analysis
3. Appropriate targets for network-wide ride quality for use in the agency's Network Health reporting and project development process.

How Will You or Others Use the Product[s]?

PMU would make extensive use of IRI information for analysis and reporting purposes. NCDOT as a whole would have appropriate goals and targets.

How Will the Product Benefit the Department?

1. Departmental goals will be better targeted. This could result in cost savings if funding is applied where need is greater. It may also help to target activities so that lower volume or classes of roads need less aggressive treatment. (Long term benefit)
2. Improved analyses generated by the PMS will provide better planning information and produce better project selection (Short and long term benefit)
3. Over time, a greater percentage of roads perceived as smooth is a main goal. Understanding what those goals should be and how to reach them is a big first step. (Long term).

Approval (Division official or Unit Head)

Judith Corley-Lay, Ph.D., P.E.

Print Name

Signature

State Pavement Management Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Judith Corley-Lay**DATE:** August 17, 2011**Branch / Unit:** Asset Management/ Pavement Management Unit**TITLE of your Research Idea:** Visual guide to identifying and treating oxidation just prior to cracking.**Background:**

Oxidation dries the surface of hot mixed asphalt pavements and over time will induce cracking. Once the cracking occurs and widens it is difficult to treat. Our current pavement condition survey limits oxidation to essentially a Yes/No, even though the process may take several years and gradually change the surface color from black to almost white.

What is the Specific Problem or Issue?

Can the color change commonly observed during oxidation be used to determine the point at which a rejuvenator or fog seal or surface seal must be placed so that cracking does not initiate? Would a different color scale apply for each of the three major regions: coastal, piedmont and mountains?

List Research Objectives and Tasks:

The objective of this research is to develop a "gray-scale" guide that will assist maintenance personnel in applying treatments prior to cracking in oxidized pavement. The tasks might include the following:

- 1) Determine if other agencies either nationally or internationally have developed or use a visual guide for oxidation cracking.
- 2) Evaluate the feasibility of using a gray scale to identify surface aging.
- 3) If the gray scale is feasible, collect photographs.
- 4) Is a single gray scale applicable statewide or must regional scales be developed.
- 5) Test the gray scale approach to oxidized roadways to see if time of cracking is reasonably estimated. If system works, develop a pocket sized field tool.
- 6) Prepare a final report on all findings.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

If successful, the product would be one or more pocket sized field tools to identify roadways in need of rejuvenation to resist crack development.

How Will You or Others Use the Product[s]?

Maintenance personnel would use the tool to assist in determining which roads need immediate treatment and which can wait one or two years.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Repair of roadways with extensive oxidation induced block cracking is expensive and often unsuccessful. Significant cost savings could be realized if road surfaces are refreshed prior to cracking.

Other Comments:**Approval (Division official or Unit Head)**

Judith Corley-Lay

Print Name

Signature

State Pavement Management Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA

Your Name: Dennis Wofford

DATE: Aug. 21, 2011

Branch / Unit: State Road Maintenance Unit

TITLE of your Research Idea: Field Calibration and Implementation of the Performance-Based Chip Seal Mix Design Method

Background:

The findings from the HWY-2008-04 project "Development of a New Chip Seal Mix Design Method" clearly demonstrate the ability of the NCSU-developed chip seal mix design to help ensure effective and consistent performance with regard to the performance parameters that are important for chip seals. The components of this method include the determination of an optimal aggregate application rate (AAR) using a modified board test and determination of an optimal emulsion application rate (EAR) using the laser profiler. The mix design algorithm is validated by the aggregate loss and bleeding test results obtained from testing using the third scale Model Mobile Loading Simulator (MMLS3). The validation study used granite 78M and lightweight aggregate with three different gradations and CRS-2L emulsion to fabricate the chip seal specimens in the laboratory. It was found from the bleeding test that the optimal EARs determined by the NCSU mix design method for the different chip seal specimens are the maximum EARs that did not cause bleeding in performance results, thus validating the NCSU mix design concept. The final optimal EAR is determined after accounting for additional parameters such as aggregate absorption and existing pavement surface absorption via the percentage of absorption of the aggregate and the surface texture measurements obtained from the laser profiler.

What is the Specific Problem or Issue?

Validation of the NCSU developed chip seal mix design and calibration of various parameters in the NCSU mix design method are needed to ensure the effectiveness of the mix design in field situation. The parameters that need to be calibrated include asphalt absorption, traffic-whip-off, and aggregate penetration. Also the application of the NCSU chip seal mix design method to multi-layered seals needs to be validated. Calibration of the design parameters and validation for multi-layered seals in field situations would strengthen the design procedure and ensure proper implementation by the NCDOT Divisions.

List Research Objectives and Tasks:

The objectives of the proposed research are:

- 1. To calibrate the design parameters in the NCSU chip seal mix design procedure,
2. To apply the NCSU chip seal mix design procedure to multi-layered seals, and
3. To implement the NCSU mix design method into the NCDOT Divisions

The major tasks to accomplish these objectives are:

- Task 1. Development of Field Testing Experimental Design for Validation/Refinement of Existing Model
Task 2. Study of Untested Adjustments Such As Traffic Whip-off Factor and Aggregate Penetration
Task 3. Selection of Materials and Field Construction Sites
Task 4. Field Construction of Test Sections
Task 5. Monitoring of the Constructed Field Test Sections for Performance
Task 6. Refinement of Mix Design Model Concepts/Parameters
Task 7. Refinement of Field 3D Laser Program/Equipment
Task 8. Final Report

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

- 1. Validated and implemented chip seal mix design procedure, and
2. Field 3D laser profiler and installed mix design program

How Will You or Others Use the Product[s]?

