

LIST OF FY-2011 NCDOT RESEARCH IDEAS

<u>Idea ID</u>	<u>Idea Title</u>	<u>Submitted by</u>
Planning and Environment		
1101	Does Direct Lighting From Vehicles Affect Nesting Sea Turtles	Beth Smyre
1102	Feasibility of Transporting Fresh/Brackish Water Submerged Aquatic Vegetation	Bruce Ellis
1103	Thermal Pollution Associated with Riparian Canopy Clearing	Heath Slaughter
1104	Stormwater BMP Monitoring at I-540 and Mango Creek	Matt Lauffer
1105	Investigation of Stormwater Characterization From Roadways with Open Graded Friction Course Surfaces	Matt Lauffer
1106	Development of a Standard Engineered Soil Media for Stormwater Bioretention	Ken Pace
1107	Developing Alternative Engineering Design Criteria for High Efficiency Sediment Containment Systems	Ted Sherrod
1108	RUSLE2 Design Tools for NCDOT	Ted Sherrod
1201	Examining NCDOT Programs and Services to Understand and Meet the Transportation Needs of Limited English Proficient Persons (LEP) in NC	Aketa Emptage
1202	Examining NCDOT Programs and Services to Determine Effective Data Collection Methods for Title VI Compliance	Aketa Emptage
1203	Understanding the Benefits of Highway Construction to Zero Car and/or Public Transportation Dependent Households in NC	Aketa Emptage
1204	Review of NCDOT Practices for Ensuring Minority and Low-Income Participation in NCDOT Programs and Activities	Shantray Dickens
1205	Project Risk Management and Quality Management Tools	Majed Al-Ghandour
1206	Improved Freight Model for Strategic Multi-Modal Planning	Judith Corley-Lay
1207	Expansion of Truck Network Flow Model to Include Total Traffic	Judith Corley-Lay
Pavement and Maintenance		
1301	Relationship Between Fuel Prices and Truck Weights	Judith Corley-Lay
1302	Rate of Development of Bridge Approach Roughness	Judith Corley-Lay
1303	MEPDG Inputs for Warm Mix Asphalts	Clark Morrison
1304	Development and Validation of Pavement Deterioration Models and Analysis Weight Factors for the NCDOT Pavement Management System	Neil Mastin
1305	Evaluation of Moisture Susceptibility of Warm Mix Asphalt Technologies	Jack Cowser/Todd Whittington
1306	Study the Effect of Water Exposure on Joint and Crack Sealant	Dennis Wofford/Jack Cowser
1307	Extending the Use of Chip Seal to Higher Volume Roads by Using Polymer-Modified Emulsions and Optimized Construction Procedures	Dennis Wofford
1308	Quantifying Dowel Bar Misalignments	Wiley Jones
1309	Geosynthetics Material Uses at NCDOT	Julie Hunkins
1310	Comparison of Data Collection Vehicles to Human Collection Methods	Jonathan Arnold
1311	Evaluation of the Relationships of Soil Indices – Moisture Content – Undrained Shear Strength for Soils in North Carolina	C. K. Su
Structures and Construction		
1401	Field Verification of Undercut Criteria and Alternatives for Subgrade Stabilization in the Piedmont Area	Njoroge Wainaina
1402	SPT Hammer Continuous Energy Measure and Calibration	Mohammed Mulla
1403	Optimal Timing of Bridge Washing to Reduce Chloride Penetration	Judith Corley-Lay
1404	Internal Curing of Concrete Using Lightweight Aggregate	Cecil Jones
1405	Durability of Light Weight Concrete Bridge Decks – Field Evaluation	Cecil Jones
1406	Durability of Light Weight Concrete Bridge Decks – Laboratory Evaluation	Cecil Jones
Traffic and Safety		
1501	Volume Warrants and Costs for Roundabout Right-Turn Lanes	Majed Al-Ghandour
1502	Performance of Weathered Steel Guardrail in NC	Joel Setzer
1503	Methodology and Technology for Crashes Analysis at the Intersections and its Turnings and VMT	Jeff Jaeger
1504	Speed and Safety in NC	Brian Mayhew
1505	Impact of Unlicensed Drivers on Highway Safety	Cliff Braam / Brian Mayhew
1506	Impact of the Hispanic Population on Highway Safety	Cliff Braam / Brian Mayhew
1507	Intersection Database Analysis	Brian Murphy / Brian Mayhew
1508	Comprehensive Safety Document/Product	Chris Oliver / Brian Mayhew

Total 40 Research Ideas

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Total 40 Research Ideas

PLANNING AND ENVIRONMENT RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Beth Smyre**DATE:** August 12, 2009**Branch / Unit:** PDEA/ Project Development Eastern Region**TITLE of your Research Idea:** Does Direct Lighting from Vehicles Affect Nesting Sea Turtles?**Background:**

In 2008, NCDOT worked with the USFWS on the Section 7 (endangered species) consultation for the Bonner Bridge Replacement Project, which includes both the replacement of the existing Bonner Bridge and the upgrade of the adjacent twelve-mile section of NC 12 within the Pea Island National Wildlife Refuge. Five sea turtle species were included in the consultation. In its initial list of conditions, USFWS stated that all bridges within the project area should include a high barrier on the ocean side of the structure in order to minimize the effect of direct lighting from vehicles on nesting sea turtles, as the turtles could confuse the vehicle lights with the light reflecting off of the ocean- this light guides the turtles from their nests. Though NCDOT and USFWS decided to postpone the final decision on any design modifications, this issue will come up again as future phases of the project move into final design.

What is the Specific Problem or Issue?

For bridge and roadway projects adjacent to sea turtle nesting areas, what level of shielding is needed in order to prevent passing vehicle headlights from interfering with nesting sea turtles? For bridges, is the current standard 54" railing height sufficient to block direct lighting?

List Research Objectives and Tasks:

1. Determine whether direct lighting from passing vehicles affects/disorients sea turtle hatchlings as they try to reach the ocean.
2. Determine practices of other coastal states with respect to minimizing the effects of vehicle lighting- do other states incorporate permanent or temporary barriers between coastal roads/bridges and sea turtle nesting areas?

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

The initial product would be a recommendation as to whether vehicle lighting has an effect on sea turtle hatchlings, as is stated by the USFWS. If it is determined that an effect is likely, recommend what design changes should be incorporated into roadway and bridge projects in order to minimize the effects to sea turtle habitat.

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

The final report would be valuable for the Section 7 process for other coastal roadway and bridge projects.

How Will the Product Benefit the Department?

If the research demonstrates that no additional types of barriers are needed, then it would potentially decrease overall project costs. At minimum, the research helps NCDOT when working with the USFWS, in that NCDOT would not be forced to rely solely on the USFWS for this type of information.

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

Rob Hanson

Print Name

Signature

Project Development Head- Eastern

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Bruce O. Ellis

DATE: August 7, 2009

Branch / Unit: PDEA/Natural Environment Unit

TITLE of your Research Idea: Feasibility of Transplanting Fresh/Brackish Water Submerged Aquatic Vegetation

Background:

Submerged Aquatic Vegetation (SAV) is an important component in the estuarine ecosystem. As such, it is regulated by federal and state agencies as a jurisdictional resource, where impacts to SAV are compensated through mitigation. NCDOT projects in coastal areas have the potential to impact SAV. Preparation of environmental documentation includes the identification of presence or absence of SAV in the project area. Upon completion of avoidance and minimization protocols, compensatory mitigation is addressed. Historically, traditional wetland mitigation methodologies have been proven to be ineffective or inappropriate for SAV mitigation.

What is the Specific Problem or Issue?

The NCDOT desires to investigate the feasibility and potential success rates for transplanting fresh/brackish water SAV. Especially, for the following SAV species: tapegrass (*Vallisneria americana*), sago pondweed (*Potamogeton pectinatus*), and Widgeon grass (*Ruppia maritima*). Other species that may be under consideration include: horned pondweed (*Zannichellia palustris*), and clasping leaf pondweed aka redhead grass (*Potamogeton perfoliatus*).

List Research Objectives and Tasks:

Harvest research specimens from known/healthy stands. Collect the following from harvested stands: substrate texture/type, salinity, water clarity, depth of water, and an estimation of wind/current energy within the system. Transplant specimens in various substrates, water clarity, water depth and salinity conditions. Observe results for at least two growing seasons. Consult with NCDOT regarding potential permit issues.

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

Determination of species success rates under various conditions and a determination of most reliable species to transplant in a restoration project. Additionally, an assessment of optimal substrate composition, water depth and clarity conditions.

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

PDEA/NEU will use this research in the permit process, as well as, determining potential restoration/enhancement opportunities.

How Will the Product Benefit the Department?

It is anticipated that the research will reduce permit processing time, maintain project schedules, streamline the mitigation process, and increase success rates for SAV restoration sites.

Other Comments:

Approval (Division official or Unit Head)

Phil Harris, PE

Print Name

Signature

Unit Head

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Heath Slaughter

DATE: July 31, 2009

Branch / Unit: Division 11 Environmental Officer

TITLE of your Research Idea: Thermal Pollution Associated with Riparian Canopy Clearing

Background:

Regulators claim that clearing trees adjacent to streams increases water temperatures (thermal pollution). I agree in principle but what if you are only clearing 50 ft? Does that really make any measurable difference? When is this *really* a measurable problem? Variables include water depth, water velocity, existing shade coverage area, shade density, possibly elevation and substrate material to name a few. I don't believe this is a problem all of the time everywhere but is treated as though it is.

What is the Specific Problem or Issue?

This thermal pollution claim is frequently made to discourage bank armoring, which we do on nearly a daily basis to protect our roadways. DWQ is now considering charging us mitigation for armoring that exceeds 150 linear feet. Is this justified?

List Research Objectives and Tasks:

Find the truth and potentially reduce mitigation costs.

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

Relationship data regarding width of clearing and water temperature in adjacent streams, including relevant variables, possibly in different parts of North Carolina.

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

NCDOT will be able to use such information in discussions with regulatory agencies regarding bank clearing, armoring and mitigation.

How Will the Product Benefit the Department?

Potentially reduce mitigation and make permitting easier through fewer objections.

Other Comments:

Approval (Division official or Unit Head)

Michael Pettyjohn

 Print Name

 Signature

Division Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Matt Lauffer

DATE: August 10, 2009

Branch / Unit: Hydraulics Unit

TITLE of your Research Idea: Stormwater BMP monitoring at I-540 and Mango Creek

Background:

To meet requirements of Session Law 2008-107, NCDOT retrofitted the I-540 bridge over Mango Creek with two bioretention basins and a swale. The bioretention basins were designed in parallel to investigate changes to treatment from reduced surface area. In addition, both basins were designed with an anaerobic layer, believed to improve nutrient removal. Dr. Bill Hunt with NCSU was contracted through the period of performance of the Session Law to monitor BMP effectiveness for these BMPs.

What is the Specific Problem or Issue?

NCDOT is required by their NPDES permit No. NCS000250 to "evaluate design-related BMPs" (Part II.B.3.b.c) and "conduct research to ...measure structural BMP effectiveness," (Part II.G.1.a). Due to time constraints of the Session Law, NCSU may not have adequate data to fully investigate BMP effectiveness for the BMPs at this site.

List Research Objectives and Tasks:

This research project would be an extension of current research objectives to capture rainfall events over a full year and a full growing season and provide training to design engineers on lessons learned. Current objectives are:

- Determine the runoff mitigation provided by a full sized (by NCDENR design standards) bioretention cell
- Determine the runoff mitigation provided by a one-half sized (by NCDENR design standards) bioretention cell
- Determine the runoff mitigation provided by a swale consisting of amended soils and specialized planting.
- Determine nutrient concentration and load reduction provided by both bioretention cells and swale.

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

BMP treatment and effectiveness data and training. Recommendations on the feasibility of implementing reduced-sized bioretention basins for the treatment of highway runoff.

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

The results of this research project will be used to create design guidance for bioretention basins and to update design guidance for the swale chapter of the NCDOT *BMP Toolbox*.

How Will the Product Benefit the Department?

Provide data to understand the performance of both the bioretention basins and swale over significant number of events and seasons and provide training to design engineers to potentially reduce life cycle cost and improve water quality treatment.

Other Comments:

Approval (Division official or Unit Head)

David Henderson
 Print Name

Signature

State Hydraulic Engineer
 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Matt Lauffer

DATE: August 10, 2009

Branch / Unit: Hydraulics Unit

TITLE of your Research Idea: Investigation of Stormwater Characterization from Roadways with Open Graded Friction Course Surfaces.

Background:

Asphalt porous friction course (PFC) is produced by eliminating fine aggregate from the asphalt mix. The void spaces created improve visibility during storm events and reduce the potential for hydroplaning. Recently, the effect of PFC on stormwater runoff quality has been studied. Preliminary results suggest PFC can prevent the generation of solids (reduced pavement abrasion) and metals (reduced spray onto vehicle undercarriages). Should PFC be accepted as a viable stormwater BMP for the linear environment, it would require no additional ROW, a benefit over traditional stormwater controls.

What is the Specific Problem or Issue?

