

LIST OF RESEARCH IDEAS for FY- 2012

Organization Or Affiliation

Submitted

Planning and Environment

2101	NCDOT's Responsibility at Former Asphalt Laboratory Testing Sites	C. Niver	Roadside Environmental Unit
2102	MNA Database and Trend Analysis for NCDOT Asphalt Testing Sites (ATS)	C. Niver	Roadside Environmental Unit
2103	Turbidity Control Compliance Research and Training Center	T. Sherrod	Roadside Environmental Unit
2104	Roadside Contaminated Soils with Heavy Metals from Vehicle Emissions	J. Kirby	Research and Analysis
2105	Wetland / Stream Total Takes	C. Rivenbark	Natural Environment Unit
2106	Influence of Shading on Submerged Aquatic Vegetation from Bridges Structures	B. Ellis	Natural Environment Unit
2107	Hydrodemolition Run-off Water (HRW) Treatment Options	R. Maycock	Roadside Environmental Unit
2108	Evaluation of Small Stream Crossing Culverts to assess Impacts on Stream Morphology and Aquatic Passage - Part II	R. Maycock	Roadside Environmental Unit
2109	Improved Signs to Alert Drivers to Greatest Collision Risk Months for Deer	A. Burroughs	Natural Environment Unit
2110	Managing Rights of Way for Biofuel Production and Carbon Sequestration	T. Sherrod	Roadside Environmental Unit
2201	Funding Project Risk Management Tools	M. Al-Ghabdour	Program Development Branch
2202	Intelligent Project Tools: Is it a Design Build or a Traditional Construction?	M. Al-Ghandour	Program Development Branch
2203	Are Multi-Lane Roundabouts Safe: Roundabouts Crash Prediction Models and Safety Assessment for NC?	M. Al-Ghandour	Program Development Branch
2204	Land Use Forecasting Models and Advanced Travel Demand Modeling	J. Alavi & L. Dosse	Transportation Planning Branch
2205	NCLOS Program 2010 Update	D. Wasserman	

Pavement and Maintenance

2301	Fleet Management Performance Monitoring	D. Harbinson	Fleet and Material Management Unit
2302	MEPDG Inputs for Warm Mix Asphalts	C. Morrison	Pavement Management Unit
2303	Surface Layer Bond Stresses and Strength	C. Morrison	Pavement Management Unit
2304	Development of IRI Limits and Targets for Network Management and Construction Approval Purposes	N. Mastin	Pavement Management Unit
2305	Performance of Cracking Mitigation Strategies on Cracked Flexible Pavements	J. Corley-Lay	Pavement Management Unit
2306	Local Calibration of MEPDG for Jointed Concrete Pavements in North Carolina	J. Corley-Lay	Pavement Management Unit
2307	Visual Guide to Identifying and Treating Oxidation just Prior to Cracking	J. Corley-Lay	Pavement Management Unit
2308	Laboratory Test Procedures for Emulsion based Asphalt Materials	J. Corley-Lay	Pavement Management Unit
2309	Determining Recycled Asphalt Binder Limits Contributed by Waste Materials	J. Cowsert & T. Whittington	Materials and Tests Unit

LIST OF RESEARCH IDEAS FOR FY- 2012

<u>Reference</u>	<u>Idea Title</u>	<u>Submitted</u>	<u>Organization Or Affiliation</u>
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Structures and Construction

2401	Quantifying and Comparing Corrosive Effects of Granular Salt, Salt/Sand Mixture and Salt Brine on NCDOT Bridges	E. McGraw & S. Capps	Bridge Management Unit
2402	Crack Free Mass Concrete Footings on Bridges in Coastal Environments	G. Perfetti & M. Robinson	Structure Design Unit
2403	Analysis of Truck Load Weight Distribution in North Carolina	D. Holderman	Bridge Management Unit
2404	Portable Horizontal Life Line	M. Miller & D. Spainhour	Division 9
2405	Preservation of Bridge Decks	J. Deyton	Division 14

Traffic and Safety

2501	Development of a Safety Evaluation Procedure for Identifying High Risk Signalized Intersections in the Triangle Area of NC	E. Morrison	Research Unit
2502	Engineering and Technology Measures To Improve Large Truck Safety: State of the Practice in North Carolina	E. Morrison	Research Unit
2503	Traffic and Highway Geometric Characteristics Associated With Pedestrian Crashes in North Carolina	E. Morrison	Research Unit
2504	Incorporating Safety into the Regional Planning Process in North Carolina	E. Morrison	Research Unit
2505	Guidelines for the Application of Active Traffic Management in North Carolina	E. Morrison	Research Unit
2506	Causal Factors for Intersection Crashes in Raleigh, NC	E. Morrison	Research Unit
2507	Pedestrian and Bicycle Accommodation on Superstreets	J. Dunlop	Congestion Management
2508	Quadrant Roadway Intersection Evaluation in North Carolina	J. Dunlop	Congestion Management
2509	Field Verification of Hillsborough Street Roundabout Simulations	J. Dunlop	Congestion Management
2510	The Upstream Effects of Left and Right Lane Drops on Freeways	J. Dunlop & E. Groundwater	Congestion Management
2511	Infrastructure Investment Protection with High Density Surveys (HDS)	T. Wyatt & C. Brown	Traffic Safety & Locations and Surveys
2512	NC Roadway Lighting Needs Assessment, Lighting Maintenance Prioritization Tool, and Performance Measures	T. Wyatt & J. Stancil	Traffic Safety Unit & Roadway Design
2513	Impact of the Hispanic Population on Highway Safety	C. Braam & B. Mayhew	Traffic Safety Unit
2514	Use of 27 inch High W-Beam Guardrail for Test Level 2 (TL-2) Conditions (44 mph)	J. Bennett	Roadway Design Unit
2515	Using 3D (XYZ coordinates) Centerline Data to Find Sight Distance Deficiencies	B. Mayhew	Traffic Safety Unit
2516	Horizontal Curve Inventory	B. Mayhew	Traffic Safety Unit
2517	Development of Real Time Performance Measurements for Closed-Loop Signal Systems Using Existing Loop Detectors	C. Baek	Transportation Mobility and Safety

Total number of research ideas from all categories: 46

**PLANNING AND ENVIRONMENT
RESEARCH IDEAS**

CALL FOR NEW RESEARCH IDEA**Your Name:** Chris Niver**DATE:** 09/02/2010**Branch / Unit:** Operations / Roadside Environmental Unit**TITLE of your Research Idea:** NCDOT's Responsibility at Former Asphalt Laboratory Testing Sites**Background:**

In 1989, the NCDOT was legislated to address contamination of soil and groundwater at former asphalt testing laboratory sites (ATS) where aggregate asphalt test utilized chlorinated solvents which were either spilled or disposed of at the sites. During the course of the past 20 years much has been learned concerning the nature of contamination at these sites.

What is the Specific Problem or Issue?

Much data has been gathered and it has been determined that the NCDOT may not be solely responsible or bear any responsibility for chlorinated solvent contamination at several of the ATS. Several sites contain perchloroethylene (PCE) which degrades to targeted NCDOT constituents (i.e. TCE). In addition, the NCDOT has a recorded timeline of chemical usage (and disposal practices) which does not coincide with the recorded constituents represented at several ATS. Furthermore, there are contaminant impacts from both off-site and on-site sources separate from the testing labs. The NC DOT neither owns nor controls the contaminated properties and unexplained contamination was found after completion of the site assessments and corrective action plans.

List Research Objectives and Tasks:

Review data from NCDOT ATS to determine which sites coincide with usage dates and determine if off-site sources are either enhancing or causing groundwater contamination with NCDOT target constituents.

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

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

A determination of which ATS are not the responsibility of NC DOT.

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

Will provide viable data on whether NC DOT is providing cleanup measures at contaminated ATS that fall outside the scope of the 1989 MOA between NC DOT and NC DENR.

How Will the Product Benefit the Department?

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

Decreased costs and decreased liability.

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

Don Lee, CPESC

Print Name

Signature

State Roadside Environmental Engineer

Title

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CALL FOR NEW RESEARCH IDEA

Your Name: Chris Niver

DATE: 09/02/2010

Branch / Unit: Operations / Roadside Environmental Unit

TITLE of your Research Idea: MNA Database and Trend Analysis for NCDOT Asphalt Testing Sites (ATS)**Background:**

PCE at ATS, timeline TCA & TCE, off-site sources, different sources. NCDOT should not be solely responsible for ATS. In 1989, the NCDOT was legislated to address contamination of soil and groundwater at former asphalt plants where aggregate asphalt tests utilized chlorinated solvents which were either spilled or disposed of at the sites. Currently there are 56 active ATS with many of the sites undergoing monitored natural attenuation (MNA).

What is the Specific Problem or Issue?

Several of the NCDOT ATS sites have been performing MNA for years without seeing any results. There is little understanding of how long or how much long term monitoring (LTM) will cost. Under what conditions does MNA obtain the desired results for attenuation of chlorinated solvents?

List Research Objectives and Tasks:

Create a database for aggregating MNA data from all ATS sites, including field measurements and laboratory analytical data for both geochemical parameters and chlorinated compounds. Perform trend analysis across sites or within individual sites to evaluate conditions affecting the applicability and effectiveness of MNA. Analysis of data at sites where bioenhancement has been utilized can help determine effectiveness of certain types of amendments and chemical applications, as well as assist with choosing appropriate bioenhancement for the conditions present at a site.

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

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

Database conglomerating historical MNA and bioenhancement data from all ATS sites. Trend analyses and determinations of conditions conducive to MNA. Determination of reasonable timeframes for natural contaminant attenuation/biodegradation as well as remediation through bioenhancement. Possibly develop an algorithm illustrating procedures for evaluating MNA and bioenhancement at chlorinated solvent sites.

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

Both the NCDOT and the NCDENR can utilize the information to determine under what conditions MNA of chlorinated solvents works best. The database could be maintained and updated by either NCDOT or NCDENR (or both) as new data or new sites are added.

How Will the Product Benefit the Department?

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

Decrease cost and liability of NCDOT ATS cleanup effort and maintaining data to support cleanup efforts at ATS. Also would provide a resource for NCDENR to make decisions on the best cleanup efforts.

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

Don Lee, CPESC

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

2103

Your Name: Ted Sherrod

DATE: 8/25/10

Branch / Unit: Operations / Roadside Environmental Unit

TITLE of your Research Idea: Turbidity Control Compliance Research and Training Center

Background:

Build on the existing work at the Sediment Erosion Research and Education Facility (SECREP) and expand to include the full array of turbidity control systems (passive, infiltration, active).

What is the Specific Problem or Issue?

Effluent Limitation Guideline (ELG) Sampling at Stormwater Discharge Outfalls (SDOs) during storm events. New systems, which are being developed and marketed rapidly in response to the US EPA Effluent Limitation Guidelines, could be tested and compared under standard conditions.

List Research Objectives and Tasks:

Required three samples during business hours

- a. Various brands of in-stream turbidity sensors with data logger storing results
- b. Grab sample with results from onsite turbidity meter (this could be represented by c.)
- c. Automatic water sampler with results from turbidity meter
- d. Single stage samplers with results from turbidity meter
- e. Flow or level activated passive systems with results from turbidity meter
- f. Others

Develop training program to include planning and design, installation/maintenance/operation and monitoring protocols.

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

A comprehensive training program would be developed to include planning and design, installation/maintenance/operation, and monitoring protocols.

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

Program would be used to train DOT, contractor, and consultant personnel.

How Will the Product Benefit the Department?