The Divisions will be able to use the mix design procedure to improve the consistency and performance of chip seals statewide. The chip seal mix design procedure, and revised field 3D laser and program, will provide the pavement preservation engineer with tools to design the appropriate mix for each job site, and help ensure consistency in chip seal performance over time. These tools, when used in conjunction with field experience and effective construction techniques, will become the foundation by which chip seal performance will improve statewide. Additionally, the product will prove to be adaptable as various regions make slight adjustments to the design to account for localized environmental variables.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The products of this research will improve the performance of chip seals in North Carolina and provide effective tools that will ensure consistent mix design practices by greatly aiding the decision making process of fabricating chip seals. It is expected that these benefits will result in long-term cost savings and overall improvement in the condition of chip seal pavements in North Carolina.

Approval (Division official or Unit Head)

Jennifer Brandenburg
Print Name

Signature

State Road Maintenance Engineer
Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA

Your Name: Todd Whittington and Clark Morrison DATE: September 2, 2011

Branch / Unit: Materials and Tests Unit/Pavement Management Unit

TITLE of your Research Idea: Impact of WMA Technology on the Use of RAP Mixtures in North Carolina

Background:

Considering the environmental and economic benefits of asphalt recycling, the use of reclaimed asphalt pavement (RAP) has grown dramatically over the past 25 years. In spite of RAP's benefits, some state highway agencies are concerned that the extensive use of RAP could negatively affect asphalt pavement performance, due mainly to the aged asphalt binder that is contained in RAP. Another production technology that is gaining major attention is warm mix asphalt (WMA) technology. One of the main benefits of WMA technology is that the asphalt binder ages less due to a lower production temperature than that used for HMA production. It is speculated that the use of WMA technology for RAP mix production (to be referred to as WMA-RAP) could improve the performance of RAP mixtures and cancel out or reduce the negative effects of the aged asphalt binder in RAP. If this speculation proves to be accurate, the use of WMA technology in RAP production could lead to greener and more widespread usage of RAP in asphalt mixtures without negatively affecting the performance of asphalt pavements.

What is the Specific Problem or Issue?

The asphalt paving industry is moving toward using a greater percentage of RAP in asphalt pavements, especially in conjunction with WMA technology. Currently, no performance data are available and no systematic approach has been determined with regard to the percentage of RAP that should be allowed when incorporating WMA technology into RAP production. The NCDOT HWY-2012-01 project currently is developing a database of a limited number of WMA-RAP mixture types. The proposed study would benefit from this project by using the data to be created from the project as a baseline and by adding mixtures with varying RAP contents.

List Research Objectives and Tasks:

The objectives of the proposed research are:

- 1. To evaluate the effects of WMA technology on the performance of asphalt mixtures with various RAP contents,
2. To develop performance model coefficients for various WMA-RAP mixtures with various RAP contents to be used in pavement designs with DARWin-ME,
3. To develop a methodology to determine the allowable RAP content for different WMA techniques, and
4. To develop a recommendation for the allowable RAP content for different WMA technologies for various Superpave mixtures

The major tasks to accomplish these objectives are:

- Task 1. Data Gathering
Task 2. Material Acquisition
Task 3. Performance Testing of WMA-RAP Mixtures with Various RAP Contents
Task 4. Development of Performance Model Coefficients for DARWin-ME
Task 5. Development of a Recommendation for Allowable RAP Contents
Task 6. Final Report

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

- 1. A performance-based methodology for determining the allowable RAP content for various WMA mixtures
2. DARWin-ME performance model coefficients for WMA-RAP mixtures with various RAP contents
3. A recommendation for the allowable RAP content for various WMA mixtures

How Will You or Others Use the Product[s]?

The M&T Unit will be able to use the performance-based methodology and the recommendation from this study to develop/revise specifications for the allowable RAP content to be used for various WMA mixtures. The database to be developed from this study can be used by the PMU for their pavement designs for WMA-RAP mixtures using DARWin-ME.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The products of this research will ensure that RAP mixtures are used properly in NC highways without negatively affecting the performance of NC pavements. The increased amount of RAP in the WMA mixtures will provide significant environmental and economic benefits. Material properties specifically determined for various WMA-RAP mixtures will result in more reliable designs of asphalt pavements with WMA-RAP mixtures by the PMU.

Approval (Division official or Unit Head)

Judith Corley-Lay

Print Name

Signature

State Pavement Design Engineer

Title

STRUCTURES AND CONSTRUCTION RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Paul Garrett, State Bridge Program Manager

DATE: June 30, 2011

Branch / Unit: Bridge Management

TITLE of your Research Idea: Alternate Bridge Rails for Low Impact Bridge Replacements

Background:

The low impact bridge replacement program was put into place to replace smaller size bridges where we have shortened the design and permitting time down to about a year from picking the project until letting. Many of these bridges do not have much clearance over the creeks they cross. When we run a hydraulic model for FEMA, we have to block out the barrier rail area which can lead to a rise in the 100 year water elevation which leads to 4-6 months more permitting time. If we could approve the use of some open-faced type of bridge railing, this might save us some design/permitting time.