NCDOT is required by their NPDES permit No. NCS000250 to "evaluate design-related BMPs" (Part II.B.3.b.c) and "conduct research to ...measure structural BMP effectiveness," (Part II.G.1.a). If PFC is shown to be effective at reducing pollutant load, it may be a cost-effective BMP to implement in impaired watersheds.

List Research Objectives and Tasks:

- Identify areas constructed or maintained by NCDOT where PFC has been implemented.
- Conduct stormwater monitoring to determine the stormwater pollutant profile for runoff exiting the paved surface of a PFC surfaced roadway.
- Compare results to other stormwater characterization data collected for NCDOT ROWs.
- Investigate the viability of PFC as a stormwater BMP for the linear environment.

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

Stormwater characterization data for a PFC surfaced roadway. Recommendations for state-wide application of PFC as a stormwater BMP.

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

If the research project identifies PFC as a viable stormwater BMP, the results will be shared with the NPDES permit writer at NCDENR, with the goal of having PFC be recognized for water quality treatment and/or pollution prevention. The NCDOT may implement PFC in sensitive watersheds to improve surface water quality.

How Will the Product Benefit the Department?

Currently, NCDOT implements land-intensive BMPs, such as bioretention basins, and dry detention basins, in sensitive watersheds. These BMPs require additional, costly ROW. If effective, PFC would be a BMP that integrates easily within the linear environment of the roadway system and acts to prevent pollutants from being generated in stormwater, providing multiple cost savings in design, installation, and maintenance. Additionally, PFC improves motorist safety during storm events.

Other Comments:

Approval (Division official or Unit Head)

David Henderson

 Print Name

 Signature

State Hydraulics Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Ken Pace

DATE: August 12, 2009

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Development of a Standard Engineered Soil Media for Stormwater Bioretention Basins.

Background:

Currently, NCDOT has approximately thirteen bioretention basins installed at various locations along its highway system. This stormwater control device is a type of filtration basin with engineered soil media, an under-drain system, and landscaped vegetation. The basin uses a landscaped mix of water-tolerant plants and soil media to improve pollutant removal.

What is the Specific Problem or Issue?

The engineered soil used in the bioretention basin is a critical component for pollutant removal and the establishment of water-tolerant plants. Currently, there is no standard soil media mixture specification and there have been problems with how some soil mixtures have functioned in past bioretention basin installations because of incorrect soil media structure.

List Research Objectives and Tasks:

- 1) Review the literature to find the best soil mixes used for bioretention basins.
- 2) Develop a standard soil mix that can be cost-effectively used on NCDOT stormwater bioretention basins and can be easily obtained or produced by contractors and suppliers.
- 3) Test the standard soil mix under various conditions to ensure the ideal mix for both pollutant removal and plant growth.
- 4) Develop the specifications for the engineered soil media and develop a process to test the soil media by the Department to ensure conformance with the specification for each contract or installation.

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

The products would be specifications for the engineered soil media for implementation during initial construction and major maintenance of the devices.

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

Since there is no standard (certified) engineered soil mixture available for use in bioretention basins, this standard (certified) engineered soil mixture product would not only be used as part of the installation of all NCDOT bioretention basins but serve as an industry standard for others installing bioretention basins and other types of stormwater control devices.

How Will the Product Benefit the Department?

The soil media is one of the primary factors in determining whether a bioretention basin succeeds or fails. By having a standard engineered soil product, there would be less concern about the composition of the installed soil media and functionality from basin to basin would be more consistent.

Other Comments:

Approval (Division official or Unit Head)

Ken Pace

 Print Name

 Signature

State Env. Operations Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Ted Sherrod

DATE: August 10, 2009

Branch / Unit: Roadside Environmental

TITLE of your Research Idea: Developing Alternative Engineering Design Criteria for High Efficiency Sediment Containment Systems

Background:

Design criterion is unable to keep pace with the changing technology in polymers used for water clarification on construction sites. Many of the current sediment containment systems employ patented, single source, surface outlets to dewater impoundments. Infiltration technology has also been refined and retrofitted for sediment containment systems. Regulatory requirements outline surface area requirements needed for gravitational settling of suspended sediments based on wastewater clarification technology.

What is the Specific Problem or Issue?

Design regulations require extensive footprints for surface area in sediment containment systems; In many cases, DOT is required to purchase easements to accommodate this design requirement. The design requirement is quite dated and needs science based research to validate appropriate criterion.

List Research Objectives and Tasks:

1. Predict, measure, and verify the time for flocculants (using polyacrylamide) to form and time for flocculants to settle at various depths during simulated runoff from 10 yr and 25 yr events for a typical baffled basin using high clay content soil and a high silt content soil (design particle). Measure turbidity, sediment trapping efficiency, and compare against conventional surface area criterion
2. Use this data to develop detention time(s) for various design particles and then apply, $V=Q*t$, where V is basin sediment storage volume in cfs, Q is flow rate in gpm, and t is the detention time in hrs.
3. Validate maximum L:W basin configuration ratio
4. Validate performance on NCDOT construction projects

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

Design criterion for linear construction projects

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

Results from this study would be used by DOT and its Private Engineering Contracting Firms as well as all private development firms in North Carolina.

How Will the Product Benefit the Department?

At present, erosion and sediment related costs total approximately 7-10 % of total construction costs. Precise design criterion could result in appreciable savings to reduce excavation, easements, and structural asset costs.

Other Comments:

Approval (Division official or Unit Head)

Ted Sherrod

Print Name

Signature

State Roadside Env. Field Op. Eng.

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Ted Sherrod

DATE: August 10, 2009

Branch / Unit: Roadside Environmental

TITLE of your Research Idea: RUSLE2 Design Tools for NCDOT

Background:

The Revised Universal Soil Loss Equation, version 2, RUSLE2, is a desktop based design tool developed by USDA scientists and engineers to model soil erosion on agricultural sites. More recently, the application has been expanded to model soil loss (sediment storage) on construction sites, including linear and vertical transportation projects. RUSLE2 provides site specific erosion rates based on soils, climate, topography, vegetative cover, and time of exposure.

What is the Specific Problem or Issue?

Currently, regulatory agencies require a fixed value for sediment storage regardless of geographic location or any of the parameters mentioned above. NCDOT prefers to customize the design to save on construction costs and easements. This task would require modification/customization of the RUSLE2 database and user interface for NCDOT applications.

List Research Objectives and Tasks:

Modify/customize RUSLE2 database and user interface for North Carolina linear and vertical construction design modeling for desktop and/or web based applications

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

Desktop tool/web based tool for designs; user manual and tutorials

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

Design tools for transportation projects for use by DOT engineers in preconstruction and operations as well as private engineering firms under contract with the Department.

How Will the Product Benefit the Department?

Delivers a tool for site specific designs, decreases construction costs, and minimizes easement costs.

Other Comments:

Approval (Division official or Unit Head)

Ted Sherrod

 Print Name

 Signature

State Roadside Env. Field Op. Eng.

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Aketa Emptage

DATE: August 11, 2009

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

TITLE of your Research Idea:

Examining NCDOT Programs and Services to Understand and Meet the Transportation Needs of Limited English Proficient Persons (LEP) in North Carolina

Background:

Typically, the transportation and mobility concerns for LEP persons are no different from those voiced by minority or low-income populations in North Carolina. Compound those issues with lack of access to programs and services due to language barriers, and LEP persons become extremely vulnerable to a decline in social and economic opportunities.

Some transportation and mobility concerns facing these groups are:

- Need for affordable, accessible transportation options
- Vulnerability in emergency transportation response situations
- Competing socioeconomic challenges that preclude intricate involvement in the transportation decision-making process

What is the Specific Problem or Issue?

How does a language barrier impact access to NCDOT programs and services?

List Research Objectives and Tasks:

Confer with interested parties (comm org/leaders) to assess type/level of LEP interaction and daylight concerns with NCDOT; determine which transportation issues are salient to LEP populations and the best practices used to address them.

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

The research will produce a valuable primary resource that captures the issues and concerns of a growing population in the state. This tool would provide the foundation of an effective Limited English Proficiency Program for the Department.

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

The research would be used by the Title VI Section to assess the nature and frequency of contact with the Department by LEP persons in the state. This is a vital component of a four factor analysis required by federal regulations to determine whether the Department is meeting its Title VI obligation to identify and eliminate national origin discrimination.

How Will the Product Benefit the Department?

The Department will receive the following benefits: increased compliance with Title VI; decrease risk of legal and administrative proceedings; effective and efficient public involvement and outreach; sound, cost-effective decision-making in the provision of language assistance, i.e. oral or written interpretations/translations.

Other Comments:

Approval (Division official or Unit Head)

Phillip Bickham

Print Name

Signature

Director, Civil Rights Unit

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Aketa Emptage

DATE: August 11, 2009

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

TITLE of your Research Idea:

Examining NCDOT Programs and Services to Determine Effective Data Collection Methods for Title VI Compliance

Background:

Implementing regulations of Title VI of the Civil Rights Act of 1964, Title 49 Code of Federal Regulations Part 21, requires that recipients have available, racial and ethnic data showing the extent to which members of minority groups are beneficiaries of programs receiving Federal financial assistance. This data collection is the crux of effective monitoring for Title VI compliance and permits quantitative analysis of impacts on program beneficiaries.

What is the Specific Problem or Issue?

Based on the Department's programs and services that come into contact with the public, what mechanisms are, or should be, in place to document the race, color and national origin of program beneficiaries?

List Research Objectives and Tasks:

Determine frequency and type of public contact for each business unit; understand the program beneficiaries of each business unit in NCDOT; examine recordkeeping practices that document demographic data; determine best practices in soliciting demographic data from the public; recommend process improvements to recordkeeping and reporting for compliance

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

This research would produce an instrumental tool for use by the Title VI Section in the internal compliance review process where departmental program area activities are assessed to ensure nondiscrimination in service delivery to program beneficiaries.

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

The Title VI Section will use the research to develop materials for departmental dissemination that will capture demographic data and permit quantitative analysis of data collected.

How Will the Product Benefit the Department?

The Department will receive the following benefits: increased compliance with Title VI; decrease risk of legal and administrative proceedings; effective and efficient public involvement and outreach; sound, cost-effective decision-making in program operations based on knowledge of service area.

Other Comments:

Approval (Division official or Unit Head)

Phillip Bickham

Print Name

Signature

Director, Civil Rights Unit

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Aketa Emptage

DATE: August 11, 2009

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

TITLE of your Research Idea:

Understanding the Benefits of Highway Construction Investments to Zero Car and/or Public Transportation Dependent Households in North Carolina

Background:

For years, there has been an outcry from proponents of public transportation that transportation funding equity formulas favor highway construction over mass transit, thus denying the delivery of equal benefits to transit dependent populations. The majority of public transportation users hail from minority, low-income or traditionally underserved communities. Land use patterns and regional economies further make public transportation essential to the socioeconomic survival of these communities.

What is the Specific Problem or Issue?

Where are the zero car and/or public transportation households in NC, what are their needs and how do NC highway projects benefit them?

List Research Objectives and Tasks:

1. Briefly discuss national highway versus transit funding equity issue and NC funding trends
2. Determine the prevalence and needs of zero car /transit dependent households in NC
3. Examine the types and location of NC highway projects
4. Examine residential/commercial land use trends, NC regional economies and commuting patterns and assess current access to public transportation.

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

The product of this research will be a resource tool to assist the Title VI Section in monitoring the activities of the Department, specifically the Transportation Planning and Project Development and Environmental Analysis Branches. This research will serve as an education and training tool for internal and external program officials.

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

The Title VI Section will use the product to determine compliance with Title VI legislation and related statutes, specifically the Executive Order 12898, "Federal Actions to Address Minority Populations and Low-income Populations", which requires the Department to make such considerations in the decision-making process. Specifically, it will assist the Section with determining the appropriate guidance and technical assistance to program personnel.

How Will the Product Benefit the Department?

The Department will receive the following benefits: sound, cost-effective decision-making in transportation funding patterns; better sited highway projects that benefit public transportation systems and their users; increased compliance with Title VI; decrease risk of legal and administrative proceedings; increased public trust.

Other Comments:

Approval (Division official or Unit Head)

Phillip Bickham

Print Name

Signature

Director, Civil Rights Unit

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Shantray D. Dickens

DATE: August 11, 2009

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

TITLE of your Research Idea:

Review of NCDOT Practices for Ensuring Minority and Low-income Participation in NCDOT Programs and Activities

Background:

Section 601 of Title VI of the Civil Rights Act of 1964 states that “no person in the United States shall on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance.” The Civil Rights Restoration Act of 1987 clarifies that all activities of a federal-aid recipient are covered by Title VI.

Executive Order 12898 requires each federal agency to make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse effects, including social and economic effects, of its programs, policies, and activities on minority populations and low-income populations.

One of the fundamental principles of environmental justice is ensuring “the full and fair participation by all potentially affected communities in the transportation decision-making process.” In practice, however, minority and low-income groups are often harder to reach than non-minority and non-low-income persons, making the achievement of environmental justice more difficult.

What is the Specific Problem or Issue?

Does the participation level of traditionally underserved groups, such as minority and low-income persons, in NCDOT programs and activities constitute the full and fair participation of groups covered under environmental justice law?