Ensure compliance with erosion and sediment control/stormwater rules and regulations.

Approval (Division official or Unit Head)

Don Lee, CPESC

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

2104

Your Name: John Kirby

DATE: 08/27/2010

Branch / Unit: Research & Analysis

TITLE of your Research Idea: Roadside Contaminated Soils with Heavy Metals from Vehicle Emissions.

Background:

Until the mid-1980s, gasoline and other fuels contained lead. The products of exhaust gas emanating from the combustion of leaded gasoline and the wear and tear of automobile components. Only rarely does soil become polluted to the extent that it can no longer support plant growth, however metals accumulated to higher levels may be a biohazard. Lead and other heavy metals can accumulate in the natural flora and soils leading to harmful effects both to the human and natural environments.

What is the Specific Problem or Issue?

Contaminated soils are regulated under the NCDENR DWM regulations requiring soils contaminated with lead and/or other heavy metals be remediated and disposed of in regulated landfills. If soils along heavily traveled roadways contain elevated levels of lead (or other regulated metals), the DWM will require the soil to be excavated and possibly levy environmental fines or orders of consent to the NCDOT.

List Research Objectives and Tasks:

To determine Pb and other heavy metal contamination along heavily traveled roadsides. A literature search report would provide the NCDOT with a means to address possible contamination prior to being compelled to address the issue by regulatory agencies.

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

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

A working knowledge of possible roadside soil contamination in heavily populated roadways and how to properly address the issue prior to regulatory oversight.

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

The REU and the GeoTech Units will have knowledge of possible contaminated media prior to roadside activities.

How Will the Product Benefit the Department?

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

Decrease cost and liability to NCDOT.

Other Comments:

Approval (Division official or Unit Head)

Don Lee, CPESC

Print Name

Signature

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2105

Your Name: Chris Rivenbark

DATE: 8/26/2010

Branch / Unit: PDEA-Natural Environment Unit

TITLE of your Research Idea: Wetland/Stream Total Takes

Background:

Often new location projects impact wetlands and/or streams. Occasionally the Department has to account for impacts to these resources even though we do not actually disturb them. These impacts are considered total takes and are basically the result of the resource being isolated or fragmented.

What is the Specific Problem or Issue?

There is often little rationale that goes into decision that determines a total take. The Department could be accounting for impacts that may or may not actually occur. This could result in paying for mitigation that could be unnecessary.

List Research Objectives and Tasks:

Determine which scenarios/situations are appropriate for total takes
Examine past projects that had total take occurrences and evaluate the outcome

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

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

A more definitive process (flow chart?) for determination of when total takes are appropriate.

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

The process will allow NCDOT staff and environmental agencies to more accurately account for impacts associated with highway projects.

How Will the Product Benefit the Department?

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

It could decrease wetland/stream mitigation costs. Additionally, by reducing mitigation needs, more mitigation would be available for other projects. Both benefits would be considered long term.

Other Comments:

Approval (Division official or Unit Head)

Philip S. Harris, III, PE

Print Name

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CALL FOR NEW RESEARCH IDEA**Your Name:** Bruce O. Ellis**DATE:** 8/26/10**Organization / Branch / Unit:** PDEA-Natural Environment Unit**TITLE of the Research Idea:** Influence of Shading on Submerged Aquatic Vegetation from Bridges Structures**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. Construction of an over water structure presumes that the effect of shading from the structure will have a negative impact on the growth of SAV and therefore, the impacts must be mitigated.

What is the Specific Problem or Issue?

Currently, shading from any over water structure is presumed to have a negative impact on SAV. Little consideration is given to the alignment of the structure or the height and width of the structure with regard to reduction of light intensity or duration. It is likely that some over water structures will have minimal shading effects where mitigation should not be required. At this time there is no hard research to support this.

List Research Objectives and Tasks:

Locate over water structures where SAV is present. Measure height of the structure over water, alignment, measure light intensity both under the structure and outside of its shading influence, record presence/absence of SAV. Data analysis to include identification of optimal structure height and alignment to reduce the effects of shading on SAV.

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

- (a) Literature/data search report.
- (b) Field Surveys
- (c) Data compilation and analysis
- (d) Draft Final Report.
- (e) Final Report

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

PDEA/NEU will use this research in the permit process, as well as, determining potential avoidance and minimization opportunities.

How Will the Product Benefit the Department?

It is anticipated that the research will reduce the need for SAV mitigation, thereby reducing project costs.

Approval (Division official or Unit Head)

Philip S. Harris, III, PE

Print Name

Signature

Unit Head

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2107

Your Name: Robin L. Maycock

DATE: 8/18/10

Branch / Unit: Operations / Roadside Environmental Unit

TITLE of your Research Idea: Hydrodemolition Run-off Water (HRW) Treatment Options

Background:

The Bridge Preservation Program (BPP) is using Hydrodemolition to remove concrete and resurface bridges throughout the state. Hydrodemolition run-off water (HRW) is generated during this process and is considered an industrial process wastewater by DWQ and EPA. During the Hydrodemolition process, large volumes of high pH, high turbidity wastewater is generated. Total containment and collection is required, with no HRW release to the ground surface or to surface waters allowed by regulatory agencies. Currently the HRW is contained and collected and disposed of at permitted wastewater disposal plants. Beneficial reuse is an option that needs to be explored, particularly the options of use of HRW in the concrete recycling industry for dust control and process water and the possibility of land application along NCDOT right of way.

What is the Specific Problem or Issue?

Sampling of the HRW shows low levels of contaminants but there is potential for beneficial reuse in the concrete recycling industry and as a soil amendment to correct soil pH problems. Research is needed to determine the potential for beneficial reuse in order to reduce disposal costs, to increase water conservation and to develop cost effective means to correct or improve soil physical characteristics. Additionally, research is needed to determine the potential for long term adverse effects on the soils in the NCDOT right of way

List Research Objectives and Tasks:

Sample and assess contaminant levels in HRW.

Investigate beneficial reuse options in the concrete recycling industry.

Land apply HRW at various rates and over time to determine potential adverse or beneficial effects to various soils in terms of vegetation establishment and maintenance.

Assess the feasibility of land application on NCDOT roadsides relative to stormwater drainage, soil compaction and vegetation maintenance.

Create a protocol that can be utilized by NCDOT to determine the appropriate application rate on NCDOT right of way based on existing or proposed conditions of right of way (vegetation type, soil type, nutrient requirements of soil and vegetation, slope and runoff potential of application area) and based on physical characteristics of material being land applied (pH, contaminants present, etc.)

Investigate the permit options and regulatory issues involved with beneficial reuse options.

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

Data on HRW constituents and contaminants, potential limitations on beneficial reuse in concrete recycling industry, feasibility assessment protocol for beneficial reuse in terms of regulations and permit conditions, limitations for land application, feasibility assessment protocol for land application on NCDOT right of way

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

The data will provide information on the potential for beneficial reuse of HRW in the concrete recycling industry and on the limitations on the use of HRW as a liming agent, potential for beneficial reuse and HRW treatment needs prior to land application.

How Will the Product Benefit the Department?

The HRW contractor is currently paying to haul HRW to wastewater treatment plants for disposal. If beneficial reuse options are developed and approved by regulatory agencies, NCDOT could save money on disposal costs conveyed to NCDOT through contract bid costs, promote water conservation and utilize a waste product to amend poor soils.

Approval (Division official or Unit Head)

Don Lee, CPESC

Print Name

Signature

State Roadside Environmental Engineer

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2108

Your Name: Robin L. Maycock

DATE: 8/18/10

Branch / Unit: Operations / Roadside Environmental Unit

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

Background:

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

What is the Specific Problem or Issue?

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

List Research Objectives and Tasks:

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

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

Results would influence the culvert installation methodology, permit conditions and training.

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

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

How Will the Product Benefit the Department?

Short term: Decrease permit delays, influence culvert installation protocols.
Long term: Increase water quality due to reduced stream instability, increase aquatic organism passage for ecological benefits. Increase credibility with regulatory agencies.

Other Comments:

Approval (Division official or Unit Head)

Don Lee, CPESC

Print Name

Signature

State Roadside Environmental Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

2109

Your Name: Anne Burroughs

DATE: 8/11/10

Branch / Unit: PDEA/Natural Environment Unit

TITLE of your Research Idea: Improved Signs to Alert Drivers to Greatest Collision Risk Months for Deer.

Background:

Typical deer crossings sign have proven to be ineffective at reducing deer vehicle collisions. NCDOT collision records have documented most of these collisions occur from October to December. Wake County has recorded the highest rate of deer vehicle collisions for the last several years.

What is the Specific Problem or Issue?

North Carolinians face increased risks of deer vehicle collision as our population rises. However alerting drivers to the highest risk during those months will add to the driver's knowledge base and could improve response time and lower speed which are both proven to reduce collisions.

List Research Objectives and Tasks:

Because Wake County has the highest rate of deer vehicle collisions place additional signs which read [Oct Nov Dec] below each deer crossing signs in Wake County. The objective is fewer deer vehicle collisions. The tasks would be making, placing and removing the signs. The signs would only be in place from Oct-Dec.

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

Decreased deer vehicle collisions and increased safety

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

After the deer vehicle collision data is collected for 2010 (or 2011 if we can't do it this year), I will compare to previous years and look for a decrease in deer vehicle collisions. If a decrease is observed in Wake County I suggest repeating the effort in the top five deer vehicle collision rate counties or if appropriate, statewide.

How Will the Product Benefit the Department?

Increased safety with relatively minimal cost.

Other Comments:

I would like to conduct this work myself including working with Division 5 to install and remove these additional signs. I would also gladly help other researchers conduct this important work.

Approval (Division official or Unit Head)

Philip S. Harris, III, PE

Print Name

Signature

Unit Head

Title

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Your Name: Ted Sherrod

DATE: 8/25/10

Branch / Unit: Roadside Environmental Unit

TITLE of your Research Idea: Managing Rights of Way for Biofuel Production and Carbon Sequestration**Background:**

Initiated in 2009, the project assessing the potential for oilseed crop production along North Carolina highway right-of-ways has received considerable attention from the public and media. The project's overwhelming positive reception is the result of very promising initial results which indicate canola can be competitively grown on this land using minimal inputs and seed can be processed into biodiesel to fuel NCDOT's diesel equipment fleet. Using GIS analysis of NCDOT right-of-way holding as well as climatic data for North Carolina, it is estimated that over 1.5 million gallons of biodiesel could be produced from these lands while addressing aesthetic and roadside maintenance concerns. The project has also evaluated tillage and cultivation methods, demonstrating that light tillage (one pass roto-till) followed by planting is sufficient to establish a crop at the least possible cost.

Many state departments are being asked to also manage their roadsides to address greenhouse gas emissions. Biomass and carbon sequestration are two of the most likely ways to approach this issue – through planting and management of vegetation for potential biofuel inputs and through management of vegetation for maximum carbon storage.

What is the Specific Problem or Issue?

1. Produce marketable biomass products and gain credit for increasing carbon sequestration (carbon credits)
2. Solutions to optimize crop production along highway rights of way
3. Investigate scale up issues involving production, movement, and marketing of the co-products to end users across the state

List Research Objectives and Tasks:

The first track will identify what will be necessary if rights of way are to produce marketable biomass products and gain credit for the increase of carbon sequestration. Determining carbon credits will require the use of a qualifying accounting methodology which addresses various established greenhouse gas (GHG) protocol steps and existing guidelines. Determine carbon sequestration offset protocols and guidelines for land use types and management techniques that are likely to apply to rights of way and to provide existing GHG benefits in addition to existing practice. Develop a plant list appropriate for biomass production and existing roadside species which includes the carbon sequestration capabilities of each species. Develop methods for measuring sequestration and possible scenarios for claiming carbon credits. Select and quantify a baseline based on existing quantification methods and calculation tools. Quantify and monitor GHG emissions and calculate GHG reductions for biomass products and existing roadside vegetation.