What is the Specific Problem or Issue?

See above. Looking for alternate bridge rails with openings that would allow us to not have to block out the whole area of railing for hydraulically modeling 100 year storms for bridges which overtop.

List Research Objectives and Tasks:

Identify or investigate other DOT bridge rails that have federal approval for their state that we could consider using in North Carolina. Look into getting these approved for use here. We would likely only want one or possibly two rail alternatives to use only when needed to avoid CLOMRs (conditional letter of map revision, i.e. a rise of 1/100th of a foot in 100 year storm). Two examples of railing are the Texas 101 rail and the Kansas Corral Rail.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

New bridge rail choices that could save permitting time.

How Will You or Others Use the Product[s]?

This would be a choice for bridges across the state. It might be limited to problem bridges in the low impact area if it is not the preferred bridge rail in general.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

More choices to fit the situation is usually better. Can save us 4-6 months design/permitting time. I think there is an \$11,000 fee to submit CLOMRs and it costs us maybe \$4,000 or more just for the extra design/hydro modeling cost not counting extra review time. These bridge rails could easily cost more than our standard cast in place rails, so this would need to be weighed in the monetary benefits area.

Other Comments:

There are rails as mentioned above that are approved by the Feds in other states. When Structure Design tried to get some rails approved, it amounted to a large amount of work. How much trouble to get approval for use is a big question.

Approval (Division official or Unit Head)

.....
 Dan Holderman

Print Name

.....
 Signature

.....
 State Bridge Management Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
 1549 Mail Service Center
 Raleigh, NC 27699-1549

FAX: (919) 715-0137
 Phone: (919) 508-1790
 email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** K. J. Kim**DATE:** 8-4-2011**Branch / Unit:** Geotechnical Engineering Unit**TITLE of your Research Idea:** Design of Temporary Slopes and Excavations in NC Residual Soils**Background:**

The design of temporary slopes and excavations in NCDOT practice is conventionally performed using drained strength parameters (either from triaxial compression tests or established correlations) and effective stress analyses. These techniques have produced consistently safe designs. However, it is often observed in practice, and noted by contractors, that some cut and natural slopes in residual soil profiles not deemed to be safe by the effective stress analyses are in fact found stable. It is this observation that has led many to conclude that the shear strength of the residual soil is actually higher than that being predicted by the sampling and testing procedures employed.

What is the Specific Problem or Issue?

The current design method and procedure for temporary slopes and temporary excavation support systems do not consider short-term characteristics of North Carolina residual soils, which sometimes results in overly conservative design and construction. Even though the geotechnical engineers are aware of the conservatism of the current design method and procedure, they do not have rational means to improve the design.

List Research Objectives and Tasks:

The research objectives will be to determine the most appropriate combination of sampling and material characterization to produce design shear strengths for the determination of temporary slopes and lateral earth pressure diagrams required for the design of temporary excavation support systems.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")

1. Improved procedure for determining the shear strength of NC residual soils to be used in the design of temporary slopes and excavations
2. Improved procedure for developing lateral earth pressure diagrams appropriate for the design of temporary excavation support systems in NC residual soils
3. Rational design method and procedure for temporary slopes and temporary excavation support systems in NC residual soils

How Will You or Others Use the Product[s]?

The products will be used by the NCDOT geotechnical engineers, geotechnical consultants, contractors, and others in their design of temporary slopes and temporary excavation support systems in NC residual soils.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The products will make temporary slopes and temporary excavation support systems in NC residual soils more cost-effective while assuring the required level of safety, which will result in reduced construction cost and accelerated construction time.

Other Comments:**Approval (Division official or Unit Head)**

Njorge Wainaina, P.E.

Print Name

Signature

State Geotechnical Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Daniel D. Holderman**DATE:** August 9, 2011**Branch / Unit:** Bridge Management**TITLE of your Research Idea:** Innovative Approaches for the Prevention of Bridge Deck Freezing**Background:**

The NCDOT expends significant funds and effort each year deploying de-icing chemicals along the State's roads. These chemicals, while effective, are expensive and, over the long run, can be harmful to the State's infrastructure and environment. Of particular interest are the State's bridges which, unlike roads, are not insulated by the thermal mass of the Earth. Thus, some of the State's costliest infrastructure is most prone to freezing and most likely to be treated with de-icing chemicals. If it were possible to prevent the freezing of bridge decks through some other means, this would result in significant time and cost savings to the NCDOT.

What is the Specific Problem or Issue?

Due to their lack of insulation, bridge decks freeze at much higher ambient air temperatures than do roadways. This requires deploying de-icing chemicals, often in dangerous conditions, to prevent freezing of only a small portion of the State's navigable roadways. A more prudent approach would be to prevent the freezing of bridge decks through some other means, particularly at ambient air temperatures that would not otherwise result in freezing of the roadways.

List Research Objectives and Tasks:

The proposed research should identify (a) possible approach(s) to prevent bridge deck freezing. The proposed technology(s) should be researched for prior applications and proof-of-concept numerical, analytical, and/or experimental models should be developed to demonstrate proof of concept. Researchers should make detailed recommendations for a large-scale laboratory or field trial of the technology as part of a subsequent project.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

The gross product of the research will be a set of calculations and numerical models to assist in the design of the proposed bridge deck de-icing system. More specifically, as part of the proposed research, a plan for a large-scale model structure will be developed. It is anticipated that a subsequent research project will use results from this project to address field-testing of the proposed technology.