List Research Objectives and Tasks:

List programs at NCDOT that have a public involvement/outreach component. Report results of program outreach and how each currently evaluates success. Identify potential barriers to participation for minority and low-income groups, and best practices to overcome them. Propose participation thresholds for what constitutes “effective” inclusion of minority and low-income populations.

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

The research will produce a valuable assessment of the Department’s current level of success at including harder-to-reach populations in the decision-making process and recommendations on how to improve department-wide outreach efforts.

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

The research would be used by the Title VI Section to assess the level of minority and low-income involvement in NCDOT public outreach efforts. This will be a vital component of the Environmental Justice Strategy of the Department, which aims to incorporate the concerns of traditionally underserved populations into departmental programs and plans.

How Will the Product Benefit the Department?

The Department will receive the following benefits: more efficient public involvement and outreach over the long-term; increased compliance with Title VI; decreased risk of legal and administrative proceedings; effective decision-making that meets the needs of all beneficiaries of NCDOT programs.

Other Comments:

Approval (Division official or Unit Head)

Phillip Bickham

Print Name

Signature

Director, Civil Rights Unit

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Majed Al-Ghandour, PE

DATE: August 12, 2009

Branch / Unit: Program Development Branch

TITLE of your Research Idea: Project Risk Management and Quality Management Tools

Background:

The NCDOT Project Management process is a series of planned and organized efforts to accomplish a specific one-time objective. Example would be construct four-lane new highway, or replacing a bridge. Project management includes developing a project plan, which includes defining and confirming the project goals, scope, objectives, identifying tasks and how goals will be achieved, quantifying the resources needed, determining budgets and timelines for completion. Risk Management is an aspect of quality, using basic techniques of analysis and measurement to ensure that risks are properly identified, classified, and managed. In order to manage risks we have to understand what a risk is.

What is the Specific Problem or Issue?

The NCDOT is continuously seeking improvement to its project management and quality tools. There is a lack of risk management plans for the projects and no quality management tools are found. NCDOT needs risk management planning integrated within State Transportation Improvement Program (STIP) and actual projects such as risk identification, risks quantification, risk response, risk monitoring and control. More quality management tools business that follows industry standards such as Six Sigma, etc. are needed for NCDOT project management.

List Research Objectives and Tasks:

- Review current literature relevant project risk management, best practices, and quality tools.
- Analyze collected data from NCDOT project management.
- Identify and quantify risk plans stages.
- Develop models, reports, graphs, simulation, and tools for risk management and quality tools.
- Evaluate current standards and determine measurement systems analysis.
- Provide new knowledge on which NCDOT engineers and practitioners can base their decisions and incorporate better utilize these tools for your business improvement.
- Identify failure modes and determine their effects
- Identify effective problem solving in area of project management.

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

Models, framework, graphs, tools, manuals, guidelines, and applications for NCDOT related to Project Risk Management and Quality Management Tools.

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

- In developing guidelines to identify project risk management and quality controls.
- Allow help transportation engineers and policy makers to quantify problems, risks, and failure.

How Will the Product Benefit the Department?

- The project management will benefit from successful use of established quality management tools and understanding risk management. Enhanced quality and management improvements along with increased customer (public citizens and official) satisfaction are the primary outcomes of proper applications of powerful tools such as quality assurance, failure testing, corrective action, and statistical process control.
- Bring the organization to Six Sigma levels of quality.
- Improving risk identification and capture in early stages.
- Improving the assessment and understanding of risk.
- Improving the ability to identify and influence risk while we still have opportunity in the project lifecycle to do so, and
- By implementing project risk management methods and tools confirm NCDOT chances of completing projects on time, within budget and to within the STIP planned program budget and resources.

Approval (Division official or Unit Head)

Calvin Leggett, PE

 Print Name

 Signature

Branch Manager

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith Corley-Lay**DATE:** July 27, 2009**Organization / Branch / Unit:** Asset Management/Pavement Management**TITLE of the Research Idea:** Improved Freight Model for Strategic Multi-modal Planning

Background: Specific needs to enhance economic growth are reported in the Statewide Logistics Plan for North Carolina(May,2008). This report focuses on the need to have the best information available regarding freight and freight movements, and to develop transportation around these needs. NCDOT recently completed a project to develop a statewide truck model that is based on the FHWA FAF dataset. This new truck model is a step forward, but additional refinement is needed to the inputs as well as the model itself. The results of this improvement will enhance planning of routes and route expansions, interactions with special features like ports, airports and freight terminis. It will allow for more strategic planning of maintenance and rehabilitation of existing pavements to meet our existing and future freight transport needs.

What is the Specific Problem or Issue? Detailed information regarding the types and numbers of freight movements is needed to strategically plan buildout of our road system and to set priorities for pavement and bridge maintenance and rehabilitation. Better freight information is key to multi-model planning of highways, aviation facilities, rail lines and ports. More detailed data and analysis are required than were available for the earlier project.

List Research Objectives and Tasks: This research will acquire the best and most current database for freight transport in North Carolina and will upgrade our previous models based on the improved data. At least the following tasks are involved:

1. Acquire the most current Transearch database for NC and 3 years of updates; updates beyond the end of the project will be deliverable to NCDOT. It may be possible to jointly acquire this data with the Department of Commerce and this possibility should be explored.
2. Evaluate the latest freight model in use at NCDOT using the new data and identify areas that can be improved.
3. Make improvements and provide a user-friendly method for NCDOT to use the improved freight model.
4. Develop training tools that will allow users to work with the new model and to update the model when the yearly database updates are received. Conduct a workshop with NCDOT multimodal, highway, and other interested parties, and including the Freight Logistics Task Force to demonstrate the new model and promote dialogue between potential users.
5. Prepare a final report detailing all aspects of the project.

What Would be the Product[s] of the Research? The products would consist of an improved freight model, a user friendly interface to the model, training tools for new users, training on how to update the model using the yearly database updates, a workshop and the final report. Quarterly reports will be submitted as required by the Research Unit.

How Will You or Others Use the Product[s]? Planning may use the model to prioritize expansions to the highway system. It will be used in intermodal logistics activities to support economic development. Maintenance may use the models to prioritize pavement and bridge rehabilitation in consideration of future freight needs.

How Will the Product Benefit the Department? Having the best available freight data helps NCDOT plan for economic development, to facilitate cooperation with the Department of Commerce, and to assist intermodal activities. This project is part of strategic planning and would result in focusing funds in areas with significant economic impact.

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

Judith Corley-Lay

State Pavement Management
Engineer-----
Print Name-----
Signature-----
Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith Corley-Lay**DATE:** July 21, 2009**Branch / Unit:** Asset Management/ Pavement Management**TITLE of your Research Idea:** Expansion of Truck Network Flow Model to Include Total Traffic**Background:**

The truck network flow model was developed in 2008 and successfully modeled truck flow in North Carolina. It clearly shows the density of truck traffic on Interstate highways and in the urban corridors. However, the model only includes trucks and in the absence of automobile traffic means that it cannot be used to consider capacity or congestion. Capacity and congestion are key focus areas of FHWA and are important measures of system satisfaction by the public as well as impacting the efficient delivery of goods and people.

What is the Specific Problem or Issue?

The existing truck network flow model needs to be expanded to include total traffic. Guidelines are needed on using the expanded model to evaluate capacity and congestion.

List Research Objectives and Tasks:

The objective of this project is a Traffic Network Flow Model that allows consideration of congestion and capacity. The tasks to complete this project should include at least the following:

1. Literature review on use of flow models to evaluate congestion and capacity, methods of expanding truck flow to total traffic and other related topics.
2. Evaluation of existing data to allow expansion of the traffic network flow model. Identify missing information and methods to obtain or estimate it.
3. Expand the model to total traffic.
4. Validate the model for at least one rural and one urban location.
5. Demonstrate use of the model for congestion and capacity identification.
6. Prepare guidelines for use of the model.

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

There are three major products expected from this research: the expanded total traffic flow model is a significant product, the examples on using the model to identify and quantify congestion and capacity will also be a valuable product, and finally guidelines for use of the model will be a product that will enhance its implementation by NCDOT.

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

ITS may be able to use the model to aid in site selection for ITS projects, making this expensive technology more strategically located. Planning can use the model in conjunction with their current applications to improve identification and quantification of congestion. It may also be useful to Roadway Design in evaluation of congestion in project design, although the flow model may not have sufficient detail to allow this use.

How Will the Product Benefit the Department?

Better understanding of traffic flow, traffic streams and freight movement improves our ability to provide a system that is adequate for both automobile and freight traffic. This improves system wide operational efficiency. Reducing congestion reduces commuting times, fuel consumption and air pollution.

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

Judith Corley-Lay

State Pavement Management
Engineer-----
Print Name-----
Signature-----
Title

PAVEMENT AND MAINTENANCE RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Judith Corley-Lay

DATE: July 21, 2009

Branch / Unit: Asset Management/Pavement Management Unit

TITLE of your Research Idea: Relationship between Fuel Prices and Truck Weights

Background:

2008 saw a significant increase in fuel prices that affected the trucking industry dramatically. One approach that a trucking company could use to control costs would be to load each truck heavier and make fewer trips. Increasing axle loads increases pavement damage and will negatively impact infrastructure health.

What is the Specific Problem or Issue?

Can Weigh-In-Motion or Weigh Station data be used to determine if there was an increased load applied to offset the increased fuel costs in 2008? Was there an increased frequency of overweight citations during 2008 and has that frequency reduced with the reduction in fuel costs in 2009? How would these changes impact the pavement system?

List Research Objectives and Tasks:

The objective is to understand how trucking companies coped with the change in fuel prices because this impacts the condition of the pavement infrastructure. The research tasks include at least the following:

1. Literature review on relationship of fuel costs to vehicle loading practices.
2. Collect weight data prior to the 2008 spike, during the 2008 spike and during 2009.
3. Compare truck loadings for the most common truck configurations.
4. Obtain citation information for the pre-, during, and post- spike period. Is there a trend or can the trend be due to other factors (increased # of patrol cars, emphasis program, etc).
5. Determine the impacts of the loading shifts, if any, on the pavement system.

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

The product of this research would be guidance to NCDOT on likely changes in truck weights due to fuel cost changes. This can impact both bridge and pavement management.

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

The product could be used to modify designs for bridges or pavements to take into account the loads that might occur if fuel prices rise again. In any case, it will allow us to quantify the impact of the changes to our infrastructure health.

How Will the Product Benefit the Department?

Improved planning for both bridges and pavements. Quantification of impacts to both classes of infrastructure.

Other Comments:

Approval (Division official or Unit Head)

Judith Corley-Lay

State Pavement Management
 Engineer

 Print Name

 Signature

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Judith Corley-Lay

DATE: July 21, 2009

Branch / Unit: Asset Management/Pavement Management Unit

TITLE of your Research Idea: Rate of Development of Bridge Approach Roughness

Background:

The areas around bridge approaches are historically weaker than adjacent materials. Roadway construction including subgrade preparation with full scale equipment tends to begin some distance from the bridge itself so the contractor building the bridge can get to the worksite. In addition, there is less lateral support for embankment at the bridge making compaction more difficult. The bridge approach slab is placed on this material and over a period of time, ride quality suffers and the underlying material settles.

What is the Specific Problem or Issue?

Can data from the high speed profilometers be used to identify the rate of development of approach slab roughness? What are the key issues leading to poor performance?

List Research Objectives and Tasks:

The purpose is to better understand the factors causing road roughness at approach slabs and the rate at which the roughness develops. The following tasks are among those that should be included:

1. Literature review on "bump at the bridge" ride quality issues, methods of measurement and rate of development.
2. Evaluation of high speed profilometer data history to determine rate of development if possible.
3. Identification of 2 or 3 structures having this issue for a more detailed study.
4. Field work at sites.
5. Laboratory testing of samples.
6. Identification of key issues leading to the ride quality issue.
7. Guidelines to reduce incidence of bridge approach roughness.

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

Products would include a method of analysis of profilometer data to track bridge approach roughness development (if possible), Key factors leading to the issue and Guidelines to reduce this distress.

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

Pavement management will use the method to evaluate profilometer data that we already collect. The key factors and guidelines would be used by construction personnel or maintenance forces to improve performance.

How Will the Product Benefit the Department?

The public values smooth ride over many other aspects of the system. This project is aimed at improving ride quality, which tends to improve vehicle operating efficiency.

Other Comments:

Approval (Division official or Unit Head)

Judith Corley-Lay

State Pavement Management
 Engineer

 Print Name

 Signature

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Clark S. Morrison**DATE:** July 31, 2009**Branch / Unit:** Asset Management / Pavement Management Unit**TITLE of your Research Idea:** MEPDG Inputs for Warm Mix Asphalts**Background:**

NCDOT Research Project # 2003-09 developed typical dynamic moduli for North Carolina asphalt mixes. Correlations between the dynamic moduli and physical properties of the asphalt mixes were also developed. These products will be used in NCDOT's implementation of the Mechanistic-Empirical Pavement Design Guide (MEPDG). Warm mix asphalts are expected to become increasingly common in NCDOT pavements, because of their cost, and environmental advantages. Because they are mixed and placed at lower temperatures, warm mix asphalts may have different physical properties than standard asphalt mixes.