The second track would continue to investigate solutions to optimize crop production along highway right-of-ways. This would include crop variety assessment (inclusion of camelina, mustard, and castor oil seed), inclusion of new low-impact tillage treatments (aeration and strip-till primarily), and incorporating composted organic nitrogen sources into the plots as a 'green' source of crop nutrients. These activities would remain in similar replicated plots that were established in the first phase of the project across the state.

The third track would investigate scale-up issues involving production, movement, and marketing of the co-products to end-users across the state. These activities would be conducted along roadsides in close proximity to existing oilseed processing facilities (i.e. Piedmont Biofuels in Pittsboro and Carolina Soy in Warsaw). The plots would be scaled up to include both sides of a roadway along stretches of 10 to 15 miles. These activities would allow a better understanding of cultivation and harvest practices as well as investigate the efficiency/utilization of equipment engaged in this activity. This activity may include the inclusion of a select group of crop producers to tend to the crops so an assessment of cultivation and harvest contracting can be determined. This scale-up activity is also necessary to understand and explore the movement of material from the roadside to a crush facility and then the assess markets for the meal and glycerin materials.

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

The outcome of track one would create a plant list appropriate for biomass production which would include the carbon sequestration capabilities of each species. Develop recommended methods for measuring sequestration and possible scenarios for claiming carbon credits to meet state initiatives to reduce carbon emissions.

The outcome of track two would be to further optimize the roadside biofuel program and further improve the ultimate deliverables of this project.

The outcome of track three would allow for the final feasibility of the program to be assessed and determine the economic benefit as well as the long-term sustainability of this program.

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

Product will be used to reduce carbon emissions as well as increasing production of biofuel crops to produce biodiesel to fuel diesel vehicle fleet.

How Will the Product Benefit the Department?

Decrease in diesel fuel costs with long term cost benefits and carbon reduction benefits.

Approval (Division official or Unit Head)

Don Lee, CPESC

Print Name

State Roadside Environmental Engineer

Title

Signature

CALL FOR NEW RESEARCH IDEA**Your Name:** Majed Al-Ghandour, P.E.**DATE:** 08/30/10**Branch / Unit:** Program Development Branch**TITLE of your Research Idea:** Funding Project Risk 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, or building double crossover diamond interchange, or building new teardrop roundabouts. 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 through a long process involved federal, state, local and public agencies. Funding 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 our funding 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 funding risk management plans for the projects and no quality management tools are found. NCDOT needs funding 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 are needed for NCDOT project management. Changing funding types from federal to state of versa has some impact and risk on the funding sources and project budge and schedule as well.

List Research Objectives and Tasks:

- Review current literature relevant project risk management, best practices, and quality tools.
- Analyze collected funding 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 funding project risk management and quality management tools.

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

- In developing guidelines to identify funding 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 funding 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 state-of-the art standard of quality control.
- Improving funding risk identification and capture in early stages.
- Improving the assessment and understanding of funding risk.
- Improving the ability to identify and influence risk while we still have opportunity in the project lifecycle to do so, and
- By implementing funding 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, P.E.

Print Name

Signature

Branch Manager

Title

CALL FOR NEW RESEARCH IDEA**Your Name:** Majed Al-Ghandour, P.E.**DATE:** 08/30/10**Branch / Unit:** Program Development Branch**TITLE of your Research Idea:** Intelligent Project Tools: Is it a Design Build or a Traditional Construction?**Background:**

The NCDOT handles several types of projects including a design build type and a traditional construction. A Design-build is a construction project delivery system where the design and construction aspects are contracted for with a single general contractor including the design professional (architect or engineer), hiring one firm. This design build type is used to minimize the project risk for the NCDOT and to reduce the delivery schedule by overlapping the design phase and construction phase of a project. A traditional build sets in several sequence phases of planning, designing, right-of way acquisition and finally construction let that can handled by different parties (architects and engineer, and contractors) including and not limited to the NCDOT staff and divisions, or consultants, and contractors. Decision on each type goes through several critical and defined procedures to select each type. Executive approval determinations are followed for the type of the projects.

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 some decision tools for the projects determination types (a design build type and a traditional). NCDOT needs planning integrated tools within State Transportation Improvement Program (STIP) development stages and within actual projects as they are ready for planning, right-of way, and construction phases. Benefit Cost analysis findings, determination of the risks (quantification), risk response, risk monitoring and control for each type can be programmed in kind of tools. More decision analysis, management tools business that follows industry standards are needed for NCDOT. These tools will aid and support the executive management in their final decisions and recommendations to make a final call of the project type, is it a design build type and a traditional construction?

List Research Objectives and Tasks:

- Review current literature relevant project types, best practices, pros and cons, and state-of the art quality tools.
- Analyze collected data from other DOT states.
- Compare and analyze collected data from the NCDOT to do B/C analysis for these types per project scale.
- Increase accountability by identifying project type,
- Identify a single source of project delivery and tool,
- Create a value based project feedback system,
- Develop models, reports, graphs, and simulation, for Decision tools,
- Evaluate current standards and determine a new measurement systems for the decision process,
- Provide new knowledge on which NCDOT engineers and practitioners can base their decisions and incorporate better utilize these tools for projects type determinations, and
- Identify failure modes and determine their effects.

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

Application tools will have: Several models, framework, graphs, tools, Database, manuals, guidelines, for the NCDOT STIP projects related to compare Traditional vs Design/Build Project methods.

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

- In developing guidelines and procedures to identify project type (a Design Build or a Traditional Construction)
- Support, aid, and allow transportation engineers and policy makers to quantify benefit of selecting project types,
- Identify problems, risks, and failure for not selecting other types.

How Will the Product Benefit the Department?

Aid the Executive Management, Preconstruction Units, Design Build Unit, Project Management Unit, and Divisions for their successful use of an established quality decision analysis management tools to determine which project type?,

- Bring the organization to implement standard levels of decision tools,
- Improving risk identification and capture in early stages,
- Improving the assessment and understanding of risk of each project type,
- Improving the ability to identify and influence risk while we still have opportunity in the project lifecycle to do so, and
- By implementing intelligent decision tools will aid and 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, P.E.

Print Name

Signature

Branch Manager

Title

Your Name: Majed Al-Ghandour, P.E.**DATE:** 08/30/10**Branch / Unit:** Program Development Branch**TITLE of your Research Idea:** Are Multi-Lane Roundabouts Safe: Roundabouts Crash Prediction Models and Safety Assessment for NC?**Background:**

In the 1950s, several Department of Transportation (DOT) agencies and local officials began designing and building roundabouts on state roads in urban and rural areas. A roundabout is a one-way, yield-controlled circular intersection, whose configuration can vary in number of approaches and circulating lanes, in which traffic flows counterclockwise around a central island. In recent years, roundabouts have become progressively more popular as an innovative operational and safety key for both low- and high-volume travel demands. For example, recently City of Raleigh installed 3 roundabouts at Hillsborough Street. Roundabouts 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. The potential for risky conflicts, such as right-angle and left-turn head-on crashes, is reduced with roundabout use. Also, research indicates that single-lane roundabouts are safer than multilane because they present less potential for conflicts between road users, and because pedestrian crossing distances are shorter. Studies by the Insurance Institute for Highway Safety (IIHS) indicate that a modern roundabout approach to traffic management can reduce injury accidents by 75 percent, pedestrian crashes by 30-40 percent, bicycle crashes by 10 percent, and fatal crashes by as much as 90 percent.

The goals from this research idea are to undertaken a safety assessment for Multi-Lane Roundabouts for the North Carolina Department of Transportation (NCDOT). The main objective is to develop models that predict the future number of crashes on multi-lane roundabouts at North Carolina. Different configurations for roundabouts need different type of predicated crash models too.

What is the Specific Problem or Issue?

The NCDOT is continuously seeking improvements to its traffic operation and safety for several signalized intersections and un-signalized intersections. The NCDOT moves in direction to build more roundabouts in the future. To day, the NCDOT constructed about fifteen roundabouts statewide. NCDOT has no crash prediction model(s) for roundabouts. It needs to develop models that predict the future number of reported crashes on roundabouts with different configurations (single-lane roundabout, multi-lane roundabout, interchange roundabout, Slip lane roundabout, Dog Bone/Turbo roundabout, and Teardrop roundabout). The models will be critical in terms of the major types of roadway connected to roundabout using average daily traffic and other simple inputs typically available during long-range transportation planning. Planners, traffic engineers can then use these models to help prioritize future roadway improvement projects.

The main goal of this proposal research idea is to address the question: How NCDOT transportation planners, traffic engineers and decision-makers efficiently can predict the safety assessment and the performance of multi-lane roundabouts. There is a need to develop models that predict the future number of crashes on roundabouts at North Carolina. Different configurations for roundabout will have different type of crash models too. Are other state's crash models transferable and transperance to North Carolina Roundabouts?

List Research Objectives and Tasks:

Models, framework, tools, and applications for NCDOT related to signalized intersections and crashed models for some pilot projects that NCDOT needs to assist in constructing roundabouts. Tools will also address visualization and simulation models too for the predicted crash models using VISSIM (PTV) and SSAM tools (FHWA).

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

- Improve NCDOT and local efficiency through simulation technologies and models for Roundabouts.
- Use Visualized models to help transportation engineers and policy makers that can be used more quantify Roundabouts.
- Evaluate Performance Measure (delay time) using Visualized simulation Models for NCDOT signalized intersections.

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

- In developing guidelines and procedures to identify project type (a Design Build or a Traditional Construction)
- Support, aid, and allow transportation engineers and policy makers to quantify benefit of selecting project types,
- Identify problems, risks, and failure for not selecting other types.

How Will the Product Benefit the Department?

- Roundabouts present several safety benefits: substantial reduction of crash rates and crash severity, and improved pedestrian safety. Roundabouts reduce speeds of conflicting flows, reduce serious crossing conflicts and simplify driver decision-making with clear indication of drivers' right of way.
- Improve NCDOT efficiency through using those predicted crash models for evaluation before construction.
- Improve Accountability on those NCDOT Roundabouts Projects for the public and decision-makers.

Approval (Division official or Unit Head)

Calvin Leggett, P.E.

Print Name

Signature

Branch Manager

Title

CALL FOR NEW RESEARCH NEEDS**Your Name:** Jamal Alavi, P.E. and Linda Dosse, P.E.**DATE:** 9/1/10**Branch / Unit:** Transportation Planning Branch**TITLE of your Research Idea:** Land Use Forecasting models and Advanced Travel Demand Modeling**Background:**

Currently there are three Regional Travel Demand Models (TDMs) in use in NC (Metrolina, Triad, and Triangle) in addition to eight smaller MPO TDMs (Goldsboro, Wilmington, Fayetteville, Jacksonville, Greenville, Rocky Mount, Hickory, and Asheville) and numerous small towns TDMs. The current methodology used for the 4-step trip-based models requires two major inputs (1. zonal demographics & land use data; 2. transportation network) to predict the number of vehicles or transit rider-ship on a transportation network. The accuracy of these input data is very critical to the TDM because a major source of errors in the TDM is the input data. This methodology has been used by NCDOT for 30 years.

What is the Specific Problem or Issue?