How Will You or Others Use the Product[s]?

Provide our bridges with the de-icing system to keep our bridge decks from freezing and causing dangerous conditions for the traveling public.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The proposed work will result in an entirely new paradigm for bridge de-icing. It will be possible to prevent bridge freeze without deploying costly and potentially harmful chemicals. This will result in considerable cost savings and environmental benefits for the NCDOT.

Other Comments:**Approval (Division official or Unit Head)**

Dan Holderman, P.E.

Print Name

State Bridge Management Engineer

Title

Please email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 268
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1819
email: mkadibhai@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Jerry Beard & Njoroge Wainaina**DATE:** August 9, 2011**Affiliation:** Hydraulics & Geotechnical Units**TITLE of your Research Idea:** Assessment of In Situ Scour Profile Using A Jet Probe**Background:**

Data by FHWA indicate that 60% of all bridge failures in the US are caused by excessive scour under the bridge piers or abutments leading to collapse or serious structural damage. On many new and existing bridge sites, it is imperative to assess the prospect of scour and its rate in order to develop the appropriate provisions during the design stage for new construction, and for development of maintenance measures for existing structures. Current techniques for measuring scour potential require either removal of soil samples for laboratory testing in a device such as the Erosion Function Apparatus (EFA) or limiting measurements to scour on the surface of the sediment using inverted flumes. Based on the review of literature and from discussions with NCDOT engineers it seems that having a tool that will allow for the assessment of scour potential and its rate as a function of depth will be invaluable to NCDOT's mission related to assessing the stability of several types of civil infrastructures including bridges, culvert and embankments.

List Research Objectives and Tasks:

The objectives of this proposed work include: (1) Develop the In Situ Evaluation of Scour Potential (ISEP) probe and test its applicability to the various types of geologic profiles encountered in North Carolina, (2) Calibrate the probe to address issues related to effect of existing overburden pressure, and weight of the probe, on scour rate (3) extend the correlation work from the lab to the field by performing field testing at sites where scour rates have been established in the past.

What Would be the Product[s] of the Research?

The research will culminate in a device that provides data that can be correlated to scour rate. The field device employs a cone-tipped vertical probe that is attached to a digitally controlled, centrifugal pump that provides controllable and repeatable vertical water velocity at the tip. The water jet is induced through a cone tip and as the vertical water jet is deflected by the underlying soil, the now horizontally moving water applies a shear stress to the soil grains causing erosion. The device, along with a scheme for reducing the data to establish scour rate with depth will be the product from the research.

How Will You or Others Use the Product[s]?

- (1) Decide on best location of foundation and bridge site on the basis of scour data,
- (2) Determine whether or not mitigation measures are needed for existing structures, and the time frame with which they need to be implemented,
- (3) Allow for the development of strategies for scour-critical infrastructure replacements, and assess potential scour in preparation for approaching severe storms.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The product will be a valuable tool in responding to concerns with scour and stability of critical highway structures. It will provide a tool that does not currently exist. The scour probe data and the proposed approach, once developed, will allow NCDOT engineers in Geotechnical, Hydraulics, Structures, and Construction Units to efficiently investigate potential for damage due to scour for new and existing infrastructure.

Approval (Division official or Unit Head)

Njoroge Wainaina, P.E.

Print Name

Signature

State Geotechnical Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** K. J. Kim**DATE:** 8-5-2011**Branch / Unit:** Geotechnical Engineering Unit**TITLE of your Research Idea:** The Use of Waste and/or Recycled Materials in Highway Construction**Background:**

Significant quantities of granular waste materials are generated every year. Some of these materials are recycled, but many are landfilled at tremendous economic and environmental expense. However, some of these waste streams have mechanical and/or hydraulic properties that are desirable in geotechnical engineering applications for highway construction, such as being freely draining (e.g., crushed glass) or lightweight (e.g., shredded tire rubber). The use of these materials in highway construction could result in considerable environmental and economic benefits. However, no research has been done to provide rational design and construction methodologies for the use of waste/recycled materials in North Carolina highway construction.

What is the Specific Problem or Issue?

It may be possible to use waste and/or recycled materials in many geotechnical engineering applications for highway construction across the state of North Carolina. Possible uses include as select backfill behind retaining walls and fill material beneath roadways. However, no rational design and construction methodologies for such use are available. It is first necessary to understand the properties of these materials both alone and in combination with local soils. Understanding these properties will provide insight into their possible uses.

List Research Objectives and Tasks:

The proposed research will start by identifying potentially useful waste streams within North Carolina and preliminarily assessing the usefulness of these materials based on cost and a gross understanding of material properties. Several of the most promising materials will be selected for further study. These materials will be tested alone and in combination with local soils to determine their engineering properties as a function of soil type and mixing ratio. The implications of these properties on engineering design will be assessed through continuum numerical modeling, and rational design and construction methodologies will be developed.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

The primary products of the research will be: (i) a database of waste/recycled material properties, both alone and in combination with local soils; (ii) design and construction guidelines for the use of waste/recycled materials for highway construction projects in North Carolina; and (iii) a suite of numerical simulations demonstrating and optimizing the efficacy of these materials in engineering applications.

How Will You or Others Use the Product[s]?