What is the Specific Problem or Issue?

MEPDG inputs developed for standard asphalt mixes may not be applicable to warm mix asphalts. This may lead to pavement designs that have a shorter than expected life, or that are unnecessarily costly.

List Research Objectives and Tasks:

Determine dynamic moduli and other MEPDG inputs for warm mix asphalts. Several warm mix asphalt technologies (foaming, synthetic zeolite, organic additives, etc.) will need to be considered. Determine if MEPDG inputs developed for standard asphalts are applicable to warm mix asphalts. If they are not, provide recommendations on MEPDG input parameters for warm mix asphalts.

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

Recommended MEPDG input parameters for warm mix asphalts.

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

Pavement Management would use the MEPDG input parameters for warm mix asphalts in the design of pavements for TIP projects where warm mix asphalts may be used.

How Will the Product Benefit the Department?

Use of accurate input parameters for warm mix asphalts will help prevent premature failure of pavements and will help prevent design of pavements that are unnecessarily costly.

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

Judith Corley-Lay, PE

State Pavement Management

Engineer

Print Name:-----
Signature-----
Title:

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Neil Mastin**DATE:** July 29, 2009**Branch / Unit:** Pavement Management**TITLE of your Research Idea:** Development and Validation of Pavement Deterioration Models and Analysis Weight Factors for the NCDOT Pavement Management System

Background: The Asset Management Branch of DOT has been involved in the development and deployment of various components of an Asset Management System for several years. The Pavement Management System is currently in place and being used to conduct funding and performance analyses of the highway system. The PMS is expected to be one of the primary tools used in understanding and managing funding shortfalls experienced by NCDOT and how to mitigate the worst effects. One of the key components of a good PMS is deterioration models that reflect real world pavement behavior as closely as possible. Additionally, weighting factors applied to the benefits calculated during cost-benefit based optimization of pavement treatment strategies and funding analysis are important for meeting defined agency goals.

What is the Specific Problem or Issue?

NCDOT Pavement Management has constructed basic models currently being used in the Pavement Management System. PMU is interested in determining first, if there is a need for additional models, possibly based on a regional and or local performance or other factors not yet identified. If that determination is an affirmative, new models and categories will need to be developed and validated. Existing PMU models should also be validated.

When optimizing funding via cost-benefit, the Pavement Management System uses the area under the benefit curve to choose the most efficient projects. This value can be modified by weight factors that should be selected to mesh with the goals of the agency. NCDOT as a whole is evolving to place various levels of emphasis on the highway network using a tier based structure. Understanding and developing weight factors that will maximize benefits based on this structure or other defined goals is critical to achieving the desired performance and assuring that analyses reflect DOT policy and goals.

List Research Objectives and Tasks:

- Evaluate existing DOT models for accuracy and suitability
- Determine the need for additional models and what variables control those needs.
- Refine and validate existing and/or new models
- Determine appropriate variable types to be used for weight factors and appropriate weight values. Variables may or may not exist in the PMS. Examples include Lane-Miles, AADT, System, Tier, etc.
- Develop a method for NCDOT PMU to evaluate and update models and weight factors on a regular basis

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

- A set of deterioration models to be entered into the Pavement Management System
- A set of weight factors to be entered into the Pavement Management System
- Clear and concise method to evaluate and update models
- Clear and concise method to evaluate and update weight factors

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

Any group making use of the PMS for analysis or consuming a PMS product produced by the Pavement Management Unit will benefit from greater accuracy and closer real-world analogs. PMS consumers include engineers from the county level to executive management.

How Will the Product Benefit the Department?

The primary goal of a Pavement Management System is to produce optimal strategies for highway network maintenance. A properly calibrated system will potentially enable NCDOT to obtain maximum benefit from available funding, or looking at it another way, to minimize funding for a desired level of service. Additionally, it provides a tool for executive management to discuss real world funding implications with government and political leaders on a firm analytical basis. At a lower level, the system will suggest appropriate rehabilitation and resurfacing projects that can be used as a multi-year work plan.

Other Comments: It is anticipated that a multi-disciplinary approach will be necessary to conduct this project including Pavement Management Systems and applied statistics expertise.

Approval (Division official or Unit Head)

Judith Corley-Lay, PE

State Pavement Management
Engineer

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Jack Cowsert & Todd Whittington**DATE:** August 21, 2009**Branch / Unit:** Materials and Tests Unit**TITLE of your Research Idea:** Evaluation of Moisture Susceptibility of Warm Mix Asphalt Technologies**Background:**

Warm Mix Asphalt (WMA) is a new technology used to reduce production and compaction temperatures by as much as 50°F in asphalt pavement construction. Benefits of the WMA technology include energy savings, lower exposure to fumes, lower greenhouse gas emissions, and less oxidative hardening. However, the moisture susceptibility of warm mix asphalt remains a concern for users of the technology. So far, NCDOT has addressed these concerns by requiring more frequent testing of WMA mixes to determine their moisture susceptibility.

What is the Specific Problem or Issue?

Although the WMA technology is very appealing in terms of environmental aspects, its long term performance under traffic loading and environmental stress is unknown. The lack of long term performance data makes it challenging to include the WMA mixtures in the design process. Evaluation of long term performance of WMA mixtures using materials from NC will not only allow NCDOT engineers to use this promising technology with more confidence, but also give performance data that can be used to design asphalt pavements with WMA mixtures.

List Research Objectives and Tasks:

The primary objectives are:

1. Investigate the WMA technologies available and their relative performance in moisture susceptibility tests by using actual field-production mix from various producers to determine any correlations between WMA technology and improved moisture susceptibility.
2. Determine what, if any, apparent fixes (hydrated lime, test method alterations, etc.) are available to NCDOT to alleviate concerns related to the moisture susceptibility of WMA.
3. Explore how the use of WMA affects the predicted performance of asphalt concrete mixtures using Superpave testing methods and equipment or other viable tests that can be performed by NCDOT on a production basis.

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

This research would result in a better understanding of the long-term performance of WMA mixtures and how it compares to performance of conventional HMA mixtures.

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

This product will be used by the materials and pavement engineers at NCDOT as a guide on what performance to expect from mixtures designed using the various WMA technologies.

How Will the Product Benefit the Department?

This product will aid NCDOT engineers in determining when and how to use WMA technology and to adopt the energy saving, more environmental-friendly WMA technology with more confidence.

Other Comments:

Researcher should coordinate directly with asphalt producers to determine what processes or products are expected to be used in NC, and perform sample collection of actual production mix. Cooperation from asphalt industry will be encouraged by NCDOT to assist in sample collection and preparation.

Approval (Division official or Unit Head)

Cecil Jones

Print Name

Signature

State Materials Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Dennis Wofford & Jack Cowsert**DATE:** August 5, 2009**Branch / Unit:**

Road Maintenance Unit / Materials and Tests Unit

TITLE of your Research Idea: Effects of Water Exposure on Joint and Crack Sealant

Background: Crack sealing and filling is the most widely used maintenance activity for in-service pavements. This preventive maintenance activity is particularly favored among pavement agencies because it is inexpensive, quick, and well-proven to delay the pavement deterioration caused by other mechanisms, such as weakening of subgrade and aggregate layers caused by water infiltration and stripping of hot-mix asphalt (HMA) layers. If an appropriate sealant material is selected and properly installed at the appropriate time of the pavement life, it retards pavement deterioration and increases its service life at a relatively low cost. However, in some cases it is reported that sealants failed prematurely, mainly due to environmental factors and water exposure. As the result of newly concluded pooled-fund study on the Characterization of Bituminous Sealant a *Performance-Based Guideline* has been developed. In that effort which was sponsored by Federal Highway Administration and the US-Canadian Crack Sealant Consortium, many characteristics of bituminous sealants have been studied and several test methods and thresholds were developed. These test methods have been submitted to AASHTO for their consideration as a set of specifications for bituminous sealant. While the effect of aging, temperature and curing on sealant performance has been considered in the aforementioned study, the effect of water exposure on sealant performance has been neglected. It should be noticed that the various sealants have different water resistance properties; hence they perform differently when exposed to large amount of rain and humidity. In a humid area with high percentage of annual rain this problem can be even more severe. The sealant failure during cold season is most noticeable because of cracks being wide open. While in such cases the failure is mostly attributed to low temperature, the real failure may have been initiated much earlier during the warmer-rainy season due to high amount of water exposure.

Currently, there is no standard test method to evaluate sealant water resistance. Therefore, there is a need for a standard test method and specification which is based on fundamental sealant property and can precisely predict sealant performance when exposed to water. Having such a test method it is expected that a threshold be developed to be able to examine various sealants in terms of their water resistance. That will allow practitioners and maintenance crews to select the right sealant based on the annual precipitation rate and humidity level in their area and to ensure sealant performs well in such an environment.

What is the Specific Problem or Issue? Exposure of joint and crack sealant to water leads to premature failure of sealant. This problem is more severe in States such as North Carolina with a relatively high precipitation rate. In addition, water with different PH can affect sealant performance differently. In industrial areas, runoff will have lower PH than in non-industrial region. Water damage on sealant happens in two ways: 1) Water can penetrate to the sealant and deteriorate sealant physical properties. 2) Water can damage the sealant-aggregate interface causing the sealant to separate from the joint/crack walls. In either case, the sealant will not prevent water and debris from entering the pavement structure. In the first case, there are cohesive failures, where the sealant itself cracks. In second case, the interface is weakened, causing adhesive failure to occur.

List Research Objectives and Tasks: A key goal of this research would be to predict accurately the water susceptibility of sealants used in highway and airport pavements. To accomplish this goal following tasks will be taken:

- 1) Develop test method(s) and procedure to evaluate the effect of water exposure on both physical and interface characteristics of sealants.
- 2) Determine the most relevant test parameters to evaluate water susceptibility of sealants.
- 3) Establish preliminary threshold (s) to ensure sealants perform well under specific environmental conditions.
- 4) Validate and fine-tune the threshold(s) using a field study; four different sections using two sealants commonly used in North Carolina will be built and monitored for three years with yearly interim reports.

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

- 1) Recommended test method(s) to evaluate water susceptibility of sealants.
- 2) Recommend specification criteria and associated limits.

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

- 1) The State Road Maintenance Unit and field operations will use the results to select the right sealant for their area.
- 2) Recommended test methods can be presented in draft AASHTO format
- 3) Test method and specification can be used by State highway agencies, contractors and sealant producers to select appropriate sealants for each specific environment.

How Will the Product Benefit the Department? Results of this study will allow Division personnel to select the most appropriate sealant for highway and airport pavements. It will ensure sealants perform well under specified conditions, hence the result of the study will decrease costs and enhance safety. In addition, the result of this study can be a complement to the new crack sealant performance based guideline which has been developed by newly concluded pooled-fund study sponsored by Federal Highway Administration and the US-Canadian Crack Sealant Consortium.

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: Dennis Wofford

DATE: August 20, 2009

Branch / Unit: State Road Maintenance Unit

TITLE of your Research Idea: Extending the Use of Chip Seals to Higher Volume Roads by Using Polymer-Modified Emulsions and Optimized Construction Procedures

Background:

The findings from the HWY-2007-06 project "Performance Based Analysis of Polymer Modified Emulsions in Bituminous Surface Treatments" clearly indicate that there is a significant improvement in the performance of chip seals when constructed with polymer-modified emulsions and that the curing behavior of these modified chip seals is quite different from that of unmodified chip seals. Although these findings are important for Division Bituminous Supervisors in adopting PME for their chip seal construction, an important question remains as to the extent that PME chip seals can be used for heavier traffic volume roads.

Also, the HWY-2006-06 project showed that changes in rolling patterns can greatly improve aggregate retention performance. However, the emulsion used in this project was CRS-2 emulsion, not PME. The respective findings from these two projects strongly suggest that by using PMEs and by optimizing the construction procedures for modified chip seals, chip seals can indeed be used for higher traffic volume roads than unmodified chip seals can handle.

What is the Specific Problem or Issue?

Guidelines are needed regarding the amount of traffic that the modified chip seals can support. Also, the very different curing and adhesive behavior of PME demands that the construction procedure must be optimized for the modified chip seals in order to maximize the benefits of polymer modification.

List Research Objectives and Tasks:

The objectives of the proposed research are:

1. To optimize construction procedures for polymer-modified chip seals, and
2. To develop guidelines as to how much heavy traffic the modified chip seals can support.

The major tasks to accomplish these objectives are:

- Task 1. Data Gathering on Other States' Practices on the Use of Polymer-Modified Chip Seals
- Task 2. Selection of Materials (granite aggregate and light weight material)
- Task 3. Construction of Field Sections Using Different Rolling Patterns
- Task 4. Laboratory Performance Testing of Unmodified and Polymer-Modified Chip Seals
- Task 5. Development of Traffic Volume Guidelines on the Application of Modified Chip Seals
- Task 6. Final Report

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

1. Optimized construction procedures for polymer-modified chip seals, and
2. Traffic volume guidelines for modified chip seals.