1. Despite a general consensus on the importance of zonal demographics & land use data to TDM, no land use forecasting tools have been developed in NC. Land use forecasting has mainly relied on a planner's subjective judgment based on the local land use plan. In recent years, NCDOT has stressed the incorporation of all modes of travel in the long range planning and modeling. More objective and accurate land use forecasting plays a critical role in the transportation planning process and can improve significantly the accuracy of TDM. Therefore, NCDOT should explore and develop a standard land use forecasting model that loops back to TDM to test various land use scenarios more objectively and accurately. This will be very useful for Indirect and Cumulative Effect (I.C.E.) consideration/analysis in the systems planning as well as project planning.
2. There have been advances in the "State of Art" Travel Demand Modeling, collection of Household Travel Surveys and modeling technology. The current 4-step TDM structure was designed over 50 years ago to evaluate major highway construction projects. Although there have been many improvements made to 4-step trip-based TDMs, it is widely accepted that the trip based models have a limitation to test a variety of policy alternatives and travel demand management strategies. Therefore, NCDOT should explore and develop more advanced TDMs such as tour based models.

List Research Objectives and Tasks:

- To develop a standard land use model that is most appropriate for NC
- To integrate the land use model with the existing Regional, MPO and local Towns models.
- To explore a more advanced TDMs (such as a tour based travel demand models) that is most appropriate for NC

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

1. Land Use Forecast Modeling Methodology
 - What land use models are available?
 - Who is using Land use Models?
 - Where are land use models applied in conjunction with travel demand models?
2. Incorporation of Land Use Modeling in Travel Demand Modeling
 - Where are land use models applied in conjunction with travel demand models
 - Where is the output from land use models actually feed back into the inputs to travel demand models
3. Travel Demand Modeling Methodology
 - What is the "State of the Art" in modeling types and methodologies?

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

TPB and regional/local partners will use the information to develop models that are more in line with the "State of Art" practice.

How Will the Product Benefit the Department?

- Increase the efficiency and accuracy of model outputs for plans
- Increase the reliability and confidence in the Department's products, plans, forecasts, project planning and design.
- Increase the capability to test various policy alternatives and travel demand management strategies that cannot be tested with current trip-based models.

Approval (Division official or Unit Head)

Mike Bruff, P.E.

Print Name

Signature

Branch Manager

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2205

Your Name: David Wasserman, P.E.

DATE: 9-22-10

Branch / Unit: Strategic Planning Office

TITLE of your Research Idea: NCLOS Program 2010 Update

Background:

The North Carolina Level of Service (NCLOS) Program is a software program developed in the mid 2000s by ITRE which provides planning level capacities for highways throughout North Carolina. The program is based on the 2000 Highway Capacity Manual (HCM) and North Carolina data. The original need for the software was to provide a consistent set of capacities for use when developing travel demand models and/or Comprehensive Transportation Plans (CTPs). Since 2008, this program has been more widely used throughout the Department. Currently the tool is used to provide data for the Performance Metrics Dashboard and used as a scoring component in the Strategic Prioritization Process and Urban Loop Prioritization Process.

What is the Specific Problem or Issue?

In early 2011, the 2000 HCM will be replaced with the 2010 HCM. The 2010 HCM is based on a decade of research and analysis from the Transportation Research Board to strengthen the calculation of roadway capacities. Several equations and procedures used to calculate capacities have changed with the update, resulting in new and improved values.

List Research Objectives and Tasks:

- Update the NCLOS software to match the new 2010 HCM calculations and procedures
- Update the default values used in the NCLOS software with the most current data

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

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

Updated procedures, equations, tables, and data for the NCLOS program. NCDOT IT will handle all of the programming with this update, working with the researcher. The maintenance of the NCLOS program is currently being transferred to IT from ITRE.

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

Newly refined capacities output from an updated NCLOS program will continue to be used:

- in the Department prioritization processes
- during the development of travel demand models and CTPs, including the new Statewide Travel Demand Model
- for the Performance Metrics Dashboard
- for the development of feasibility studies

How Will the Product Benefit the Department?

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

The updated product will strengthen the data-driven project prioritization processes (as mandated by Governor Perdue's Executive Order #2) through use of the most current data and analysis. An enhanced prioritization process will result in better investment decisions to enhance safety, reduce congestion, and improve the health of the state's transportation infrastructure (short and long-term benefit).

Other Comments:

Approval (Division official or Unit Head)

Don Voelker

Print Name

Signature

Director

Title

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**PAVEMENT AND MAINTENANCE
RESEARCH IDEAS**

CALL FOR NEW RESEARCH IDEA**Your Name:** Drew Harbinson**DATE:** August 9, 2010**Branch / Unit:** Fleet and Material Management Unit**TITLE of the Research Idea:** Fleet Management Performance Monitoring**Background:**

The Fleet and Material Management Unit is responsible for the acquisition and maintenance of the North Carolina Department of Transportation (NCDOT) fleet. The fleet is made up of approximately 24,000 pieces of heavy construction and ancillary support equipment. The Unit's primary mission is to provide a cost effective fleet of equipment in good working order and available for use when needed. The Department has recently completed research to better understand the depreciated rate of the fleet, proper disposal point of equipment, and target utilization rates for the fleet. This research focused on the six most common equipment class codes by total dollar value.

What is the Specific Problem or Issue?

The depreciated rate, utilization rate, and disposal point of the fleet will change for each of the class codes over time. The purpose of this study will be to monitor and evaluate the existing targets for these six class codes over a 24 month period and recommend adjustments where necessary. Another issue to address is the remaining equipment class codes in the fleet that were not covered in the previous research study. These equipment class codes will require an evaluation of depreciated rate, utilization rate, and disposal point with recommended targets based upon existing methodology.

List Research Objectives and Tasks:

1. Monitor and evaluate the existing utilization rate for the six most common class codes over a 24 month period and recommend adjustment of targets where necessary.
2. Use existing methodology to collect data from Department databases and determine the depreciation rate, utilization rate, and disposal point for the remaining equipment class codes in the fleet.
3. Literature review of the current state of the practice.

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

A final report that provides adjusted individual performance targets for each equipment class code in the fleet as well as spreadsheets containing the data and methodology used to determine depreciated rate, utilization rate, and disposal point. And, to apply that adjusted methodology to the remaining class codes by setting appropriate utilization targets, disposal points, and depreciated rate.

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

The Department will utilize the information in the final report to make necessary adjustments to the fleet in order to maximize the utilization rate for all equipment class codes. Fleet size will be adjusted based on the targeted rates vs. actual performance.

How Will the Product Benefit the Department?

The benefit of the research project would be an appropriately sized equipment fleet that is maintained in a cost effective manner through an increased utilization rate across the fourteen division offices and improved performance of the equipment on the jobsite.

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

Drew Harbinson

Print Name

Signature

Director

Title

Please FAX, Mail, or email to: Dr. Moy Biswas, Research & Analysis Group

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

2302

Your Name: Clark S. Morrison, Ph.D., P.E.

DATE: 8/25/2010

Branch / Unit: Asset Management / Pavement Management Unit

TITLE of your Research Idea: MEPDG Inputs for Warm Mix Asphalts

Background:

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. Fatigue and rutting characteristics have been developed under Project #2007-07. 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:

The MEPDG models have been locally calibrated using the asphalt mix properties determined under Projects 2003-09 and 2007-07. It is important that the warm mix asphalts are tested and analyzed in the same way so that the design properties determined for WMA are consistent, and can be compared with the properties in the HMA database. Consistency will also eliminate the need for redoing the local calibration.

Approval (Division official or Unit Head)

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

Print Name:

Signature

State Pavement Management Engineer

Title:

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

2303

Your Name: Clark S. Morrison, Ph.D., P.E.

DATE: 8/25/2010

Branch / Unit: Asset Management / Pavement Management Unit

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

Background:

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

What is the Specific Problem or Issue?

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

List Research Objectives and Tasks:

- Determine what stresses typically act on the interface between the top surface layer and the underlying asphalt.
- Determine a method to measure the strength of the bond at this interface.
- Determine what factors influence the bond strength. These factors might include method of surface preparation, type of tack coat, placement temperature, type of pavement marking left in place, etc.

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

1. A method to determine stresses acting on the interface between the top surface layer and the underlying asphalt.
2. A method to measure the strength of the bond at this interface.
3. Identification of measures (that may include both design elements and revised construction procedures) to ensure the strength of the bond is adequate to prevent premature distresses.

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

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

How Will the Product Benefit the Department?

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

Other Comments:

Approval (Division official or Unit Head)

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

Print Name:

Signature

State Pavement Management Engineer

Title:

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Your Name: Neil Mastin, P.E.

DATE: 8/24/2010

Branch / Unit: Asset Management / Pavement Management Unit

TITLE of your Research Idea: Development of IRI Limits and Targets for Network Management and Construction
Approval Purposes

Background:

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

What is the Specific Problem or Issue?

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

The Construction Unit would like to get a handle on what sort of values should be used and how, from a construction approval perspective, Should IRI criteria be interval and continuous or one or the other? What are reasonable targets?

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

List Research Objectives and Tasks:

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

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

1. Appropriate and updated IRI targets for use in PMS analysis and reporting
2. Appropriate and updated IRI indices for use in PMS analysis
3. Appropriate targets for network-wide ride quality for use in the agency's Network Health reporting and project development process.
4. Guidelines for construction approval criteria to be used by the Construction Unit.

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

PMU would make extensive use of IRI information for analysis and reporting purposes. NCDOT as a whole would have appropriate goals and targets. The Construction Unit will have updated criteria for use in standards and project approval.

How Will the Product Benefit the Department?

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

Approval (Division official or Unit Head)

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

Print Name

Signature

State Pavement Management Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Judith B. Corley-Lay, Ph.D., P.E.

DATE: August 17, 2010

Branch / Unit: Asset Management/Pavement Management Unit

TITLE of your Research Idea: Performance of Cracking Mitigation Strategies on Cracked Flexible Pavements

Background:

If a thin overlay is placed on a roadway that has no cracking or surface distresses, we have a strong sense that the overlay will perform well. Most of the time, overlays are placed on pavements with existing cracking, and the project budget may not allow for repair of all cracked areas. This project will look at treatments that can be placed prior to the overlay to enhance the pavement performance. Of specific interest is the mat and seal surface treatment, geosynthetic fabric, and geomembranes. Other options may also be evaluated. Each option increases the incremental project cost. Is the improved performance sufficient to warrant the cost increase? How does the treatment impact the future rehabilitation options for the roadway?

What is the Specific Problem or Issue?

What is the incremental improvement in performance associated with several different methods to retard cracking in an overlay placed on a cracked pavement? What are the project selection criteria that should be used for each treatment type? Does the process work well for a single lift overlay? Does the treatment limit options for future treatments on the roadway?

List Research Objectives and Tasks:

This research will attempt to add one or more tools to the maintenance toolbox to assist on roadways with extensive cracking. To achieve this goal, at least the following tasks are required:

1. Conduct a literature review of treatments used by other agencies nationally and internationally.
2. Select treatments for additional study and evaluate their performance relative to a straight overlay in retarding cracking or reducing cracking severity. Determine if a laboratory study is possible to evaluate the performance.
3. Use field test sections to evaluate difficulties in construction, required overlay thickness and other aspects of section laydown. Monitor the test sections for the duration of the project and prepare a monitoring guide for NCDOT to continue the monitoring beyond the end of the project.
4. Determine if the treatment will limit future treatment options (for example, can it be milled and recycled?).
5. Prepare a final report detailing the research effort.