The primary users of the research products will be NCDOT geotechnical engineers and construction personnel. The geotechnical engineers will identify potential use of the waste/recycled materials based on the product (i) above and provide detailed design plans and specifications using the products (ii) and (iii) above. The construction personnel will use the product (ii) above along with the design plans and specifications during construction.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The results of this research project will enable the NCDOT to employ recycled and waste materials in highway construction throughout the state. Use of these materials will result in cost savings and also significant environmental benefits.

Approval (Division official or Unit Head)

Njoroge Wainaina, P.E.

Print Name

Signature

State Geotechnical Engineer

Title

TRAFFIC AND SAFETY
RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Phillip Hart

DATE: 7/5/2011

Branch / Unit: DOT-Div.6 / Traffic Services

TITLE of your Research Idea: Monolithic Concrete Island Delineation with RPM's and/or Pavement Markings

Background:

Concrete islands at/near intersections.

What is the Specific Problem or Issue?

Vehicles striking concrete islands mainly during night. Aged pavement surfaces start to blend in with monolithic concrete islands (Grayish color).

List Research Objectives and Tasks:

Objective: Make obstruction in the roadway more visible.

Tasks: Implement into standard drawings.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

Obstruction delineation

How Will You or Others Use the Product[s]?

Motorists could readily identify hazardous obstructions in the roadway. Marker and/or pavement marking delineation would guide motorists through an intersection.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Enhance the safety of motorists traveling through intersections that have little to no pavement markings, limited sight to other side of intersection (ex. vertical curve, skewed intersection, dark intersection). Terms of benefit would depend upon maintenance of markers and markings. Markers and markings would last longer than post type delineation at high impact areas where keep right signs are hit on a regular basis. Reduce vehicular incidents, reduce sign damage/cost/employee exposure, reduce phone calls/citizen request, etc...

Other Comments:

Place markers inside of travel lane so dirt built up does not cover reflective properties of marker and provide an audible alert to drivers when nearing the edge of an obstruction (similar to a rumble strip). Provide 20 feet or less spacing, similar to other standard drawings. Providing an identifiable border for motorist to use during nighttime, inclement weather, etc.

Approval (Division official or Unit Head)

Kent Langdon

Print Name

Signature

Div. 6 - Assistant Division Traffic Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217

1549 Mail Service Center

Raleigh, NC 27699-1549

FAX: (919) 715-0137

Phone: (919) 508-1790

email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Majed Al-Ghandour, Ph.D., P.E.**DATE:** 8/8/2011**Branch / Unit:** Program Development Branch**TITLE of your Research Idea:** Improvement of the Conventional Diverging Diamond (DDI) Interchange and Diverging Double Roundabout Interchange (DDR)**Background:**

FHWA introduces the DDI design to accommodate left-turning movements at signalized, grade-separated interchanges of arterials and limited-access highways while eliminating the need for left-turn phasing (FHWA-HRT-07-048). DDI shows a safety benefits by reducing the conflicts points from 26 (conventional) to 14 (DDI) and where the conflicts points spread out throughout interchange. DDI provides a better sight distance at turns and pedestrian crossings are shorter. DDI also shows operational benefits by supporting a unique phase combinations, simple left and right turns from all directions, only two phases needed with short cycle length and a better signal network synchronization. Finally, DDI adds more cost benefits such as existing bridge can be used or less bridge structure and additional right-of-way rarely needed.

What is the Specific Problem or Issue?

Is DDI considered as the best solution in some cases for the NCDOT interchanges?

What are the variations of the DDI to be addressed?

What are some of the limitations of the conventional DDI?

The DDI works best when there is at least one heavy left turn movement and/or unbalanced thru movements. What are other options?

What are more innovative geometric designs to be considered for DDIs such as DDR? More challenges will be the channelization turns at roundabouts, how can be evaluated?

List Research Objectives and Tasks:

- Review current literature relevant to DDI, best practices, safety and operational features, cost, and limitations.
- Brief evaluate current practice for the NCDOT standards in designing intersections, interchanges, DDI: the operations, benefits, limitations.
- Develop a conceptual framework, methodology, and guides for DDI selection criteria.
- Develop the best practices for implementing DDI and other variations of DDR.
- Determine ways to solve some issues involving DDI & DDR.
- Provide new knowledge on which NCDOT engineers and practitioners can base their decisions and incorporate better utilize these tools for optimum DDI & DDR design.
- Explore the safety and operational performance of DDI & DDR.
- Perform traffic analysis and trade-off analysis related to the need to use DDI & DDR.
- Optimize the cost benefits from variations of DDI & DDR.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

- Tools, models, and innovative practices.
- Graphs, tools, manuals, and guidelines.
- Document analysis and report recommendations.

How Will You or Others Use the Product[s]?

- Engineers will use supportive criteria, standards, innovations for producing, manipulating, and presenting for delivery project with DDI and others.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

- Bring the organization to state-of-the art standard of designing DDI and variations such as DDR.
- Improve the practice of designing DDI.

Other Comments:**Approval (Division official or Unit Head)**

Calvin Leggett, P.E.

Print Name

Signature

Branch Manager

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS

Your Name: Thomas Alston

DATE: 8/16/2011

Branch / Unit: Division 1 NCDOT/ Safety Dept.

TITLE of your Research Idea: Safety Visibility Enhancement

Background:

In the field of safety, there continues to be arguments on the reflectivity of safety Vest and head apparel. Which vest is more visible, the orange safety vest or the lime green safety vest. Also, does the presence of a fluorescent orange ball cap increase the visibility or target value of personnel and enhance the safety of the employee. At current, some division in the state enforce the use of the orange ball cap, some do not. If orange is the preferred color to require our employees to wear, then why is it not required of our contractors or put into the provisions of their contract.