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

The Divisions will be able to use the optimized construction procedures to improve the performance of polymer-modified chip seals. Also, they will use the developed traffic volume guidelines to determine the conditions that the polymer-modified chip seals can satisfactorily support. This will increase the amount of road mileage that each Division can anticipate utilizing chip seals on and thereby thru Pavement Preservation efforts effectively keep our system at required operational levels at a lower cost?

How Will the Product Benefit the Department?

The products of this research will improve the performance of polymer-modified chip seals in North Carolina and provide guidelines for maximizing the benefits of polymer modification. 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.

Other Comments:

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: Wiley Jones

DATE: August 12, 2009

Branch / Unit: Construction Unit

TITLE of your Research Idea: Quantifying Dowel Bar Misalignments

Background:

For our jointed concrete pavements we place dowel bars to help with load transfer between the two adjoining slabs. Two methods for placing the dowels at the appropriate locations are: dowel baskets pinned to the drainage layer and a dowel bar inserter paving machine. Both methods seem to be able to approximately locate the dowels. On most projects there are a few joints where the dowels are misaligned causing concern about the performance of the pavement joint.

What is the Specific Problem or Issue?

How much dowel misalignment is allowable before the performance of the joint is effected.

List Research Objectives and Tasks:

1. To determine the maximum allowable dowel bar misalignment before corrective action is necessary.
2. To determine the best method to measure dowel alignment for both dowel basket placement and DBI placement.
3. What effect does the type of basket have on the measurement for dowel misalignment

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

Recommended specification tolerances for dowel bar misalignment.

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

Improve current specification requirements.

How Will the Product Benefit the Department?

Ensure dowel bar placement is measured to give the best expected performance for our PCC pavements.

Other Comments:

Approval (Division official or Unit Head)

Ron Hancock

 Print Name

 Signature

State Construction Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Julie Hunkins**DATE:** August 4, 2009**Branch / Unit:** Quality Enhancement Unit**TITLE of your Research Idea:** Geosynthetics Material Use at NCDOT

GeoGrid / Geotextile Fiberglass Fabric are a kind of new model materials for reinforcement of road surface and bases. This product is made with coated fiberglass yarn. Fiberglass gridding fabric or cloth offers high tensile strength in vertical and horizontal direction, low elongation, high elastic modulus, high and low temperature resistant properties. Fiberglass gridding fabric offers excellent anti-aging properties and anti-alkali property after being coated.

Fiberglass GeoGrid Fabrics are used in asphalt pavement, the enhancement of cement and concrete pavement of roads. This kind of fiberglass fabrics can also be used in reinforcing of soft soils and road foundations. Industry suggests that compared with the traditional road design, using fiberglass geogrid fabric can reduce costs, increase long work life and prevent reflective crack of pavements in roads; however this has not been substantiated here in North Carolina because we have not fully evaluated this product.

Several VECP's presented by NCDOT contractors included the use of geosynthetic materials. The fact that several contractors have proposed using these materials the over last several years suggest that the Department may not be using these new materials to their full advantage. Reports by industry and other states suggest that NCDOT could possibly cut costs and add value to our roads by using more of the geosynthetic materials in our road foundations and pavements.

Geotechnical Unit and Pavement Management Unit personnel are the experts on this use and, based on discussions the Quality Enhancement Unit has had with them, there are varying opinions on the benefits of GeoGrid/Geofabric use by different personnel within these two units. There are conflicting opinions of the benefits of Geogrid/Geofabric for stabilization in undercut areas and for soil stabilization for pavements. While vendors provide information about new products, such as GeoGrid, is available but without trial use results, we have no definitive knowledge on which to base a decision on the best use of these materials.

The Quality Enhancement Unit suggests that a study or research be performed by the Research Unit to determine if/how these products can and should be used and to quantify the benefits that can be derived on the projects that the department is undertaking. As an initial part of the research, we suggest that the Research Unit conduct a meeting between the Geotechnical Unit, Pavement Management Unit, Quality Enhancement Unit and any other interested unit to determine the varying issues and concerns related the use of these products and decide on the specific questions that should be answered by the research. In addition, the following questions should be included as part of the research: How are these products currently used and by whom? What are the results of these products under different uses (include data)? What application may lend themselves to application here in North Carolina?

Approval (Division official or Unit Head)

Julie Hunkins

Print Name

Signature

Manager, Quality Enhancement Unit

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Jonathan Arnold

DATE: August 24, 2009

Branch / Unit: State Road Maintenance Unit

TITLE of your Research Idea: Comparison of Data Collection Vehicles to Human Collection Methods.

Background: NCDOT gathers data on the maintenance condition of our highways every two years for our Maintenance Condition Assessment Program (MCAP). This data is collected on a sample set of routes that will result in a measure of performance by the type of route, i.e. Interstate, Primary, and Secondary and by county. In order to ensure that the data collected is statistically significant, relatively large sample sizes are typically collected by Department personnel. The 2008 MCAP data collection effort involved over 100 assessors to collect data on over 23,250 0.2 mile samples at a cost to the Department of over \$1.8 million. This data is then analyzed and compiled into a report that is presented to the Legislature in the Fall of all the even years as directed by General Statute. This report is a tool the Department employs to justify our existing funding levels and to pursue additional funding if the need is identified.

In 2007 the Department embarked on a new type of contracting; known as "Performance Based Maintenance" that requires the collection of this same maintenance condition data on a more frequent interval of every six months to insure the contractor's performance during the assessment period. Because his payment is directly related to his performance, the accuracy of these surveys is vital. Estimates show that NCDOT has spent an average of \$60,000 per assessment over the course of the four assessments and utilized approximately 20 different assessors. This outlay of resources is for a single pilot project in Charlotte and would expand exponentially if the performance based contracting program were expanded. Of course, this estimate in no way represents the significant risks that our employees experience in the pursuit of this data collection as they are exposed to Interstate traffic volumes in the Charlotte Metropolitan area that range on average from 60,000 vehicles per day on I-485 to over 150,000 vehicles per day on I-77.

In addition, there has been significant difficulty in using the same locally based assessment teams for each assessment, which has led to some bias and discrepancy in the assessment results. An option to address this issue has been to utilize centrally located forces that have no local ties to the Division being assessed, but this leads to even higher costs due to the overnight travel that is often required.

What is the Specific Problem or Issue? A safer and more efficient approach is needed to collect all of the data that is necessary to meet the intentions of our Maintenance Condition Assessment Program and the Performance Based Maintenance Contract (PBMC) in Charlotte. The current approach utilizes many different human assessors that collect data on a significant number of selected samples of our roadways, making the current methodology prone to assessor bias and most importantly exposes the assessors to extremely unsafe conditions. The Department needs to evaluate alternatives to our current approach of human data collection for the sake of efficiency, consistency, and most importantly safety.

The assessments performed on the PBMC are done more frequently and on a much smaller scale given that the contract only addresses 135 miles of highway as compared to the nearly 80,000 miles of highway that MCAP addresses. This makes the PBMC assessment an excellent opportunity to test and compare alternative strategies for data collection and analysis.

List Research Objectives and Tasks:

Objectives:

1. Determine the cost of data collection for our maintenance condition assessments with the use of vehicles specially equipped for automated data collection activities as compared to our traditional methods.
2. Determine the speed at which maintenance condition data can be collected (including any post-processing) with a data collection vehicle.
3. Determine the accuracy at which condition data can be collected with a data collection vehicle.
4. Determine the accuracy at which inventory data can be collected with a data collection vehicle.
5. Identify the strengths and weaknesses of such a data collection vehicle.
6. Identify the equipment/resources necessary for automated data collection activities.

Tasks:

1. Compile any previous research done on automated data collection including data from the 2008 National Highway Asset Inventory Workshop held in Durham NC
2. Use previous research data to determine man-hours needed, accuracy level desired and approximate cost to perform analysis of 135 miles of roadway in Charlotte NC and report data as well as issues associated with collection
3. Collect data on 135 miles of interstate roadways in Charlotte and post process as needed to determine the roadway score tracking and reporting hours of post processing and all costs associated
4. Compare post processed data with NCDOT's hand collected data and determine variance rates
5. Analyze costs and hours of each collection method and report data

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

Report that describes the viability of these vehicles for data collection activities and the costs associated with their use as compared to traditionally collected data for the Department. A set of guidelines and/or specifications for the use of these vehicles include recommendations on which elements could be most effectively collected using this technology.

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

If viable, data collection vehicles could change data collection efforts throughout the Department. The report would provide a basis of analysis and justification for the purchase of data collection vehicles or provide enough data to show that contracting this function would be more cost effective. The guidelines and specifications would be used to then develop purchasing documents or contracts for the use of these vehicles.

How Will the Product Benefit the Department?

Automated data collection vehicles have been available on the market for about 10 years now and the technology has increased substantially over the original vehicles. These vehicles can potentially help the Department increase data collection efficiency, reducing data collection costs, and would certainly increase safety by preventing our forces from performing assessments along the roadside. The data collected would also become more reliable as there would not be as many sources of data collection required since such a vehicle could potentially replace many teams and would only require a small crew to post process the collected data.

The potential to reduce costs over our current data collection methods are significant, considering the vast volume of samples needed to represent our system with the appropriate confidence and our average cost to collect data on a single 0.2 mile sample was approximately \$80. This new method could give us data for up to a 100% network coverage with only one pass of the vehicle along a roadway that we could use as needed for condition assessments conducted from the safety of the office. Also, since the vehicle collects the data at highway speeds and the analysis can be performed on computers in the office, there is no time spent on the roadside with personnel walking and measuring features, which will lead to significant anticipated time savings. The risk associated with this data collection will undoubtedly be reduced due simply to the fact that our personnel will not spend nearly the time collecting data manually along the roadways that are all open to traffic with no traffic control.

Other Comments:

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: C. K. Su

DATE: August 11, 2009

Branch / Unit: Materials and Tests Unit

TITLE of your Research Idea: Evaluation of the Relationship Between Soil Indices, Moisture Content and Undrained Shear Strength for Soils in North Carolina

Background:

In the highway building industry, the soil indices tests (liquid limit and plastic limit tests), are commonly used for soil classification only. It is rare to apply or correlate the values to other engineering properties. Contrarily, for the last 30 years, much research has been done on the theoretical and practical correlation of the indices tests. These correlation formulae are well accepted in EU Countries.

What is the Specific Problem or Issue?

Common practice for field soil compaction acceptance is to achieve a target density. In many cases the final product meets the specified density; but is not stable due to lack of strength. Currently NCDOT utilizes proof rolling or Dynamic Cone Penetrometer to identify these kinds of problems. The issue is those methods are after-the-fact verification, which means the product has already been placed. Whatever the remedies we choose oftentimes will impose extra cost at the end. Could we develop a methodology to predict the soil behavior before construction begins?

List Research Objectives and Tasks:

1. Comprehensive evaluation of current knowledge of the correlations between soil indices and soil undrained shear strength.
2. Comprehensive test plan to evaluate the relationships for representative soils from North Carolina.
3. Develop the correlation between typical soils found in North Carolina if one exists.

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

Graphs, Charts or formulae that correlate the soil indices, moisture content and soil undrained shear strength. The product(s) should be easily applied by designers and field personnel.

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

By using the research product(s), the designers or planners can use the soil indices values provided by the Soils Laboratory to estimate the expected soil strength for the pavement structure. In addition to the required density, the field personnel can use the product(s) to verify the approximate soil strength based on the in-situ moisture content.

How Will the Product Benefit the Department?

This product could minimize the low strength incidents by providing valuable information beforehand. It translates into hundreds and thousands dollars of saving. Also the successful product(s) could be the first installment of developing a novel methodology to minimize the unnecessary undercut problems.

Other Comments:

A separate goal for the NCDOT will be to determine similar correlations for resilient modulus to be used in the MEPDG, but this research concentrates more on field predictions of strength to avoid constructing an embankment that is unstable and must be removed and replaced, resulting in project delays.

Approval (Division official or Unit Head)

Cecil Jones

Print Name

Signature

State Materials Engineer

Title

STRUCTURES AND CONSTRUCTION RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Njoroge Wainaina

DATE: August 12, 2009

Branch / Unit: Highway Design Branch / Geotechnical Engineering Unit

TITLE of your Research Idea: Field Verification of Undercut Criteria and Alternatives for Subgrade Stabilization in the Piedmont Area

Background:

The research project "Undercut Criteria and Alternatives for Subgrade Stabilization" (HWY-2008-07) is just completed, and the research appears to produce valuable results to achieve its objectives. A follow-up research "Field Verification of Undercut Criteria and Alternatives for Subgrade Stabilization" (HWY-2008-13) is scheduled to start soon to verify the results of the research project 2008-07 at a construction project in the coastal region. The research project 2008-13 will be limited to the field verification in the coastal region due to the budget constraint even though field verification is necessary for project in the piedmont region. This research project is proposed to perform Phase II field verification of the results of the research project 2008-07 at a construction project in the piedmont region to provide comprehensive undercut criteria and alternatives for subgrade stabilization for all NCDOT highway projects.

What is the Specific Problem or Issue?

A field verification of the results of the research project 2008-07 for the piedmont soils is necessary, but it is not included in the research project 2008-13 due to the limited budget. Applying the results of the research projects 2008-07 and 2008-13 without a field verification for the piedmont soils may result in overly conservative undercut or uneconomical application of alternatives for subgrade stabilization.