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

Recommendations on feasibility of several treatments to mitigate cracking when a thin overlay is placed on cracked pavement. The recommendations will include project selection, key issues of laydown, and performance expectations. Quarterly reports, a report of the literature search and a final report will be submitted.

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

County maintenance, district and division maintenance engineers will use the results to improve treatments on cracked roadways. Pavement management engineers will use the results in making treatment recommendations for division requested pavement studies.

How Will the Product Benefit the Department?

If successful, this could reduce maintenance costs and decrease the frequency of maintenance activities.

Approval (Division official or Unit Head)

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

Print Name

Signature

State Pavement Manage. Engineer

Title

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CALL FOR NEW RESEARCH NEEDS**Your Name:** Judith Corley-Lay**DATE:** August 26, 2010**Branch / Unit:** Asset Management/ Pavement Management Unit**TITLE of your Research Idea:** Local Calibration of MEPDG for Jointed Concrete Pavements in North Carolina**Background:**

A project to perform a local calibration of the flexible pavement portions of the MEPDG is in final completion and will apply to a significant percentage of our road network. However, that project did not address rigid pavements and until a local calibration is performed, NCDOT will be using national calibration for rigid pavement designs.

What is the Specific Problem or Issue?

Provide a local calibration for jointed concrete pavement for ME-design. This local calibration will need to determine typical values of coefficient of thermal expansion and will be complicated by the fact that the most common joint spacing for which performance data is available (18, 19, 21, 22) is not our current joint spacing (15'). Issues of sample size will have to be addressed by the researchers.

List Research Objectives and Tasks:

Provide material characterization and calibration coefficients for rigid pavement models in MEPDG in a form suitable for import into the design software.

The following tasks, at a minimum, are involved:

- 1) Identify key inputs into rigid pavement portion of MEPDG and use literature reviews and computer testing to find the most critical values (it is anticipated that coefficient of thermal expansion will be one of these).
- 2) Use literature and current practice to determine values and ranges used by other agencies. Test samples to develop databases if appropriate to characterize NC materials.
- 3) Identify test locations, construction history, materials data, and performance data. Determine if sufficient sites are available to conduct a local calibration. If not, develop a plan whereby NCDOT can add sites until sufficient data is available. If sufficient sites are available, conduct a local calibration.
- 4) Make specific recommendations for each input type regarding local, regional or national default values.

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

Databases of important material characteristics for rigid pavement design in formats that allow importation into MEPDG software. Calibration coefficients for performance models for rigid pavement design or a plan for NCDOT to collect additional site data. A user's guide for rigid pavement design in MEPDG.

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

This will be used by pavement design engineers in NCDOT, by design-build consultants, and by engineering companies providing designs for the Turnpike Authority to design rigid pavement alternates as part of the pavement type selection process.

How Will the Product Benefit the Department?

It is anticipated that MEPDG will provide designs for high volume roadways that are less costly than our current method. Since we have already calibrated the flexible pavement portion, we need to also evaluate the rigid pavement models.

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

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

State Pavement Management Engineer

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Signature

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CALL FOR NEW RESEARCH NEEDS**Your Name:** Judith Corley-Lay, Ph.D., P.E.**DATE:** August 17, 2010**Branch / Unit:** Asset Management/ Pavement Management Unit**TITLE of your Research Idea:** Visual Guide to Identifying and Treating Oxidation just Prior to Cracking.**Background:**

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

What is the Specific Problem or Issue?

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

List Research Objectives and Tasks:

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

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

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

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

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

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

How Will the Product Benefit the Department?

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

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

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

Print Name

Signature

State Pavement Management Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2308

Your Name: Judith Corley-Lay, Ph.D., P.E.

DATE: August 13, 2010

Branch / Unit: Asset Management/Pavement Management Unit

TITLE of your Research Idea: Laboratory Test Procedures for Emulsion based Asphalt Materials

Background:

Emulsion based asphalt materials are the glue of our chip seal program, and we are expanding our preservation program to include fog seals. Our ability to define and measure key properties of a successful emulsion is limited. This project would define the properties that are fundamental to a successful seal and determine laboratory tests that can be applied to an emulsion to measure these properties. This may include development of new laboratory tests.

What is the Specific Problem or Issue?

We currently lack tests that will define a successful emulsion from one that results in poor performance.

List Research Objectives and Tasks:

This research will define the key performance indicators for asphalt emulsions and determine methods to measure them in the laboratory. Tasks may include the following:

1. Literature search on performance measure for asphalt emulsions. Also any laboratory tests that lead to successfully separating good performing from poor performing emulsions.
2. Identify key performance indicators and possible methods of measuring them.
3. Test the measure and the methods for a range of emulsions commonly used in NC.
4. Develop tests for any measures for which no tests are available if possible.
5. Recommend a testing series to identify good performing asphalt emulsions. This series should include the critical levels of each key performance indicator.
6. Final report outlining the work.

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

Key performance indicators, critical levels of each indicator and test methods for each indicator to allow identification of good, fair and poor performing emulsions.

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

Can be used to accept emulsion or to identify the causes of poor performance if it occurs.

How Will the Product Benefit the Department?

If we can identify good versus poor emulsion, we can specify good emulsion and reduce chip seal failures that are costly, increase maintenance costs and negatively impact the public.

Other Comments:

This research need was identified by the Joint FHWA/NCDOT task group on preservation.

Approval (Division official or Unit Head)

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

Print Name

Signature

State Pavement Management Engineer

Title

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CALL FOR NEW RESEARCH IDEA**Your Name:** Jack Cowsert, P.E. and Todd Whittington, P.E.**DATE:** 09/09/2010**Branch / Unit:** Division of Highways - Field Support - Materials and Tests**TITLE of your Research Idea:** Determining Recycled Asphalt Binder Limits Contributed by Waste Materials**Background:**

As Materials and Construction costs continue to increase, there is a strong interest by both Agencies and Industry to develop ways to include more recyclable materials in asphalt pavements. With both cost savings and sustainability in mind, the Department has increased allowances for recycled materials in hot mix asphalt (HMA) in the past few years. The two recyclable materials that receive the most use in North Carolina are recycled asphalt pavement (RAP) and recycled asphalt shingles (RAS). With respect to recycled shingles, the Department has also begun allowing waste shingles from the re-roofing of buildings in HMA.

What is the Specific Problem or Issue?

The current state of practice in HMA mix design is to place limits on the percentage by weight of total mixture that has been replaced by RAP, RAS, or some combination of both. The contributed binder content is then computed and is shown as a replacement for a percentage of virgin asphalt binder added to the mix. The need exists to determine if changes in specifications are warranted to limit recycled materials based on the percent recycled binder they contribute to the total binder percentage instead of the percent by total weight of mixture. The potential exists to write a specification that would be "blind" to the type of recycled material used. This would allow contractors to use multiple waste streams (RAP, RAS, or others as approved) to meet one specification limiting recycled binder content only.

List Research Objectives and Tasks:

- Compare NCDOT's current specification to other agencies' specifications and/or research practices for design of recycled HMA mixes. Specifically, determine if the state of practice of limiting recycled material by total weight of mix.
- Investigate various sources of recycled binder – including RAP, RAS (both post-manufacturer and post-consumer waste) - for Performance Grade (PG) of binder. This should be done using standard binder recovery methods (extraction, Abson, rotary evaporator) and PG binder grading test methods. Binder from post-consumer recycled shingles (PRAS) tends to be much stiffer than those from the manufacturing waste stream. Therefore, there should be a separate quantification of PG grading to determine if the same amounts of PRAS can be allowed in our mixes without detrimental effects.
- Using limits defined by PG grading, determine the effects on HMA mix of various percentages of recycled binder contributed. Perform (at a minimum) standard tests for Dynamic Modulus, Flow Number, and Fatigue on mixes.
- Develop a draft specification utilizing limits for recycled materials based on recycled binder percentage in the mix.

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

- Knowledge for design engineers of the effects different recycled binder types have on our mixes.
- New specification limits for allowable recycled binder from all types of recycled material that allow for more flexibility in the utilization of different sources of recycled binder.

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

Engineers will use these products to better determine virgin binder grades for use with higher contributed recycled binder percentages. Choosing the proper binder grades is key to reducing rutting and fatigue cracking in the field. This also could give engineers more flexibility in using higher amounts of recyclable products in our pavements.

How Will the Product Benefit the Department?

- Reduce costs of hot mix asphalt by allowing higher recycled binder contents in hot mix asphalt.
- Increase the environmental stewardship of the Department by diverting shingle waste from the landfills to become a beneficial product in pavement.

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

Christopher A. Peoples, P.E.

Print Name

Signature

State Materials Engineer

Title

**SRTUCTURES AND CONSTRUCTION
RESEARCH IDEAS**

CALL FOR NEW RESEARCH NEEDS**Your Name:** Emily McGraw and Scott Capps**DATE:** 8-17-10**Branch / Unit:** Bridge Management and State Road Maintenance**TITLE of your Research Idea:** Quantifying and Comparing Corrosive Effects of Granular Salt, Salt/Sand Mixture and Salt Brine on NCDOT Bridges**Background:**

NCDOT is responsible for the preservation and maintenance of over 13,000 bridges in the state of North Carolina. In 2005, NCDOT increased its utilization of salt brine in an effort to prevent frozen precipitation from bonding to roadways and bridges. By increasing salt brine utilization, the quantity of granular salt required during a storm event decreases. Public safety and economic stability requires state agencies to keep roadways and bridges passable during winter weather events.

What is the Specific Problem or Issue?

Emphasis on passable transportation networks has resulted in an increased amount of anti-icing (salt brine) applications in comparison to the de-icing activity of granular salt applications. Because of this increased focus of anti-icing, bridges receive numerous applications of salt brine annually. Has this increased utilization of salt adversely affected bridge decks and superstructures?

List Research Objectives and Tasks:

- Quantify corrosive effect of granular salt on concrete and steel components of bridges
- Quantify corrosive effect of sand/salt (4 to 1) mixture on concrete and steel components of bridges
- Quantify corrosive effect of 23% salt brine on concrete and steel components of bridges
- Compare the corrosive effects between granular salt, sand/salt and salt brine
- Compare the rate of thawing between granular salt, sand/salt and salt brine as it relates to corrosive effects
- Compare the freeze point between granular salt, sand/salt and salt brine as it relates to corrosive effects

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

Individually and comparatively quantify the corrosive effects of granular salt, sand/salt (4 to 1) mixture and 23% salt brine solution.

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

Divisions and central units will use this information to make well informed decisions on anti-icing and de-icing activities on bridges.

How Will the Product Benefit the Department?

This research will provide comparative information between applications, safety, and long term corrosive effects. Further, this research will provide the Department with information related to maximizing the benefit of snow and ice removal applications while minimizing the corrosive nature of the materials used.

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

Dan Holderman, PE

Print Name

Signature

State Bridge Management Engineer

Title

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CALL FOR NEW RESEARCH IDEA**Your Name:** Mike Robinson, Greg Perfetti**DATE:** August 25, 2010**Organization / Branch / Unit:** Structure Design Unit**TITLE of the Research Idea:** Crack Free Mass Concrete Footings on Bridge in Coastal Environments**Background:**

Concrete in bridge footings has the potential to crack when the temperature gradients within the concrete causes thermal stresses to exceed the tensile strength of concrete. The concrete generates heat from the chemical process involved as it sets and gains strength. In large structures (mass concrete), such as footings on piles typically used to support bridges in harsh coastal environments, the temperature gradients develop because the surrounding air and/or water cool the concrete on the surface much more rapidly than the concrete in the core of structure.