What is the Specific Problem or Issue?

Which Vest is more visible the Orange Class II safety Vest or the Lime Green Class II safety vest. Does fading (in color) of the hat or vest truly affect the safety of our DOT employee's working in the field? If the fading is to be monitored, how will we monitor it in the field for replacement? Which secondary reflective material is better on the safety vest, the 3-M Scotchlite silver material or the 3-M reflective safety yellow. Of the two colors, which vest offers the best visibility during the daylight. Of the two colors, which vest offers the best visibility during the night. Does the use of an orange ball cap increase safety factor in our work at DOT vs. using any color or style of head apparel or should the policy be dropped as a requirement in the divisions. There are complaints that use of Orange safety vest and hats in work zones blends in with signs barricades flashing lights etc. makes the personnel blend into the orange. Lime green makes them stand out from the "orange" environment. Lime green on the other hand does not stand up to the elements as well as the orange and cannot be seen as well from a distance.

List Research Objectives and Tasks:

- 1. Determine the reflectivity of the safety vest.
2. Determine the sight distance at which the safety vest is clearly visible.
3. Determine the vest which is least visible during the various season's and if it truly makes a difference.
4. Determine the overall effectiveness of requiring the use of orange reflective ball caps or hats making employees visible.
5. Determine if the color of orange used in highway construction project is overbearing and the orange PPE blends into the worksite or if lime green causes a contrast to the standard orange background.

What Would be the Product[s] of the Research?

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")

The final product would be a recommendation as to the safety factor involved in the visibility of the vest being worn and its effectiveness in assisting motorist as to the presence of people at Highway construction or maintenance activities. The end product would be a policy that states requirement for use of specific PPE in Highway construction projects and maintenance units to meet a specific color not just "Class II" requirements This specific policy would translate to the safety of public, construction workers, maintenance and other contractors or units involved in maintaining our state highways. The policy would also require enforcement to use the specific color on State projects.

How Will You or Others Use the Product[s]?

Determination of the correct vest and its visibility will increase the safety factor of all personnel working on NCDOT projects. A final determination will assist in making a firm policy on the use of the correct colored vest and the use of ball caps so that a policy can be set for entire state vs. a specific division. The PPE policy can then be added to contracts requiring the use of materials that will enhance the safety of the personnel on the construction projects and highway

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

Increased visibility of personnel will enhance the potential for accident reduction throughout the state. DOT will benefit from the reduction in potential deaths by motor vehicle strikes and severe injury leading to increased cost in Workers Compensation payouts. If the visibility of the ball cap makes a difference, we can increase the selection of the ball cap variety for the seasons or eliminate it from the depot. The potential cost savings would be significant both in lives and cost.

Other Comments:

The final project recommendations should be forwarded to central DOT safety dept. and made as a policy for the whole state. This would eliminate the confusion and put a stop to the conflicts.

Approval (Division official or Unit Head)

Thomas D. Alston

Div. 1 - Safety Consultant

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Ron King, PE**DATE:** 08/11/11**Branch / Unit:** Signing and Delineation Unit**TITLE of your Research Idea:** Effectiveness of Elongated Shield Pavement Markings**Background:**

The 2004 Standard Highway Signs Book published by the FHWA included the addition of elongated route shields in the form of pavement markings to supplement guide signs. The Department has limited installations of these pavement markings due to the lifespan and all-inclusive cost of installing them.

What is the Specific Problem or Issue?

Are the elongated route shield pavement markings a cost-effective solution for mitigating unexpected weaving at various locations? On which type of routes (Interstate, US, NC) are these markings effective? Are there constraints to operating speeds to which these markings remain effective? What size(s) are the most cost-effective? What lifespan is expected for the markings if installed in various regions of the state and susceptible to maintenance activities such as snowplowing? What is the most effective alignment when using multiple shields (single route and multiple routes) along the same section of the roadway (horizontal, angled, staggered, etc.)?

List Research Objectives and Tasks:

Determine effect of elongated shield pavement markings on weaving scenarios. Explore any speed constraints to the effectiveness of the markings. Compare total costs (material, delay, etc.) of installation and maintenance with similar costs of other countermeasures.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

A recommendation regarding if these markings should be installed as a cost-effective countermeasure, and, if so, where to install them.

How Will You or Others Use the Product[s]?

If deemed a cost-effective solution, these markings can be installed, following an engineering study, in any location that has a history of dangerous or unexpected weaving.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

This product could increase operational efficiency by decreasing weaving delays. It could also enhance safety by reducing the amount of short-distance weavings. This product could also decrease costs, both of collisions and collision investigations, as well as the cost to replace or re-install fallen signs located in the gore areas that are fallen due to short-distance weavings.

Other Comments:**Approval (Division official or Unit Head)**

Ron King, PE

Print Name

Signature

State Signing & Delineation Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Ron King, PE**DATE:** 08/11/11**Branch / Unit:** Signing and Delineation Unit**TITLE of your Research Idea:** Effectiveness of Wide Dotted Line Pavement Markings**Background:**

The 2009 MUTCD includes new shall conditions requiring wide dotted lines to be installed segregating lane-drops from through lanes.

What is the Specific Problem or Issue?