List Research Objectives and Tasks:

1. Perform a field verification of the undercut criteria and the alternatives for subgrade stabilization developed from the research project 2008-07 at a construction project in the piedmont region.
2. Conduct additional field and lab testing to develop a correlation between DCP, CBR, and shear strength values.
3. Confirm or modify the undercut criteria and the alternatives for subgrade stabilization based on the results of the field verification.
4. Present comprehensive undercut criteria and alternatives for subgrade stabilization for all NCDOT highway projects.

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

Comprehensive undercut criteria and alternatives for subgrade stabilization for all NCDOT highway projects.

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

NCDOT Geotechnical Engineering Unit will use the products for subgrade design recommendations during the design phase of all highway projects in which subgrade stability is an issue. NCDOT construction personnel will use the products to verify subgrade stability during the construction phase of all highway projects in which subgrade stability is an issue.

How Will the Product Benefit the Department?

The research products will provide our geotechnical engineers and construction personnel with the tools for optimum design and construction of subgrade, which will result in significant cost savings and accelerated construction, as well as minimize construction disputes and claims and undercut quantity and cost overrun.

Other Comments:

Approval (Division official or Unit Head)

Njoroge Wainaina

Print Name

Signature

State Geotechnical Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Mohammed A. Mulla

DATE: August 12, 2009

Branch / Unit: Geotechnical Engineering Unit

TITLE of your Research Idea: SPT Hammer Continuous Energy Measure and Calibration

Background:

The Standard Penetration Test (SPT) is widely used in geotechnical investigation to estimate soil strength. An SPT hammer drives a split barrel sampler at the bottom of a drive rod and recovers soil samples. The number of blows required to drive the last one foot is the "N value", and indicates soil strength. Based on our experience the SPT hammer energies can vary greatly even among the type of hammers. The hammer performance will influence the N value and the variations in this value can be traced to the hammer the hammer transfer energy. The ratio between the measured energy transferred to the rod and the theoretical potential energy of the hammer are vary widely. This ratio will compensate for the wide variability of the estimates obtained from the SPT test.

What is the Specific Problem or Issue?

1. The hammer energy is very hard to estimate without testing.
2. The N value is not reliable due to the variety of the SPT hammer efficiency.
3. It is not practical to assume that the correction factor for all hammers is the same.

List Research Objectives and Tasks:

1. Collect data for automatic SPT hammer energy and provide a summary of the deficiency of the energy and the reasons.
2. Develop a system including software that can be used during the SPT operation to determine the hammer energy and to measure the energy transferred by the Standard Penetration Test (SPT) hammer to the SPT rod and record the blow counts (N).
3. The system shall be reusable and shall not exceed \$4000

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

1. A device that will be hooked or can be wirelessly connected to the SPT W rod
2. Software to evaluate the results form the SPT reading that can generate a report for efficiencies and the blow counts and how to be corrected when used for design.

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

Any drill rig used for NCDOT work will benefit from this research. The in house and our consultant's rigs will use this device to estimate the actual efficiency of the hammer which results in a better design.

How Will the Product Benefit the Department?

It will assist the Geotechnical Engineering Unit implementing the LRFD more accurately and more efficiently. Instead of checking the efficiency in each hammer once a year this system will measure it continuously and that will limit our assumption from over or under estimating the N value.

Other Comments:

Approval (Division official or Unit Head)

Mohammed A. Mulla

Print Name

Signature

Assist. State Geotechnical Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith B. Corley-Lay**DATE:** July 21, 2009**Branch / Unit:** Asset Management/Pavement Management Unit**TITLE of your Research Idea:** Optimal Timing of Bridge Washing to Reduce Chloride Penetration

Background: NCDOT has made significant strides in developing preservation tools for infrastructure. One tool for concrete bridge preservation is bridge deck washing. This is a low cost activity that can be conducted by state maintenance forces and that can reduce damage to steel by reducing chloride penetration. The chloride is introduced during winter weather to prevent ice formation, so the amount of exposure is variable across the state.

What is the Specific Problem or Issue?

How frequently must bridge washing occur in order to reduce chloride penetration into the bridge deck? Is the same frequency required throughout the state, or does it vary by region. What environmental concerns need to be considered in performing bridge washing?

List Research Objectives and Tasks:

It is anticipated that this project will consist of the following tasks:

1. Conduct a literature search of similar work related to bridge washing both in the US and abroad.
2. Develop a test plan on how best to evaluate various washing scenarios for different exposure levels. This should include consideration of best methods to measure chloride penetration and/or condition of reinforcement.
3. Perform testing to measure effectiveness of bridge washing on chloride penetration.
4. Develop guidelines for maintenance forces on "best practices."
5. Identify environmental issues and develop maintenance guidelines for bridge washing activities.

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

This work should result in best practices guidelines for maintenance forces on the efficacy and timing of bridge washing. It will also include guidelines for environmental issues in deck washing.

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

The product will be used by maintenance forces and by bridge management to extend the life of concrete bridge decks by reducing chloride attack on steel reinforcement.

How Will the Product Benefit the Department?

Bridge washing is a low cost activity. Deck replacement is a very high cost activity. Conversion to a program that emphasizes low cost treatments will save money and maintain the condition of the infrastructure.

Other Comments:

This idea was generated as part of discussion by the joint FHWA/NCDOT task group on preservation of pavements and structures.

Approval (Division official or Unit Head)

Judith Corley-Lay

State Pavement Management
Engineer

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Cecil Jones**DATE:** August 17, 2009**Branch / Unit:** Materials and Tests**TITLE of your Research Idea:** Internal Curing of Concrete using Lightweight Aggregate

Background: For a number of years, it has been recognized that the increased absorptive capacity of lightweight aggregate can be used to deliver moisture into concrete for enhanced curing. However, this topic has only recently become the topic of increased interest and research. The American Concrete Institute (ACI) has recognized the potential of this concept by sponsoring a technical session on the topic and is developing a publication on the topic. The use of prewetted lightweight aggregate to deliver internal curing moisture to concrete is of significant value for bridge and transportation related applications. Such applications are often subject to less than optimal curing conditions, either due to environmental conditions or construction related issues, which can have significant negative impact on the long-term performance and durability of the concrete. This is especially important for bridge decks and pavements. Internal curing water is typically delivered by replacing a portion of the normalweight fine and/or coarse aggregates with prewetted lightweight fine or intermediate aggregate. Limited research has been performed on internal curing using mortar mixes and some limited experience has been obtained using internal curing in pavements. From these studies, it appears that internal curing using prewetted lightweight aggregate can improve strength and durability properties of concrete. Since the benefits of internal curing are dependent on the type and quantity of lightweight aggregate used, research is needed to demonstrate the benefits for aggregates used in North Carolina. If the benefits are confirmed, the use of lightweight aggregate for internal curing could provide both structural and durability benefits leading to more economical bridges and pavements.

What is the Specific Problem or Issue? Evaluate the performance of concrete with prewetted lightweight aggregate used to deliver internal curing moisture. Determine ratios of replacement of normalweight fine and/or coarse aggregate with prewetted lightweight aggregate that are effective in providing enhanced performance of concrete. Compare the performance of the internal curing mix designs to a typical normalweight concrete mix design for both bridge decks and pavements.

List Research Objectives and Tasks:

1. Perform a literature review for current research and other published experience with internal curing using prewetted lightweight aggregate in concrete.
2. Identify typical normalweight concrete mix designs that conform to current NCDOT specifications for both bridge deck and pavement applications. Obtain typical aggregate gradations for normalweight aggregates used in these mixtures.
3. Obtain samples and determine characteristics of local lightweight aggregates that are related to internal curing.
4. Develop conceptual framework and objectives for designing internal curing concrete mixtures to use local aggregates.
5. Develop a range of mix designs for bridge deck and pavement that can be used to evaluate performance of internal curing concrete mixtures.
6. Develop a test program to which each of the mixtures would be subjected to measure the following quantities at appropriate time intervals: compressive strength, tensile strength (splitting tensile and modulus of rupture), modulus of elasticity, density, freezing and thawing resistance, permeability (rapid chloride penetration and air permeability), scaling, and concrete abrasion. Other properties may also be measured including creep, shrinkage, cracking potential (ring test) and thermal properties (coefficient of thermal expansion).
7. Prepare and cure the specimens needed for the testing program.
8. Perform laboratory tests according to the test program.
9. Evaluate laboratory test results and make comparisons between the types of concrete tested.
10. Evaluate effectiveness of internal curing for concrete and develop proposal for proportioning internal curing mixtures.
11. Propose project standard specifications to address use of internal curing mixtures.

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

A clear evaluation of the performance of internal curing of concrete bridge decks and pavements using prewetted lightweight aggregate and recommendations for implementation if testing indicates benefits.

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

The results of the project will be used by the Department and others involved in the design and construction of transportation structures to improve the quality and durability of concrete bridge decks and pavements in NC.

How Will the Product Benefit the Department?

The results of this study will allow the Department to determine whether the use of prewetted lightweight aggregate for internal curing of concrete can be used effectively to improve the quality and durability of concrete bridge decks and pavements in NC. If the study reveals clear advantages to using internal curing with prewetted lightweight aggregate, and these benefits are shown to improve either the initial or long-term cost of the concrete, the Department may establish policies that define the conditions in which the use of internal curing should be used.

Other Comments:

Lightweight aggregate may be supplied for the project at no cost/reduced cost by Carolina Stalite Company, the lightweight manufacturer in North Carolina.

Approval (Division official or Unit Head)

Cecil Jones

Print Name

Signature

State Materials Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Cecil Jones**DATE:** August 17, 2009**Branch / Unit:** Materials and Tests**TITLE of your Research Idea:** Durability of Lightweight Concrete Bridge Decks – Field Evaluation**Background:**

The Department has occasionally used lightweight concrete bridge decks since their first known use in NC on the I-26 bridges over the Green River, which were completed in 1968. It is reported that lightweight concrete bridge decks have reduced permeability and cracking compared to normalweight concrete bridge decks. If this is confirmed, the use of lightweight concrete could provide both structural and durability benefits leading to more economical bridges. The confirmation of improved durability should include the evaluation of both the performance of existing bridges with lightweight concrete decks and the laboratory testing of lightweight concrete bridge deck mixes. This research statement addresses the first of the two studies. The two studies should be conducted simultaneously.

What is the Specific Problem or Issue?

Evaluate the field performance of lightweight concrete bridge decks, comparing to normalweight concrete in the same structure or environment where possible.

List Research Objectives and Tasks:

1. Identify existing bridges with lightweight concrete decks in various types of conditions, including environmental and traffic exposure and age of structure.
2. Select several projects covering a range of conditions and ages. Identify a similar normalweight concrete structure for direct comparison where possible.
3. Collect plans, mix designs and other design, construction, maintenance and operations information on the selected bridges, including information on the exposure of the deck to deicing salt applications and atmospheric salt.
4. Evaluate field condition of the selected lightweight and normalweight concrete bridge decks, including determining the density and depth of cracking on these decks.
5. Obtain cores and other samples from the decks to determine depth of cracking and for laboratory evaluation. Evaluate condition of deck reinforcement when exposed by coring.
6. Evaluate samples removed from structures, measuring chloride penetration and permeability, along with other properties as possible.
7. Evaluate the results and make comparisons, including the effect of design, construction, specifications, maintenance and operations on performance.
8. Recommend changes to design and construction methods and specifications as needed.

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

A clear evaluation of the field behavior of lightweight concrete decks and a direct comparison of the behavior of lightweight concrete bridge decks to normalweight concrete bridge decks subjected to similar conditions.

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

The results of the project will be used by the Department and others involved in the design and construction of bridges to improve the quality and durability of lightweight concrete decks in NC.

How Will the Product Benefit the Department?

The results of this study, combined with the companion laboratory study, will allow the Department to make informed decisions regarding the use of lightweight concrete for bridge decks in NC. If the study reveals clear durability advantages to using lightweight concrete for bridge decks, and these benefits are shown to improve either the initial or long-term cost of the structure, the Department may establish policies that define the conditions in which the use of lightweight concrete should be used to provide a more structurally efficient and longer-lasting bridge structure.

Other Comments:

Carolina Stalite Company, the lightweight aggregate manufacturer in North Carolina, has agreed to offer technical assistance with this project, including the use of their database of lightweight concrete bridge decks in the state.

Approval (Division official or Unit Head)

Cecil Jones

Print Name

Signature

State Materials Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA

Your Name Cecil Jones

DATE: August 17, 2009

Branch/Unit: Materials & Tests Unit

TITLE of your Research Idea: Durability of Lightweight Concrete Bridge Decks – Laboratory Evaluation**Background:**

The Department has occasionally used lightweight concrete bridge decks since their first known use in NC on the I-26 bridges over the Green River, which were completed in 1968. It is reported that lightweight concrete bridge decks have reduced permeability and cracking compared to normalweight concrete bridge decks. If this is confirmed, the use of lightweight concrete could provide both structural and durability benefits leading to more economical bridges. The confirmation of improved durability should include the evaluation of both the performance of existing bridges with lightweight concrete decks and the laboratory testing of lightweight concrete bridge deck mixes. This research statement addresses the second of the two studies. The two studies should be conducted simultaneously.