To prevent thermal cracking the Department prescribes fly ash content in the concrete mix and places limits on the maximum temperature differential for mass concrete, but the results have been inconsistent.

What is the Specific Problem or Issue?

Cracking has been observed on mass concrete footings of several coastal bridges despite prescribing measures such as placing limits on the temperature differential in the mass concrete, using set-retarders and water reducers, and reducing the cement content by use of fly ash.

List Research Objectives and Tasks:

1. Critique the Department's specifications and procedures for concrete mixes, concrete placement, and temperature monitoring on mass concrete structures.
2. Examine mix designs, construction methods, and environmental conditions on several coastal bridges where mass concrete was employed. Evaluate each case and determine causes for success or failure of each placement.
3. Make recommendations on new or revised measures to prevent cracking in mass concrete structures and structural elements, including guidelines on how to identify potential mass concrete elements.

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

Improved specifications and quality control guidelines for use on projects where mass concrete is employed.

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

The products of this research will be used to improve the quality control specifications (Standard Specifications for Roads and Structures) that contractors and material suppliers must adhere to.

How Will the Product Benefit the Department? (e.g., increase operational efficiency, decrease costs, enhance safety, etc.)

Indicate short term and/or long term benefit)

Products of the research will be used to ensure that the maintenance costs of future mass concrete structures will be reduced, and thereby extend the life of the bridge substructure.

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

Robinson/Perfetti

Print Name

Signature

State Bridge Design/Construction

Title

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CALL FOR NEW RESEARCH IDEA**Your Name:** Dan Holderman**DATE:** 8/27/10**Organization / Branch / Unit:** Bridge Management Unit**TITLE of the Research Idea:** Analysis of Truck Load Weight Distribution in North Carolina**Background:**

The North Carolina Department of Transportation is responsible for issuing oversize permits for all vehicles on state-owned roadways with a gross weight in excess of legal loads. The allowable loading per axle is dependent upon the number of axles grouped together (e.g. single axle, tandem axle, 3 or more axles). Single axles are allowed up to 25,000 lbs., tandem axles are allowed up to 50,000 lbs. and 3 or more axles are allowed up to 60,000 lbs.

What is the Specific Problem or Issue?

When permits are received, the applicant often assumes the weight of the load to be equally distributed across the bed of the trailer to each axle, even in instances where the load is confined to one part of the trailer.

List Research Objectives and Tasks:

The researcher for this project should identify the axle load distribution for the most commonly occurring hauling rigs axle configurations and spacing that apply for overweight permits as determined by the Department, thru previous verifiable testing and field testing by research group.

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

A final report documenting the findings of the study as well as a booklet documenting the load distribution of the various axle configurations that can be used by the Oversize/Overweight Permit Unit.

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

This product will assist the Oversize/Overweight Permit Unit and State Bridge Management Unit in issuing permits to applicants with overweight vehicles with confidence that axle spacing and axle loads are within allowable limits.

How Will the Product Benefit the Department?

The importance of keeping axle loads at or below the allowable limit is critical to the safety and maintenance of the state-owned road and bridge network in North Carolina.

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

Dan Holderman

Print Name

Signature

State Bridge Management Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2404

Your Name: Michael E. Miller, P.E.

DATE: 8-16-10

Branch / Unit: NCDOT Division 9

TITLE of your Research Idea: Portable Horizontal Life Line

Background:

What is the Specific Problem or Issue?

A quick Life Line for applications of 60 feet or less is needed.

List Research Objectives and Tasks:

To provide a quick useable Life Line for applications of 60 feet or less.

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

Portable Life Line that attaches to a truck.

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

It will be used for fall protection by our bridge department.

How Will the Product Benefit the Department?

It will provide another tool to be used for fall protection. Enhance Safety

Other Comments:

Approval (Division official or Unit Head)

.....
David Spainhour, P.E.

Print Name

.....
Signature

.....
Div. 9 Maintenance Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

2405

Your Name: Josh Deyton, P.E.

DATE: August 26, 2010

Branch / Unit: Division 14 Bridge Maintenance

TITLE of your Research Idea: Preservation of Bridge Decks

Background:

Bridge decks receive various forms of damage due to environmental conditions, snow and ice removal, and traffic related causes. In an effort to minimize these damages, Division 14 currently uses an epoxy overlay on bridge decks with minimal damage.

What is the Specific Problem or Issue?

Division 14 would like to know if the products they are currently using are the most cost effective for the life of the bridge. There has been no clear guidance on what product should be used and it is currently a trial by error process.

List Research Objectives and Tasks:

To determine the most cost effective way, with minimal impact to traffic, to preserve a bridge deck based on the age and condition of the deck.

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

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

Different types of epoxy overlays and any other concrete sealants that would seal cracking and prevent further damage to the deck by environmental influences.

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

Other Divisions would most likely use the research to determine the method to preserve bridge decks throughout the State. The application of preservation measures could be used on new bridges as well when they are constructed.

How Will the Product Benefit the Department?

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

Determining the proper way to preserve bridge decks would increase efficiency and safety by minimizing the need to repair pot holes on bridge decks. The proper application of bridge deck preservation would also decrease long term maintenance costs.

Other Comments:

It is a possibility that extensive research on this subject has already been completed. If it is determined that research has already been performed, then results of that research might be used to determine a method of bridge deck preservation.

Approval (Division official or Unit Head)

Joel Setzer, P.E.

.....
Print Name

.....
Signature

Division Engineer

.....
Title

**TRAFFIC AND SAFETY
RESEARCH IDEAS**

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 2, 2010

Branch / Unit: Research Unit

TITLE: Development of a Safety Evaluation Procedure for Identifying High Risk Signalized Intersections in the Triangle Area of NC

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To reduce traffic accidents.

List Research Objectives and Tasks:

The purpose of this research is to develop a procedure to identify high risk signalized intersections in the Triangle area of NC in terms of all crashes, and specific types of crashes, under various intersection conditions. The scope of this project is limited to evaluations of signalized intersections in the Triangle Area of NC.

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

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

Analysis methods and techniques should lead to the development of crash estimation models and a user's guide for field implementation.

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

Analysis methods and techniques should lead to the development of crash estimation models and a user's guide for field implementation. This will make our transportation network safer.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 3, 2010

Branch / Unit: Research Unit

TITLE: Engineering and Technology Measures To Improve Large Truck Safety: State of the Practice in North Carolina

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To reduce traffic accidents.

List Research Objectives and Tasks:

1. Identify engineering and technology measures that other states have used to improve large truck safety.
2. Determine what measures the NCDOT has implemented in North Carolina.
3. Solicit ideas from the NCDOT personnel for new truck safety initiatives.

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

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

New truck safety initiatives.

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

Implement procedures to reduce accidents and improve safety for the users of highway facilities.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 3, 2010

Branch / Unit: Research Unit

TITLE: Traffic and Highway Geometric Characteristics Associated With Pedestrian Crashes in North Carolina

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To reduce pedestrian deaths and injuries resulting from crashes with motor vehicles.

List Research Objectives and Tasks:

This study should be initiated to determine the traffic and geometric characteristics that significantly affect the safety of different classifications of pedestrians as a first step in the identification of potentially effective countermeasures for reducing pedestrian deaths and injuries resulting from crashes with motor vehicles.

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

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

The traffic and geometric characteristics that significantly affect the safety of different classifications of pedestrians as a first step in the identification of potentially effective countermeasures for reducing pedestrian deaths and injuries resulting from crashes with motor vehicles.

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

To reduce pedestrian deaths and injuries resulting from crashes with motor vehicles. This will make our transportation network safer.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 3, 2010

Branch / Unit: Research Unit

TITLE: Incorporating Safety into the Regional Planning Process in North Carolina

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To increase road safety by incorporating safety issues in the transportation planning process.

List Research Objectives and Tasks:

The purpose of this project is to determine ways in which the NCDOT (which generally is responsible for roadway safety) may work with metropolitan planning organizations (MPOs) and rural planning organizations (RPOs) to integrate safety and planning.

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

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

A listing of ways in which the NCDOT (which generally is responsible for roadway safety) may work with metropolitan planning organizations (MPOs) and rural planning organizations (RPOs) to integrate safety and planning.

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

To reduce deaths and injuries resulting from crashes with motor vehicles. This will make our transportation network safer.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

Title

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

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 3, 2010

Branch / Unit: Research Unit

TITLE: Guidelines for the Application of Active Traffic Management in North Carolina

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To determine ways in which the NCDOT can define guidelines for when various Active Traffic Management techniques might offer positive improvements in North Carolina.

List Research Objectives and Tasks:

This project will synthesize available data from other deployments of this technology and develop generalized guidelines for when different ATM approaches should be applied on North Carolina roads. The research team will develop a list of candidate locations where active traffic management may offer the potential to improve flow and safety. Methods to include ATM in traditional planning processes along with common capacity expansion projects also will be developed.

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

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

Methods to include Active Traffic Management in traditional planning processes along with common capacity expansion projects also will be developed.

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

To make use of automatic systems and human intervention to manage traffic flow and ensure the safety of road users.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Ernest Morrison

DATE: September 3, 2010

Branch / Unit: Research Unit

TITLE: Causal Factors for Intersection Crashes in Raleigh, NC

Background:

One of the goals of the NCDOT is to "Make our transportation network safer"

What is the Specific Problem or Issue?

To determine ways in which the NCDOT can reduce intersection crashes and resulting deaths, injuries, property damage, and congestion.

List Research Objectives and Tasks:

The purpose of this project is to take detailed measurements of the geometry, highway design and signal parameters for intersections in Raleigh, NC which have a history of multiple intersection crashes. The data will be analyzed to determine if causal factors can be determined for the intersection crashes in Raleigh, NC. If causal factors are determined, appropriate mitigation methods or design changes may be implemented to reduce crashes in the future.

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

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

Casual factors for the intersection crashes in Raleigh, NC

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

If causal factors are determined, appropriate mitigation methods or design changes may be implemented to reduce crashes in the future. Although detailed data will be collected for intersections in Raleigh, NC, the causal factors determined will most likely apply to other areas in North Carolina.

How Will the Product Benefit the Department?

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

Reduce accidents and improve safety for the users of highway facilities. This will meet one of the primary goals of the NCDOT to "Make our transportation network safer"

Other Comments:

Approval (Division official or Unit Head)

Moy Biswas

Print Name

Signature

Assistant Branch Manager

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** James Dunlop**DATE:** 9/14/2010**Branch / Unit:** Transportation Mobility and Safety Division/Congestion Management**TITLE of your Research Idea:** Pedestrian and Bicycle Accommodation on Superstreets**Background:**

Superstreets, called restricted crossing u-turns by the Federal Highway Administration, are a part of a menu of unconventional arterial designs that may provide a promising solution for arterials. They have the potential to move more vehicles efficiently and safely through the same arterial pavement as conventional arterials, at-grade, with minimal disruptions to the surrounding environment and businesses. The NCDOT has adopted the superstreet as a congestion treatment for urban conventional intersections, and as a safety treatment for rural conventional intersections. The NCDOT has also adopted superstreets as an important design tool for segments of its Strategic Highway Corridor system.

What is the Specific Problem or Issue?

The NCDOT has recently completed research on the operational and safety effects of superstreets, but the effects on pedestrians and bicyclists have not been evaluated. In theory, superstreets should strongly benefit these groups; however, pedestrians and bicyclists have shown resistance to superstreets in previous public hearings. It is important to evaluate the effects of superstreets on pedestrians and bicyclists to determine the real impacts, and to modify superstreet designs as needed to make the pedestrian and bicycle experience with superstreets as positive as possible.