Was the installation of wide dotted lines as a use for segregating lane-drops from through lanes studied prior to its inclusion in the 2009 MUTCD? Is the increased cost of installation effective in enhancing safety and reducing collisions due to weaving at lane-drop locations?

List Research Objectives and Tasks:

Determine the effectiveness of installing wide dotted lines segregating lane-drops from through lanes. Determine the cost-effectiveness of installing wide dotted lines segregating lane-drops from through lanes.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

Support for the requesting of the National Committee on Uniform Traffic Control Devices (NCUTCD) to modify the requirements pertaining to the use of wide dotted lines delineating between lane-drops and through lanes.

How Will You or Others Use the Product[s]?

The study results may be used to recommend to the NCUTCD a modification of the requirements pertaining to the use of wide dotted lines. Other states could also use the results for the same recommendation.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The product will provide support for the use of wide dotted lines as an enhancement of safety or will support a cost savings by not requiring wide dotted lines in all locations of lane-drops.

Other Comments:**Approval (Division official or Unit Head)**

Ron King, PE

Print Name

Signature

State Signing & Delineation Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Ernest Morrison**DATE:** August 12, 2011**Branch / Unit:** Research Unit**TITLE of your Research Idea:** Evaluation of Truck Lane and Speed Restrictions on Multi-lane Highways**Background:**

This research will investigate the potential for road safety, capacity and travel time improvements by applying speed and lane restrictions to trucks on multi-lane highways. Some European countries restrict truck traffic to a single lane on multi-lane facilities and also require a lower speed limit for trucks. As road construction funds are reduced the NCDOT needs to investigate innovative low-cost solutions to highway safety and capacity issues.

What is the Specific Problem or Issue?

Trucks shifting from lane to lane on multi-lane highways are a safety issue, reduce highway capacity, and increase roadway congestion and travel times for all road users. The concept is to increase road safety and capacity by limiting travel lanes and/or maximum speeds for truck traffic. For example, reducing allowable truck travel lanes and/or speed limits in urban areas will reduce the desire for frequent lane change maneuvers by trucks.

List Research Objectives and Tasks:

The purpose of this project is to evaluate the safety and operational effects of the truck lane and speed restrictions. This evaluation will cover both speed and travel lane restrictions on multi-lane highway segments. The impact of the truck lane restrictions on overall crash frequency and truck-involved crash frequency will be evaluated. Traffic operations will be examined by comparing sites with restrictions to similar sites without restrictions in North Carolina, other states, and countries. An assessment of the efficacy of truck restrictions will be made, and recommendations for truck speed and lane restrictions on multi-lane highways will be made.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

Recommendations for changes in regulations and/or posted signing regarding truck speed and lane restrictions on multi-lane highways.

How Will You or Others Use the Product[s]?

This research will assist the NCDOT in improving highway safety, highway capacity and reducing travel time.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

This research will result in safer travel for highway users, reduced congestion, reduced air pollution and improvements in vehicle travel time at virtually no cost to the public.

Other Comments:**Approval (Division official or Unit Head)**

Moy Biswas

Print Name

Signature

State Research Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH NEEDS**Your Name:** Ernest Morrison**DATE:** August 5, 2011**Branch / Unit:** Research Unit**TITLE of your Research Idea:** Evaluation of Red Light Camera Enforcement in North Carolina**Background:**

The North Carolina Legislature has considered a bill to ban Red Light Camera enforcement in the state. The purpose of this research is to provide facts concerning the benefits, costs and safety issues of Red Light Camera Enforcement. This research is needed to determine if red light camera enforcement is a useful tool to improve safety for the driving public.

What is the Specific Problem or Issue?

The issue is to determine the benefits, costs, safety issues and public acceptance of red light camera enforcement in North Carolina.

List Research Objectives and Tasks:

The study should summarize key data regarding each locality's program (e.g., costs, revenue, duration of the program, and technology used), how the red light running programs affect crashes and violations at these intersections relative to intersections where no camera are used, how photo-red enforcement compares to traditional methods of enforcement, and levels of public support for such programs. Recommendations for improvements to the photo-red enforcement program to improve safety and acceptance by the public would also be provided.

What Would be the Product[s] of the Research?

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*

Factual determination of the effects of red light camera enforcement on safety in North Carolina. Recommendations for improvements in red light enforcement in North Carolina.

How Will You or Others Use the Product[s]?

This research will assist the NCDOT and the North Carolina Legislature in making decisions which affect the safety of the traveling public.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

The department can show they are taking a research based approach in regard to improving safety on the roads in North Carolina. The long term goal is to assist the people of North Carolina and the NC Legislature by taking a leadership role in providing fact based information regarding highway safety issues.

Other Comments:**Approval (Division official or Unit Head)**

Moy Biswas

Print Name

Signature

State Research Engineer

Title

Please FAX, Mail, or email to: Ms. Melvena Sams, Office of Research

104 Fayetteville Street, Rm. 217
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1790
email: msams@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Chris Howard**DATE:** 08/30/2011**Affiliation:** Signing and Delineation Standards**TITLE of your Research Idea:** Assessment of Automated Sign Retroreflectivity Measurement Tools**Background:**

Automated asset inventory is a hot topic among federal and state transportation agencies in the past few years. Roadway assets and pavement distress are among the two most studied transportation features across the country. The primary motivation for collecting this data using automated methods is the ability to keep staff out of the roadway, especially high speed facilities such as interstates. The other reason is that it can be done more efficiently. Current studies are already underway looking at the feasibility of vendors collecting data for roadway assets; however, another key area is still missing.