What is the Specific Problem or Issue?

Evaluate the performance of sand-lightweight and all-lightweight concrete bridge deck concrete in the laboratory with emphasis on durability. Compare the performance of the lightweight mix designs to a typical normalweight concrete mix design.

List Research Objectives and Tasks:

1. Identify or develop a sand-lightweight concrete deck mix design that conforms to current NCDOT specifications. Identify or develop an all-lightweight concrete mix design that would conform to current NCDOT specifications except for density. Identify a typical normalweight concrete mix design that conforms to current NCDOT specifications.
2. Develop a test program to which each of the mixtures would be subjected to measure the following quantities at appropriate time intervals: density, compressive strength, tensile strength (splitting tensile and modulus of rupture), modulus of elasticity, creep, shrinkage, thermal properties (coefficient of thermal expansion), permeability (rapid chloride penetration and air permeability), freezing and thawing resistance, scaling, cracking potential (ring test), and concrete abrasion.
3. Obtain concrete from a ready mix plant. Prepare and cure the specimens needed for the testing program.
4. Perform laboratory tests according to the test program.
5. Evaluate laboratory test results and make comparisons between the types of concrete tested.
6. Compare laboratory test results to results from the field evaluation of the performance of lightweight concrete bridge decks.
7. Recommend changes to mix designs and specifications as needed.

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

A clear evaluation of the laboratory behavior of lightweight concrete decks and a direct comparison of the behavior of lightweight concrete to normalweight concrete.

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

The results of the project will be used by the Department and others involved in the design and construction of bridges to improve the quality and durability of concrete bridge decks in NC.

How Will the Product Benefit the Department?

The results of this study will allow the Department to make informed decisions regarding the use of lightweight concrete for bridge decks in NC. If the study reveals clear durability advantages to using lightweight concrete for bridge decks, and these benefits are shown to improve either the initial or long-term cost of the structure, the Department may establish policies that define the conditions in which the use of lightweight concrete should be used to provide a more structurally efficient and longer-lasting bridge structure.

Other Comments:

Lightweight aggregate may be supplied for the project at no cost/reduced cost by Carolina Stalite Company, the lightweight manufacturer in North Carolina.

Approval (Division official or Unit Head)

Cecil Jones

Print Name

Signature

State Materials Engineer

Title

TRAFFIC AND SAFETY RESEARCH IDEAS

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Majed Al-Ghandour, PE**DATE:** August 12, 2009**Branch / Unit:** Program Development Branch***TITLE of your Research Idea: Volume Warrants and Costs for Roundabout Right-Turn Lanes***

Background: In recent years, roundabouts have become progressively more popular as an innovative operational and safety key for both low- and high-volume travel demands. They must be designed to meet the needs of all road users, including vehicle drivers, pedestrians (including those with disabilities such as visual impairment), and bicyclists. Research indicates that well designed roundabouts can be safer and more efficient than traditional intersections because they present fewer conflict points and thus reduce the likelihood and severity of collisions. As modern roundabouts gain popularity in the U.S. (1500 roundabouts) and in the North Carolina (60 roundabouts), consideration of the effects of right-turn lanes (called slip lanes), separate right-turn lanes that lie adjacent to a roundabout, also gain importance. Right-turn lanes reduce crashes, allow right-turning movements to bypass a roundabout, intend to facilitate right-turn traffic flow, reduce approach delay, and may reduce vehicle conflicts; yet, warrants or guidelines or costs are not clearly established for single or multi-lane roundabouts. The goals of this proposed research idea are to determine when a right turn lane is needed at roundabout (numbers and locations), when treatments by themselves are adequate, what volume threshold requires neither treatments nor turn lanes and how much costs add to the total roundabout cost (right-of-way and construction). This in turn will allow for better volume warrants for right turn lanes and eventually lead to more cost-effective intersection safety plans and programs. Both rural and urban roundabouts, and types such as single, multi-lane, raindrop (teardrop), roundabout interchange, and turbo, would be examined in this study.

What is the Specific Problem or Issue? The NCDOT is continuously seeking improvement to its traffic operation and safety for several intersections including roundabouts. Warrants, guidelines, and costs are not clearly established for a single or multi-lane roundabouts right-turn lane. How NCDOT transportation planners, traffic engineers and decision-makers, efficiently, determine when a right turn lane is needed at a roundabout? What are the total numbers of right- turn lanes is needed and number of lanes and their locations? Is it feasible to install right- turn lane and adding extra cost to right-of way and construction?

List Research Objectives and Tasks:

- Review current literature relevant to roundabouts Right- turn lanes operations, safety and cost-benefit.
- Analyze collected right- turn lane data from NC sites.
- Identify and quantify the volume warrants, truck percentages and other parameters affect right- turn lane design and performance in terms of performance, safety, and economic analysis.
- Develop models, reports, graphs, and tools to warrant volumes including thresholds values per roundabout area type.
- Identify number of right- turn lanes per roundabout.
- Determine multi-right- turn lane effects on single-lane roundabout and multi-lane roundabout.
- Evaluate right- turn lane effect on pedestrians crossing.
- Evaluate right- turn lane effect on bicyclist and large truck traffic.
- Provide new knowledge on which NCDOT engineers and practitioners can base their decisions on the use of right- turn lanes at roundabouts.

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

Models, framework, graphs, tools, manuals, guidelines, and applications for NCDOT related to roundabouts Right- turn lane per types.

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

- To develop guidelines to warrant volumes and numbers of right- turn lanes if needed as treatment.
- To help transportation engineers and policy makers to quantify roundabouts right- turn lanes in terms of safety and cost.

How Will the Product Benefit the Department?

- Improve NCDOT efficiency through guidelines, simulation, and models.
- Improve accountability for NCDOT roundabouts projects in front of the public, officials, and decision-makers.
- Evaluate the effects of right- turn lane on the operating and safety characteristics of the roundabouts.
- Use analysis, visual models, and tools to make NCDOT investment efficient if a roundabout right- turn lane is adequate or not.

Indicate short term and/or long-term benefit

- Right- turn lanes for roundabouts present several safety benefits: substantial reduction of crash rates, crash severity, and improving pedestrian's safety.
- Improve accountability on those NCDOT roundabouts projects for the public and decision-makers.

Approval (Division official or Unit Head)

Calvin Leggett, PE

Print Name

Signature

Branch Manager

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Joel Setzer

DATE: August 10, 2009

Branch / Unit: Division 14

TITLE of your Research Idea: Performance of Weathered Steel Guardrail in NC

Background:

The FHWA has begun resisting allowance of weathered steel guardrail as an option due to accelerated deterioration in other states.

What is the Specific Problem or Issue?

Weathered steel guardrail has performed well in Division 14. There are many projects within national lands that weathered steel guardrail has been an effective aesthetic treatment instead of galvanized rail.

List Research Objectives and Tasks:

Determine the performance of the product in NC. Just because one state had performance issues does not mean we should not use it here.

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

Information about performance of weathered steel in various states. Also identification of reasons for performance, and causes of non-performance.

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

With favorable results, NCDOT will be able to deploy weathered steel guardrail in North Carolina.

How Will the Product Benefit the Department?

The allowed use of this material will keep aesthetically pleasing guardrail affordable.

Other Comments:

Approval (Division official or Unit Head)

Joel Setzer

 Print Name

 Signature

Division Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Jeff Jaeger

DATE: August 17, 2009

Branch / Unit: Mobility and Safety Information Engineer

TITLE of your Research Idea: Methodology and Technology for Crashes Analysis at the Intersections and its turnings and VMT

Background: The Federal Highway Administration (FHWA) has identified that the intersection safety is a serious problem in the United States, and addressing this problem is one of the FHWA's top priorities. As the FHWA research, the intersection crashes account for more than 45 percent of all crashes nationwide. In 2004, more than 2.7 million intersection-related crashes occurred, accounting for more than 45 percent of all crashes in the United States. That same year, intersection fatalities were 9,117 or 21 percent of all traffic fatalities. In addition, approximately 45 percent of all injury crashes, or nearly 900,000 crashes, occurred at intersections. Each year, side-impact crashes, which occur mostly at intersections, cause more than one-third of all vehicle occupant deaths. It is also a serious issue in the NC. The intersection crashes are strongly related to the turning counts, the vehicle miles of travel (VMT) and the annual average daily traffic (AADT) at the intersections. In order to provide useful information for the mobility and safety and its plan strategy, we need to have an effective methodology and technology for analyzing the intersection crashes, turning counts, VMT and AADT at the intersections in the NC, and collecting these related information. It is one of the high priorities to reduce the crashes and loss, and save the lives.

What is the Specific Problem or Issue? The intersection safety is a serious problem in the United State, and an important issue in the state. The turning counter data are not widely covering the state. On the other hand, the camera monitors at many major intersections with sufficient valuable information have not offered the turning count information at the intersections automatically. Furthermore, the VMT, AADT and turning data may not be available at local intersections due to a lack of monitors and counters there. Thus, the specific problems include how to provide correct traffic turning counts by effectively utilizing the available camera monitors information at the intersections, what is an effective technology for automatically generating it, how to have and apply the AADT, VMT and turning information at the intersections to the analysis, and what is an effective methodology to analyze and predict the crashes rate at the intersections by the related information for the state safety strategy and plan.

List Research Objectives and Tasks: Develop an effective methodology to analysis and probabilistically predict the traffic accidents at the intersections, and a technology to automatically generate the turning counts based on the camera image information.

What Would be the Product[s] of the Research? A system or methodology for analyzing and probabilistically predicting crashes at the intersections by using the information including the turning data, the VMT data and AADT data; and a useful automation technology for analysis of the traffic image of the camera monitors to obtain the turning information at the intersections.

How Will You or Others Use the Product[s]? The Mobility and Safety Information (MSI) will use the product to analyze the crashes data and to offer plan strategy to predict, prevent and reduce the crashes. The information generated from the developed methodology and technology can be used by other division in the Mobility and Safety, and widely by the other branch and units in the NCDOT, and special requests for the data from planners, researchers, etc.

How Will the Product Benefit the Department? The department will benefit by having better information and analysis on the crashes at the intersections, and making better mobility and safety strategy and planning decision. That will contribute to prevent and reduce the crashes and the loss of lives and properties.

Other Comments:

Approval (Division official or Unit Head)

Terry Hopkins

 Print Name

 Signature

State Traffic Safety Engineer

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Brian Mayhew, PE

DATE: August 21, 2009

Branch / Unit: Traffic Mobility & Safety Division; Traffic Safety Unit

TITLE of your Research Idea: Speed and Safety in North Carolina

Background: Speed is directly related to the severity of crash injuries, and to the ability to avoid a crash when the unexpected occurs. NC had the fourth highest number of speeding-related traffic fatalities of all the states in 2007 (FARS data). Thirty-four percent of all reportable crashes and 38% of fatal crashes in NC were indicated to be speeding-related on police crash reports in 2007 (NC TEAAS data). North Carolina (NC) was recently identified by FHWA as a Focus State to reduce speeding-related crashes and injuries.

Speeding is a complex traffic safety problem that includes a culture that glorifies speed; a society that is pushing the limits of time creating the psychological sense of always being rushed; expansion of suburbia and greater traffic volumes into rural areas; incongruities between roadway design speeds, speed limits, and roadway uses that may contribute to misperceptions about safe travel speed; enforcement and judicial resources and responses that are not keeping up with need; public misperceptions about revenues generated by enforcement activities (all kinds); and other public misperceptions about the impacts of speeding on roadway safety.

What is the Specific Problem or Issue? Targeting the many contributing factors to speeding-related crashes is hindered by insufficient understanding of the problem and lack of a comprehensive approach in targeting both driver and environmental contributors to speeding-related crashes, injuries and fatalities. For example, we have not been able to understand and examine the effectiveness of enforcement and how best to target enforcement activities to prevent speed-related crashes in NC due to an absence of linkage between enforcement/citation or conviction data with crash data. Many complex, inter-related factors affect the ability to develop sound speed crash reduction strategies, including questions such as where and when do drivers speed, where and when is it most unsafe to speed, what is the expectation of receiving a citation or conviction when speeding, do sanctions (and what type) decrease the risk of future speeding-related crashes, what are drivers' perceptions of speeding and safety, etc. Answering such questions will require broad conceptual thinking, review of past research, as well as linking and analysis of multiple databases to obtain answers specific to North Carolina.

List Research Objectives and Tasks: The project would focus on providing an in-depth description of the speeding-related crash problem in NC, and identifying potential solutions to specific issues identified. This project would build on recent and on-going efforts at a State and National level to shed light on how, why, and when speeding-related crashes occur, who is involved, and what countermeasures have been effective in targeting the problems identified. The research should identify the types of data needed, and the most appropriate new questions to ask of data to enhance our understanding of speeding crashes, describe effects of existing countermeasures, and suggest strategies to develop new and improved countermeasures.