List Research Objectives and Tasks:

Evaluate the convenience and safety effects of superstreets on pedestrians.
 Evaluate the convenience and safety effects of superstreets on bicyclists.
 Recommend superstreet design modifications to benefit pedestrian and bicycle users.

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

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

This research will produce a paper on the travel time and safety effects of superstreets on pedestrians and bicyclists, as well as provide modifications to standard drawings. This research will also develop materials for public meetings.

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

The NCDOT and other agencies can use these products in future superstreet implementation in areas where pedestrians and bicyclists may be current or future facility users.

How Will the Product Benefit the Department?

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

The research outcomes will enable NCDOT to have a better understanding of superstreet impacts which can lead to cost savings by reductions in collisions involving pedestrians and bicyclists. The research could also decrease costs because of reduced delay in project planning. Pedestrians and bicyclists are vocal groups that have previously shown resistance to superstreets. Their acceptance could help push the designs through more quickly.

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

James Dunlop

Print Name

Signature

Congestions Management Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA

Your Name: James Dunlop

DATE: 9/14/2010

Branch / Unit: Transportation Mobility and Safety Division/Congestion Management

TITLE of your Research Idea: Quadrant Roadway Intersection Evaluation in North Carolina

Background:

Quadrant roadway intersections are an unconventional intersection design that may provide a promising solution for a failing conventional intersection between two major arterials. The design eliminates left turns from the primary intersection, and instead creates or designates a nearby roadway to serve those left turns. The idea of the quadrant roadway intersection appears promising in publications of the FHWA and others, but no field installations have been opened to the point. The quadrant roadway intersection that the Department will open soon in the Charlotte area (TIP Project R-2632AA) may be the first in the US.

What is the Specific Problem or Issue?

The operational and safety effects of quadrant roadway intersections have been evaluated using theory, analytical models, and simulation, but have not been evaluated on a complete design. This research would provide the first complete operational and safety analysis of a quadrant roadway intersection.

List Research Objectives and Tasks:

Evaluate the travel time effects of quadrant roadway intersections through field data and calibrated and validated VISSIM simulation models.
 Evaluate the safety effects of quadrant roadway intersections through Empirical Bayes analyses of collision data.

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

(Note: Progress reports and the Final report are NOT considered a "product," but "deliverables.")
 This research would produce a paper on the travel time and safety effects of quadrant roadway intersections, a calibrated and validated VISSIM model, and a framework for the safety analysis of future quadrant roadway intersection installations using Empirical Bayes techniques.

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

The NCDOT and other agencies will use this research to evaluate congested conventional intersections where quadrant roadway intersections could be beneficial. This research will also provide calibrated and validated VISSIM models and safety analysis techniques for future NC implementations.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
 Quadrant roadway intersections can increase operational efficiency at congested intersections between major arterials, thereby reducing costs due to travelers. The safety analyses may also show a reduction in collisions which will enhance safety and reduce costs. Quadrant roadway intersections could provide great capacity and quality of service much cheaper than a comparable interchange, saving the NCDOT millions of dollars in construction costs.

Other Comments:

Approval (Division official or Unit Head)

James Dunlop		Congestion Management Engineer
Print Name	Signature	Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: James Dunlop

DATE: 9/14/2010

Branch / Unit: Transportation Mobility & Safety/Congestion Management

TITLE of your Research Idea: Field Verification of Hillsborough Street Roundabout Simulations

Background:

In 2000-2002, various studies/analyses were done on the theoretical operation of the proposed Hillsborough Street Roundabout corridor. Now that the first three roundabouts have been completed (Pullen-Stinson was completed in 2003, and Hillsborough-Oberlin-Pullen and Oberlin-Oberlin extension were completed in 2010), validation of the analysis models and simulations would be helpful for future roundabout planning and design.

What is the Specific Problem or Issue?

Most of the planning and design of roundabouts in North Carolina have been done using theoretical models and analysis using software packages such as VISSIM and SIDRA. Some field work has been done as part of NCHRP 03-65, however little field verification has been done in this state. While roundabouts have been more accepted by the public, there are still questions regarding how effective they are in North Carolina. Local data and information specific to the State would help in convincing the public and public officials, as well as assist in choosing roundabouts at specific locations. More detailed operational data will also help in design.

List Research Objectives and Tasks:

Gather field data such as traffic volumes, travel time and delay. Create simulation and analysis models for the corridor, and compare theoretical results with field data.

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

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

This research would produce a paper on the travel time, delay and capacity for the Hillsborough roundabouts, along with calibrated and validated VISSIM and SIDRA models.

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

NCDOT and municipalities will use these results to better refine roundabout analysis to make decisions on if a roundabout is a suitable traffic control device for a particular location, and determine design criteria, such as inscribed diameter size, and laneage.

How Will the Product Benefit the Department?

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

Roundabouts have shown to be a safer and more efficient intersection control than most other types of intersections. Identifying specific North Carolina operational criteria will help in better decisions now and in the future in locating roundabouts, as well as allowing for more efficient designs. Roundabouts help save operational, maintenance and construction costs.

Other Comments:

Approval (Division official or Unit Head)

James Dunlop
Print Name

Signature

Congestion Management Engineer
Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: James Dunlop/Elise K. Groundwater

DATE: September 14, 2010

Branch / Unit: Transportation Mobility and Safety Division/Congestion Management

TITLE of your Research Idea: The Upstream Effects of Left and Right Lane Drops on Freeways

Background:

Safety and capacity issues have arisen at many freeway lane drops on the State Highway System. There is not much information regarding dropping the left lane or right lane in these locations.

What is the Specific Problem or Issue?

High crash rates are reported in locations of lane drops during the peak hours. Safety, including adequate sight distance is a major concern and it is our duty to increase safety. Questions have also come up regarding capacity differences between left and right lane drops.

List Research Objectives and Tasks:

Collect volume and speed data at locations of existing right lane and left lane drops on our freeways. Use a traffic modeling software and calibrate the data and evaluate the effects of right and left lane drops on freeways.

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

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

Recommendations and guidelines as to geometric considerations, operational effects, signing for safety of freeway lane drops.

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

NCDOT and others will use this research to evaluate and use as guidelines for recommendations for operation and safety on freeways.

How Will the Product Benefit the Department?

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

Offering us options to improve design and increase safety on freeways. Helping us to better determine if to drop the through lanes on the right or left.

Other Comments:

Approval (Division official or Unit Head)

James Dunlop

Print Name

Signature

Congestion Management Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Anthony Wyatt, P.E. & Charles Brown, P.E., P.L.S

DATE: September 16, 2010

Branch / Unit: Traffic Safety Unit and Locations and Surveys

TITLE of your Research Idea: Infrastructure Investment Protection with High Density Surveys (HDS)

Background:

It is important that we have the capability to accurately estimate, analyze, and document facilities/features for conformance to design standards, quality control, and in service performance/durability. HDS or the other technologies mentioned can be a vital element in our efforts to better manage our aging Assets (highways & bridges) and our new facilities.

In addition, HDS and helicopter based photogrammetry/LiDAR may serve as excellent tools in the creation of as-built plans for highway facilities, structures, etc., and in preparation of background for visualization applications.

What is the Specific Problem or Issue?

While NCDOT Location & Surveys has secured initial hardware and software that can perform the 3 dimensional High Density Surveys (and we also have PEFs with this expertise & equipment), we do not yet have a business plan that would introduce a requirement for this type of detailed condition mapping as a condition of project inspection, acceptance, or claim litigation. NCDOT continues to struggle with a lack of contemporary and effective accurate inventories and system assessment documentation and records. Unfortunately many of the efforts utilizing tools like HDS have been after a break down in the inspection and/or quality control of a project, with very little pro-active action taken in the area of facilities mapping and quality control.

List Research Objectives and Tasks:

To provide an assessment of the Department's needs, capabilities and the potential of the HDS technology for enhancing and being integrated into NCDOT inspection/project close out procedures (preventative tool) in addition to being used for troubleshooting (corrective / after Department assumes maintenance of project). In addition to an assessment of the Department's capabilities and potential for application in the inspection / acceptance process the research effort should also investigate the potential benefits in terms of defending the Department in TORT and Construction Claim actions – particularly those involving surface deficiencies.

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

It is expected that the successful research effort would produce a report that would enable personnel to determine: (1) If NCDOT's capabilities (both human and collection, processing, analysis and presentation equipment & software) in this technology area are sufficient; (2) A recommendation for and implementation and completion of a PILOT HDS report at Conclusion of a TIP or major Resurfacing Contract (prior to project close out & as part of project QC and Inspection) ; and (3) Recommendations of Guidelines for When HDS would be more appropriate for Troubleshooting, Crash/Incident Reconstruction, and Corridor studies (report would provide guidance for when traditional methods, alternate methods Low Altitude Mapping, LiDAR), or HDS would be appropriate. In addition to the traditional bound and electronic report, the research should also provide a synthesis of contemporary literature and in practice surveys (from other States & Agencies/firms) and a professionally prepared presentation of the technology and the findings/recommendations.

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

The Department of Transportation would be able to utilize the research findings to improve Asset Management, Quality Control, and Analysis and Troubleshooting capabilities required in the management of a vast and complex transportation system. It is expected that the research could improve the Department's capabilities in integrating this emerging technology into not only inspections, but also visualizations, crash reconstructions, and litigation defense efforts. The research should provide NCDOT management with an indication of necessary training investments, hardware purchases and upgrades, outsourcing contracts, and business process changes to effectively apply this fundamental three-dimensional facility mapping and condition model. Future enhancements should also look toward integration with photogrammetric and other GPS feature and inventory efforts such as mobile van data collection and video logging capabilities.

How Will the Product Benefit the Department?

An effective delivery of this effort would greatly enhance the Department's capabilities in HDS technology, improve our efforts to improve project inspection & quality control, improve safety by allowing identification of deficiencies before projects are opened to traffic, improve troubleshooting capabilities (isolating existing problems), improve Crash & Incidence Reconstruction capabilities and improve our ability to challenge construction claims and TORT litigation (Ref: House Bill 22).

Other Comments:

Various sources inside of NCDOT would be available to assist with information gathering, interviews, etc., in the use of equipment and in applications of data for design and analysis. Although not extensively experienced, these resources may be some of the best equipped to provide additional background information regarding many of the concerns raised in this request.

Approval (Division official or Unit Head)

Kevin Lacy, PE

Print Name

Signature

State Traffic Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Anthony Wyatt, P.E. & Jay Stancil

DATE: September 16, 2010

Branch / Unit: Traffic Safety Unit & Roadway Design

TITLE of your Research Idea: NC Roadway Lighting Needs Assessment, Lighting Maintenance Prioritization Tool, and Performance Measures

Background:

Unfortunately the overwhelming maintenance and modernization demands of a 78,000 mile highway system have relegated rapidly deteriorating obsolete roadway lighting systems into the category of "inadequate funds to address need." North Carolina's Roadway Lighting Committee (Reference in-house Division Assessments & Needs Report December 2005) has acknowledged the deteriorating state of many of North Carolina's Roadway Lighting Systems and concern has been expressed with continuing to construct new systems with the likely scenario being one of very limited to no maintenance and ultimate system failure / shut down.

What is the Specific Problem or Issue?

North Carolina has accumulated needs in excess of 25 million dollars of obsolete, malfunctioning and deteriorating lighting systems. A lack of consistency, low business priority, and perception of marginal public safety and security benefit have relegated these life saving freeway features into a quagmire of deterioration with no mechanism or priority for modernization, replacement, phase out, or repair. The deteriorated systems waste energy, require recurrent maintenance, provide marginal to poor lighting for traveler navigation, and place a recurrent drain on very limited traffic services budgets. The aging Circuitry was often "direct buried" and many of the Band-Aid repairs that are made – say due to lightning hits – are often short lived due to recurrence of circuitry issues.