This particular research effort piggybacks on current research being conducted by NCDOT. In light MUTCD requirements for sign retroreflectivity, there is a need to determine the best practice for collecting sign retroreflectivity data along various roadway types. Methods for sign replacement could be done by yearly visual nighttime inspections, mass replacement, actual field measurements using a retroreflectometer, etc. One method being explored recently is the use of automated methods, such as LIDAR and other recently patented devices. This proposal seeks to formally evaluate these up-and-coming technologies ability to collect useful and accurate retroreflectivity data and, assuming they work, provide guidance about when those technologies should be deployed for a safety, operational, and cost standpoint.

What is the Specific Problem or Issue?

The MUTCD is requiring that all States have a plan for replacing signs based on retroreflectivity standards. There are multiple methods for doing sign replacement, noted earlier; however, given the advent of newer technology in the asset data collection field, there may be reason to use automated methods if they can provide accurate and dependable data.

List Research Objectives and Tasks:

Determine the current state of the practice through a literature search, obtain a list of vendors who claim to collect this data, get estimates from vendors to collect data on a predetermined road course, collect manual retroreflectivity data for comparison purposes, analyze vendor data sets against field measurements, and provide a final report documenting the findings and any guidelines.

What Would be the Product[s] of the Research?

Will provide a concrete determination of the current practices for collecting sign retroreflectivity using automated methods and their ability to collect that data accurately.

How Will You or Others Use the Product[s]?

Assuming one or more methods can accurately collect retroreflectivity, NCDOT will have another tool at their disposal to collect sign inventory data.

How Will the Product Benefit the Department?

Automated methods of asset extraction are safer to conduct than traditional methods, especially those that require field personnel to work in and around the roadway. This method has the potential to be used in instances where an automated extraction makes more sense. In addition, it is possible that this method is more efficient and cost effective.

Other Comments:

104 Fayetteville Street, Rm. 268
1549 Mail Service Center
Raleigh, NC 27699-1549

FAX: (919) 715-0137
Phone: (919) 508-1819
email: mkadibhai@ncdot.gov

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Joseph Ishak, PE**DATE:** August 26, 2011**Branch/Unit:** Mobility & Safety Division, Traffic Management Unit**TITLE:** Delay and User Cost Estimation for Work Zones on Urban Arterials**Background:**

Construction activities on major arterials and thoroughfares can cause significant disruptions to the traveling public. The analysis of delay and user cost inputs of such significant work zones is mandated by the FHWA Safety and Mobility Rule and is important to assure that the NCDOT can adequately predict work zone impacts. A thorough understanding of the estimated delays caused by a particular work zone scenario is important to be able to weigh that scenario against others, and to be able to make construction staging decisions that minimize disruptions to the traveling public to the extent possible. For freeway work zones, NCDOT has recently acquired a new analysis tool that allows estimation of work zone impacts at the planning level. However, currently no adequate tool is available to perform such analysis on arterial streets.

What is the Specific Problem or Issue?

NCDOT currently does not have a tool to predict the impacts of work zones on urban arterials and thoroughfares. While modern microscopic simulation tools are available to perform such analyses, the resources necessary to develop and run these models are often beyond the scope of preliminary work zone assessment. As an alternative, Synchro is used to predict operations on the arterial, but that tool is limited to the evaluation of the peak 15 minutes and therefore not useful for evaluating work zone scheduling decisions. NCDOT is in need of a planning-level methodology and tool to evaluate the impacts of work zones on arterial streets.

List Research Objectives and Tasks:

The objective of this research is to develop a multi time-period methodology to evaluate the impacts of work zones on arterial streets with signalized and roundabout controlled intersections. This methodology should be applicable in a planning-level context to allow for efficient in-house comparison of different work zone scenarios. The method should further be sensitive to unconventional corridor strategies, like superstreets, which are increasingly used in North Carolina. The methodology should be implemented in a computational engine that assures that it can be directly applied at the conclusion of the research. Project tasks may include: (1) Synthesis of Literature, (2) Development of Analysis Framework, (3) Data Collection Plan, (4) Field Data Collection, (5) Methodology Development, (6) Computational Engine Development, (7) Calibration and Validation, and (8) Final Report and Deliverables.

What Would be the Product[s] of the Research?

The products of this research are a methodology for analyzing work zones on arterial streets, and a computational engine that implements the method.

How Will You or Others Use the Product[s]?

The Traffic Management Unit will use the products to evaluate work zone strategies for arterial streets in North Carolina. The evaluation results will be used to screen work zone scenarios in the early planning stages, and inform the decision-making process for work zone staging and scheduling. The products will also be used to assist in the development of design-build work zone contracts to incorporate specific performance criteria into the project bid. The products will also be used by the Congestion Management Unit to perform multi time-period analyses of arterial corridors with and without work zones.

How Will the Product Benefit the Department?

The products will improve the operational efficiency of arterial work zone analyses performed by NCDOT, and help inform work zone decision-making. The tool will be immediately useful to evaluate new work zone projects, but will have even bigger long-term effects, as the work zone unit builds experience in this area and minimizes work-zone-induced impacts to the traveling public.

Approval (Division official or Unit Head)

Stuart Bourne, P.E.

Print Name

Signature

State Traffic Management Engineer

Title