Phase 1 Tasks

1. Review literature, including international research, regarding causes of, and effective solutions to, speeding-related crashes.
2. Interview or hold panel discussions with key State and local officials (and possibly national or international experts) in agencies having an impact on traffic safety in North Carolina to learn about current data being collected, activities underway, evaluations, successes, and challenges in reducing speeding-related crashes and injuries.
3. Conduct preliminary analyses of NC crash data to describe driver, vehicle, roadway, and environmental factors in speeding-related crashes.
4. Determine important additional research questions relating to the role of driver and other factors in speeding-related crashes (including role or impacts of existing strategies).
5. Identify data needs and determine whether existing data may be used, or new data may be collected, to answer research questions identified. Include appropriate State agencies in discussions of this and next steps.
6. Develop research questions and data collection and analysis plan for second phase.

Phase 2 Tasks

1. Collect or acquire other data that will help answer key research questions. For example, there may be a need to conduct a statewide speed study of actual traffic speeds.
2. Link other data to crash data as needed and conduct analyses to answer key questions.
3. Summarize results and implications for speeding crash countermeasures.
4. Describe key recommended actions needed to implement important countermeasures to speeding-related crashes or improve implementation of appropriate countermeasures in North Carolina.

What Would be the Product[s] of the Research? The product would be greater understanding of the speed-related crash problem in NC including who, what, when, and where speed-related crashes are a problem, a description of effective countermeasures to target key problems identified, and the actions needed to address data limitations, institutional barriers, and other hindrances to implementing the countermeasures in North Carolina. Panel discussions would also be held to fully develop the initiatives and begin dialogue. Prioritized recommended courses of action that could have the largest benefits and a presentation to the NC Executive Committee for Highway Safety (ECHS) would be done. Legislation could be developed from the information developed.

How Will You or Others Use the Product[s]? The research will lay important groundwork for NCDOT to build an inter-disciplinary and inter-agency program to address speeding-related crashes, in effect to begin developing a speed-related crash safety action plan. It will also enable DOT to educate the public and key decision-makers about the problem of speeding in the State and the strategies and cooperative efforts needed to reduce these crashes. DOT may use the products to guide policy, legislation, and administrative support needed to maximize effectiveness of such a program.

How Will the Product Benefit the Department? Speed is a factor in a large proportion of crashes in North Carolina and contributes to around 600 fatalities each year. This would have a direct positive impact on NCDOT performance metrics and help NCDOT meet our goal of making our transportation network SAFER. There would be short term benefits but the long term benefits could be extensive. The societal impact of having a person die on NC roadways is estimated to be \$4.2 million in 2007 dollars so preventing fatal crashes from occurring can lead to tremendous benefits.

Other Comments:

Approval (Division official or Unit Head)

Terry Hopkins

Print Name

Signature

State Traffic Safety Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Cliff Braam, PE / Brian Mayhew, PE**DATE:** August 21, 2009**Branch / Unit:** Traffic Mobility & Safety Division; Traffic Safety Unit**TITLE of your Research Idea:** Impact of Unlicensed Drivers on Highway Safety

Background: North Carolina has been and continues to be a leader in highway safety. A growing area of concern is the involvement of unlicensed drivers in motor vehicle crashes, injuries and fatalities. Preliminary data analysis has shown this problem to be severe enough that North Carolina's Executive Committee for Highway Safety established a working group to analyze the issue of unlicensed drivers. However, in order to move forward on this topic additional analysis and strategies need to be accomplished, developed and presented.

What is the Specific Problem or Issue? For the past five years, approximately 15% of all fatal crashes involve an unlicensed driver; someone who should not have been on the road to begin with. Raleigh Police Department averages over 600 citations each month for drivers operating a motor vehicle without a proper license. The full scope of this problem is still unknown however. What are the factors involved in why these drivers present a greater risk to all roadway users than other drivers? What is the full scope of the impact of this subset of illegal roadway users? Are speed, alcohol, seat belt use, other factors also contribute to these drivers being high risk? Of course, addressing this issue is complex but correctly defining the scope and magnitude of the issue is a first step in taking action.

List Research Objectives and Tasks: Provide background data that clearly defines the severity and scope of this issue. Identify historical trends and current impacts on highway safety in N.C. Prioritize recommended courses of action that could have the largest benefits. Present to the NC Executive Committee for Highway Safety (ECHS). Develop marketing and information packets for key initiatives selected by the ECHS.

What Would be the Product[s] of the Research? A primary deliverable will be a resource paper providing background information, defining the problem, defining the impact on overall highway safety and prioritized recommended courses of action. A presentation to the NC Executive Committee of Highway Safety (ECHS) is also expected. It is expected for legislative opportunities to also be part of the final product where appropriate. It is anticipated that the ECHS may ask for some key recommendations from the presentation and resource paper to be developed further and that marketing products and information packets be delivered.

How Will You or Others Use the Product[s]? The resource paper and presentation would be utilized by North Carolina's Executive Committee for Highway Safety as well as other possible agencies (legislators, Governor's office, etc) to identify the need for action in reducing target crashes, injuries and fatalities and to provide the justification for resources dedicated to implementing appropriate programs/strategies.

How Will the Product Benefit the Department? Improve highway safety by reducing the number of collisions, injuries and fatalities involving unlicensed drivers and all roadway users. This would have a direct positive impact on NCDOT performance metrics and help NCDOT meet our goal of making our transportation network *SAFER*. There would be short term benefits but the long term benefits could be extensive. The societal impact of having a person die on NC roadways is estimated to be \$4.2 million in 2007 dollars so preventing fatal crashes from occurring can lead to tremendous benefits.

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

Terry Hopkins

Print Name

Signature

State Traffic Safety Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Cliff Braam, PE / Brian Mayhew, PE

DATE: August 21, 2009

Branch / Unit: Traffic Mobility & Safety Division; Traffic Safety Unit

TITLE of your Research Idea: Impact of the Hispanic Population on Highway Safety

Background: North Carolina has been and continues to be a leader in highway safety. A growing area of concern is the involvement of Hispanic drivers in motor vehicle crashes, injuries and fatalities.

What is the Specific Problem or Issue? Each year, the Hispanic population in N.C. continues to increase and along with this, so does their representation and/or over representation in traffic collisions, injuries and fatalities. Highway safety issues involving the NC Hispanic population range from unlicensed drivers, lack of safety belt use, and drinking and driving but there may be many more patterns and trends that are unknown. The scope of this issue in NC has not been clearly defined. Clearly defining this issue based on data and analysis would allow for identification of specific opportunities to improve the road safety of the Hispanic population and all roadway users in NC.

List Research Objectives and Tasks: Provide background data that clearly defines the severity and scope of this issue. Identify historical trends and current impacts on highway safety in N.C. Prioritize recommended courses of action that could have the largest benefits. Present to the NC Executive Committee for Highway Safety (ECHS). Develop marketing and information packets for key initiatives selected by the ECHS.

What Would be the Product[s] of the Research? A primary deliverable will be a resource paper providing background information, defining the problem, defining the impact on overall highway safety and prioritized recommended courses of action. A presentation to the NC Executive Committee of Highway Safety (ECHS) is also expected. It is expected for legislative opportunities to also be part of the final product where appropriate. It is anticipated that the ECHS may ask for some key recommendations from the presentation and resource paper to be developed further and that marketing products and information packets be delivered.

How Will You or Others Use the Product[s]? The resource paper and presentation would be utilized by North Carolina's Executive Committee for Highway Safety as well as other possible agencies (legislators, Governor's office, etc) to identify the need for action in reducing target crashes, injuries and fatalities and to provide the justification for resources dedicated to implementing appropriate programs/strategies.

How Will the Product Benefit the Department? Improve highway safety by reducing the number of collisions, injuries and fatalities involving Hispanic drivers and all roadway users. This would have a direct positive impact on NCDOT performance metrics and help NCDOT meet our goal of making our transportation network SAFER. There would be short term benefits but the long term benefits could be extensive. The societal impact of having a person die on NC roadways is estimated to be \$4.2 million in 2007 dollars so preventing fatal crashes from occurring can lead to tremendous benefits.

Other Comments:

Approval (Division official or Unit Head)

Terry Hopkins

Print Name

Signature

State Traffic Safety Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Brian Murphy / Brian Mayhew**DATE:** August 21, 2009**Branch / Unit:** Traffic Mobility & Safety Division, Traffic Safety Unit**TITLE of your Research Idea:** Intersection Database Analysis**Background:**

For years, the Department has struggled with ways to store information relating to intersections. The Traffic Safety Unit has developed several small intersection databases over time to meet the analysis needs of specific projects. The ITS and Signals Unit has also developed a database to store information regarding their traffic signals at intersections. The Department has fairly good characteristic data stored by route sections, but very little stored by intersection. The Traffic Safety Unit has many needs for an intersection database to help with existing processes established for identifying potentially hazardous locations, analyzing the performance of a subject intersection relating to peer locations for project development purposes, and evaluating the safety benefits of completed safety projects.

What is the Specific Problem or Issue?

The specific issue is the Department does not maintain a central intersection database available for business units to store, view, and analyze information relating to intersections.

List Research Objectives and Tasks:

The main objective of this project would be to identify the key components of an intersection database and develop an implementation approach for NCDOT. A needs analysis would need to be conducted with the applicable business units within NCDOT to identify the key components. Research should be done to see what other States have been able to successfully implement and the strategies by which they were implemented. National roadway inventory standards such as MMIRE should also be referenced as applicable. Useful and reasonable data elements that NCDOT currently does not collect or store should also be considered and recommended as future additions for implementation. Existing NCDOT databases should be reviewed and current projects such as the Spatial Data Viewer should also be considered so that a seamless design and implementation could be achieved.

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

The deliverables would be an identification of the key components of an intersection database, as well as an implementation plan agreed upon by the project committee. The project committee should have representatives from the business units that would utilize an intersection database and Information Technology staff as they would obviously be critical in developing the database.

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

The product that comes out of this research project will be used to identify the business needs and practical applications for an intersection database. The research project should also identify a well defined, practical strategy for implementing an intersection database. It is anticipated that the products of this research would form the basis of a project within DOT to produce and implement the solution.

How Will the Product Benefit the Department?

The product will benefit the Department by documenting the key components and implementation strategy of an intersection database. This is the first step to get the Department to the long term goal of the development and implementation of an intersection file or database. An intersection database would benefit the department in many ways. It would allow the Department to centrally store, view, and analyze information related to intersections. The Traffic Safety Unit specifically would use the database to generate intersection crash rates and safety performance functions. These tools would allow the Department to utilize crash data in new ways and would allow for better decisions to be made regarding the safety at intersections. Many business Units within NCDOT would be able to make use of this type of database.

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

Terry Hopkins

Print Name

Signature

State Traffic Safety Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Christopher J. Oliver, PE / Brian Mayhew, PE**DATE:** August 21, 2009**Organization / Branch / Unit:** NCDOT / Transportation Mobility and Safety Division / Traffic Safety Unit**TITLE of the Research Idea:** Comprehensive Safety Document/Product

Background: The goal of the Comprehensive Safety Document will be to provide a product that provides useful safety information that the NCDOT Transportation Planning Branch, MPOs, RPOs, County Commissioners, City/Town Councils and Law Enforcement Agencies can use to help identify the highway safety issues within their respective boundaries. The document or product will contain information about the safety issues relevant to engineering, education, and enforcement. Furthermore, the document will help to determine potential safety initiatives and possible driver education opportunities based on sound engineering information.

What is the Specific Problem or Issue? The Traffic Safety Unit has completed a draft Comprehensive Safety Document. Although the document has lots of safety information, it was labor intensive and very time consuming to produce. The document also needs to be tailored more towards a general audience (i.e. city/town officials) instead of an engineering/technical audience. Determining the appropriate content of the product and identifying an appropriate format is important in producing a document that is useful for the customer. It must be a product that NCDOT - Safety Planning Group can provide in a repeatable and sustainable way. A marketing and delivery plan is also needed as part of this effort (meaning how we should deliver this product in a reasonable way for maximum impact and use. Webinar? Document only? Presentation? Series of workshops?).

List Research Objectives and Tasks:

1. Identify any skills and knowledge that our unit needs to acquire in order to produce the product
2. Identify any software that would be ideal for this effort
3. Tailor the documentation more towards a general audience of readers
4. Streamline the production of the product to ensure it can be done in a repeatable and sustainable way
5. Marketing and delivery plan (i.e. how the product should be delivered for maximum impact and usage)

What Would be the Product[s] of the Research? A product that the NCDOT Safety Planning Group can provide for the end users to use in their decision making process.

How Will You or Others Use the Product[s]? The Traffic Safety Unit will use the new skills and knowledge to produce and distribute the products to the end users in an appropriate way to have the desired affect of providing useful information to the local level so that informed decisions and actions taken at that level.

How Will the Product Benefit the Department? Improve highway safety by reducing the number of collisions, injuries and fatalities among all roadway users. This would have a direct positive impact on NCDOT performance metrics and help NCDOT meet our goal of making our transportation network *SAFER*. There would be short term benefits but the long term benefits could be extensive. The societal impact of having a person die on NC roadways is estimated to be \$4.2 million in 2007 dollars so preventing fatal crashes from occurring can lead to tremendous benefits. Involving local governments in the challenge of improving safety should provide numerous opportunities for partnering and collaboration.

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

Terry Hopkins

Print Name

Signature

State Traffic Safety Engineer

Title