List Research Objectives and Tasks:

- A. Literature Synthesis: To provide an update on maintenance and life cycle costs and benefits of roadway / highway lighting (including security & incident management)
- B. Lighting Needs and Condition Assessment – magnitude of need and chaotic condition of systems (Refer to NCDOT December 2005 Assessment from Roadway Lighting Committee) – Research to Provide a Method (Lighting Priority Index Tool) to ID and Prioritize Critical Lighting Repair \ Maintenance \ Modernization & Replacement Needs.
- C. Provide Investigatory Support and Coordination with NCHRP 05-19effort being conducted by Rensselaer Polytechnic Institute (New York) to ensure North Carolina is represented and involved in the execution and development of this badly needed update to national Roadway Lighting Guidance.

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

Assessment Report, Summary of Accumulated Modernization/Replacement Needs, Solid Documentation of Recurrent Maintenance and Energy Needs (and privatization options) and an improved Warranting Criteria with Operational (In-Service) and Performance Measures. Contemporary literature review should include modern studies for crash modifications factors and positive guidance benefits of highway lighting. Additionally the Research should also include a PPT presentation that can be utilized by NCDOT Management for purposes of advising and educating BOT and Management of magnitude of accumulated lighting needs and need for dedicated resources and/or outsource options for continuation of critical lighting systems.

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

The research should improve the state of knowledge with regard to both the value of properly designed, well maintained highway lighting and the magnitude of immediate need and recurrent drain that the obsolete, deteriorated, partially functioning lighting systems cause. The product can be used as the Department's contemporary guidance for "when" and where to pursue freeway and safety improvement lighting and it can also be utilized to help better address the impacts that the deterioration of existing systems is having on other limited NCDOT operations forces.

How Will the Product Benefit the Department?

From a business perspective the research, findings, recommendations, and report will enable management to better access the magnitude of the highway/roadway lighting system crisis and will hopefully be an effective tool in further demonstrating and substantiating the severe funding and resource deficiencies that have evolved with regard to highway infrastructure and systems – like lighting. Additionally the improved Lighting Needs Index Tool should better enable the department to focus limited resources to those locations and freeways with most pressing (Safety / Night Crashes) and highest payoff for freeway lighting repairs, maintenance, modernization, and /or replacement.

Other Comments:

Research Should be Performed in Coordination with NCDOT Roadway Lighting Committee and Roadway Lighting / Electrical Engineer Jay Stancil.

Approval (Division official or Unit Head)

Kevin Lacy, PE

Print Name

Signature

State Traffic Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

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

DATE: September 16, 2010

Branch / Unit: 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)

Kevin Lacy, PE

Print Name

Signature

State Traffic Engineer

Title

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH NEEDS

Your Name: Jay A. Bennett, PE

DATE: September 16, 2010

Branch / Unit: Roadway Design Unit

TITLE of your Research Idea: Use of 27 inch High W-Beam Guardrail for Test Level 2 (TL-2) Conditions (44 mph).

Background:

Recent research on standard 27 inch guardrail G4(1S) shows that it does not meet NCHRP Report 350 Test Level 3 (TL-3) criteria. Transportation agencies should ensure the minimum height of newly-installed G4(1S) W-Beam guardrail should be at least 27 3/4 inch (minimum) to the top of the rail, including construction tolerance. (USDOT, Roadside Design: Steel Strong Post W-Beam Guardrail, May 17, 2010).

What is the Specific Problem or Issue?

NCDOT maintains 79,261 miles of state maintained roads. 64,390 miles of these roads are on state secondary routes with a majority of the routes with operating at speeds less than 45 mph. Is the 27 inch High W-Beam guardrail effective for lower speed conditions?

List Research Objectives and Tasks:

Create guardrail simulation models
Determine if 27 inch High G4(1S) W-beam Guardrail meets the Manual for Assessing Safety Hardware 2009 (MASH) Test Level 2 criteria for length of need using a small car 1100C (2420 lb) and a large passenger vehicle 2270P (5000 lb).

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

Determine if 27 3/4 inch high W-Beam guardrail is required for all new installations. Determine the effectiveness of 27 inch W-Beam guardrail for lower speeds.

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

Provide guidance for the Roadway Standard Drawing updates for guardrail placement (862.01).

How Will the Product Benefit the Department?

The department will not need to determine whether or not to adjust guardrail heights on non-National Highway System roadway improvement and/or resurfacing projects where lower speeds prevail. For non-National Highway System facilities maintenance and repair of damaged guardrail can be at the original height of 27 inches (as long as prevailing speed conditions are met).

Other Comments:

Approval (Division official or Unit Head)

Jay A. Bennett, PE

Print Name

Signature

State Roadway Design Engineer

Title

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CALL FOR NEW RESEARCH IDEA**Your Name:** Brian Mayhew, PE**DATE:** September 14, 2010**Branch / Unit:** Traffic Safety Unit**TITLE of your Research Idea:** Using 3D (XYZ coordinates) Centerline Data to Find Sight Distance Deficiencies**Background:**

Highway safety is partially dependent on the driver's ability to have long and uninterrupted visual sight lines. Sight distance is a function of any given road's 3D centerline geometry. 3D coordinates of road centerlines are now available and may be able to be analyzed to assess roadway geometry defining physical roadway elements such as curves, sags, and crests to determine driver sight distance.

What is the Specific Problem or Issue?

While 3D road centerline data are available, NCDOT does not have an automated method to analyze those data to determine geometric roadway characteristics. NCDOT does not have a mechanism to use 3D road centerline data to identify and characterize key safety-related roadway geometric characteristics like sight distance. Unless we have as-built plans available for a road, a time-consuming field study is the only current method to determine sight distance.

List Research Objectives and Tasks:

The objective of this study is to develop a methodology to analyze 3D roadway centerline data to identify roadway locations with deficient combinations of sight distance, speed, intersection and driveway locations and other factors that critically affect driver safety. The emphasis will be on a method to quickly and accurately identify locations that pose potential safety risks before collisions have a chance to happen. The methodology should enable personnel to enter acceptable ranges for parameter values. This project should also inform NCDOT as to the quality and limits of the existing 3D road centerline data available from the LRS.

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

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

The research products will include:

- An articulation of related work by other DOT's.
- A clearly defined methodology to find spots with deficient sight distance using 3D roadway centerline data.
- A case study illustrating the use of the methodology to assess a portion of the NCDOT road network.
- An assessment of the quality and limitations of the 3D centerline data

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

The Traffic Safety Unit and other NCDOT units could use the methodology to assess NC roadway geometry, identify potentially unsafe conditions, and characterize the degree of danger of those conditions. The results could help in prioritizing spots for improvement and determining cost-effective treatments for deficiencies.

How Will the Product Benefit the Department?

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

The identification of potentially unsafe roadway locations will benefit the Department by enabling improvement projects that could improve safety. Proactively identifying sight distance deficiencies that exist from roadway geometry could allow for NCDOT to consider improvement programs based on crash potential and not only crash history.

Other Comments:

NCDOT sources will be available to assist with information gathering.

Approval (Division official or Unit Head)

Print Name

Signature

Title

Please FAX, Mail, or email to: Dr. Moy Biswas, Office of Research

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CALL FOR NEW RESEARCH IDEA**Your Name:** Brian Mayhew, PE**DATE:** September 14, 2010**Branch / Unit:** Traffic Safety Unit**TITLE of your Research Idea:** Horizontal Curve Inventory**Background:**

The immense network of roadways that NCDOT maintains requires efficient processes. An inventory of horizontal curves containing the location and relevant geometric characteristics will supplement current NCDOT practices with readily available information. Horizontal curve data is relatively static compared to many asset types, which makes it an ideal target for an inventory. Once curve information is derived, the parameters of that curve are likely to remain unchanged for many years which decreases the effort required to maintain the inventory.

What is the Specific Problem or Issue?

Horizontal curve investigations require key field measurements such as radius, length, and deflection angle to perform a thorough investigation. However, the location of the curve might be in a remote area of the state that requires significant NCDOT staff and equipment resources to obtain the necessary data. A horizontal curve inventory could serve as the central repository for curves throughout NCDOT's system allowing quicker analysis for curves of interest that have been identified for study because of safety concerns or other purposes.

List Research Objectives and Tasks:

The primary objective of the research is to provide NCDOT with a prototype horizontal curve inventory (for a county or a division) and detailed directions on how that prototype should be extended for curves throughout the state. The objective will be carried out through tasks including the investigation of current NCDOT data sources, curve analysis needs, database structure, and analysis of alternative methods for populating the database.

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

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

The research products will include:

- Demonstration of an successful methodology using GIS analysis tools for deriving the curve data from existing GIS / LRS data, including quality assessment
- An inventory file structure for horizontal curves
- A prototype horizontal curve inventory for a county or division
- An implementation plan to fully populate the database of horizontal curves

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

The curve inventory will be used to study horizontal curves that are identified as hazardous locations. The inventory will provide relevant information about each curve that can be studied for potential deficiencies. Other units might find the inventory useful for tasks including heavy truck routing, pavement resurfacing, and others.

How Will the Product Benefit the Department?

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

The horizontal curve inventory will increase operational efficiency by reducing the burden of travel for field data collection with analysts referring to the database for relevant data. The inventory will also enhance safety by either eliminating the need for a field visit or reducing the amount of time NCDOT employees are exposed to traffic. These benefits can be realized in the short term and long term.

Other Comments:

NCDOT sources will be available to assist with information gathering.

Approval (Division official or Unit Head).....
Print Name.....
Signature.....
Title

CALL FOR NEW RESEARCH IDEA

Your Name: Chang Baek, PE

DATE: Aug / 31/ 2010

Branch / Unit: Mobility & Safety / Traffic Systems Operations

TITLE of your Research Idea: Development of Real Time Performance Measurements for Closed-Loop Signal Systems Using Existing Loop Detectors.

Background:

As implementing coordination plans for the closed-loop signal control system, an engineer should evaluate the performance of the plans. Current performance measurements are based on observing the traffic flow along the arterial, conducting "before/after" travel times, listening to the public, and so on. Traffic data from existing detectors at an intersection can be easily obtained and then may be utilized to collect real time performance measurements.

What is the Specific Problem or Issue?

During the process of implementing and evaluating coordination plans in the real world, a traffic engineer needs to monitor queue lengths on every movement at each intersection and drive to collect arterial travel times. Hours for a traffic engineer to observe traffic patterns would be numerous. In addition, in order to measure travel time along an arterial, additional infrastructures and systems need to be built at every signal system. Understanding how to analyze traffic data from loop detectors helps the traffic engineer save time and efforts.

List Research Objectives and Tasks:

- Literature review for the travel time measurement and the real-time arterial performance measurements.
- Evaluate the relationship between signal timings and flow characteristics through system and approach loop detectors.
- Develop the mathematical models to evaluate arterial performance.

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

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

The study would provide a set of mathematical models and recommendation for MOEs to a signal system timing engineer or Divisions to evaluate arterial performance through data collection from existing detectors.

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

When developing coordination plans and retiming the existing signal systems, the products can be used to select a better coordination plan, determine a need of retiming, and prioritize the signal system project.

How Will the Product Benefit the Department?

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

The Department can develop the initiative of arterial performance measurement and use the product to evaluate the arterial mobility in the State, efficiently and periodically.

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

Print Name

Signature

Title

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