

LIST OF AY-2010 NCDOT RESEARCH IDEAS

<u>Reference</u>	<u>Idea Title</u>	<u>Submitted</u>	<u>Organization Or Affiliation</u>
Planning and Environment			
0101	Modeling Road and Driver Characteristics Associated with Deer/Vehicle Collisions	L. Fontaine	Natural Environment Unit
0102	Freeways to Fuel Program	T. Sherrod	Roadside Environmental Unit
0103	Effectiveness Comparisons of Hydraulically Applied Erosion Control Permits	D. Pearson	Roadside Environmental Unit
0104	Long Term Water Quality Performance of Coastal Infiltration Systems	B. Holman, M. Lauffer	Roadside Environmental Unit
0105	Indirect Land Use Effects Matrices/Metrics	T. Gardiner	Human Environment Unit
0106	Trend Analysis of Submerged Aquatic Vegetation	B. Ellis	Natural Environment Unit
0107	Deer/Vehicle Collision Reduction in North Carolina	A. Burroughs	Natural Environment Unit
0108	Modeling of On-Board and Drive-By Tire/Pavement Noise In North Carolina	G. Smith	Human Environment Unit
0109	Effects of Mowing on Virginia Spiraea	M. Frazer, M. Miller	Natural Environment Unit
0201	Transpo Industries-Boden Highway/Railroad Grade Crossing System	D. Hinnant	Project Services Unit
Pavement and Maintenance			
0301	Investigation of the Effect of Ndesign Values on Performance of Superpave Mixtures	T. Whittington	Materials and Tests Unit
0302	Long Term Performance Evaluation of Warm Mix Asphalt Mixtures	T. Whittington	Materials and Tests Unit
0303	Performance of Higher Fines Aggr. Base Course with Low Levels of Cement, Lime of Fly Ash	J. Corley-Lay	Pavement Management Unit
0304	Evaluation of Crash Rate versus Time Since Paving and Pavement Macrotecture	J. Corley-Lay	Pavement Management Unit
0305	Frequency and Severity of Centerline Joint Separation in Flexible Pavements in North Carolina	J. Corley-Lay	Pavement Management Unit
0306	Performance of Cracking Mitigation Strategies on Cracked Flexible Pavements	J. Corley-Lay	Pavement Management Unit
0307	Causes of Fatigue Cracking in North Carolina	J. Corley-Lay	Pavement Management Unit
0308	Improved Freight Model for Strategic Multi-Modal Planning	J. Corley-Lay	Pavement Management Unit
0309	Fog Seal Effectiveness on Bituminous Surface Treatments	E. McGraw	State Road Maintenance Unit
Structures and Construction			
0401	North Carolina Bridges Vulnerable to Coastal Storms	D. Holderman	Bridge Management Unit
0402	Lateral Flange Bending in Heavily Skewed Steel Bridges: Part II	G. Perfetti	Structure Design Unit
0403	Predicting Camber, Deflection and Prestress Losses of Prestressed Concrete Members	G. Perfetti	Structure Design Unit
0404	Repair of Decayed Timber Structural Members of In-Service Structures	R. Briley	Division 5 Bridge Management
Traffic and Safety			
0501	Corridor-Based Forecasts of Work-Zone Impacts for Freeways and Multi-lane Highways	J. Ishak	Preconstruction/Work zone Traffic Control Unit
0502	Infrastructure Investment Protection with High Density Surveys (HDS)	A. Wyatt, C. Brown	Traffic Engineering, Locations & Surveys

Total number of research ideas from all categories: 25

CALL FOR NEW RESEARCH IDEA**Your Name:** Lance P. Fontaine, Ph.D.**DATE:** June 25, 2008**Branch / Unit:**

BioSurveys Group – Natural Environment Unit - PDEA

TITLE of the Research Idea: Modeling Road and Driver Characteristics Associated with Deer/Vehicle Collisions**Background:**

Population growth, rural development, and growing white-tailed deer populations have resulted in rapidly increasing incidence of deer vehicle collisions (DVCs) throughout the range of white-tailed deer. More than 1 million DVCs occur annually, but the estimated costs (> 30,000 injuries, > \$2,300 per vehicle) are likely gross underestimates due to low (< 50%) reporting rates. With the largest state maintained highway network in the US and a high deer population, North Carolina has more than its share of DVCs. Deer vehicle collisions are the single greatest wildlife related hazards to humans in North Carolina.

What is the Specific Problem or Issue?

Relatively expensive strategies (e.g., wildlife crossings) can reduce DVCs, but could represent a poor investment given current knowledge levels. Little is known regarding how different types of road projects, geographic locations, or infrastructure types (e.g., urban versus rural) influence DVCs. To efficiently reduce the threat to human health, safety, and welfare posed by DVCs several questions must be answered: 1) what road, landscape, and driver characteristics predict risk of deer vehicle collisions, 2) what do drivers know and believe about DVCs, 3) what is the driver reporting rate for DVCs, and 4) what is the effect of DVCs on attitudes towards deer population levels and managers of transportation and wildlife resources?

List Research Objectives and Tasks:

1. Model relative risk for DVCs based on project type (e.g. linear versus bypass), population density (e.g. urban versus rural), and region (coastal plain, piedmont, mountains) and compare risk among those areas and with randomly chosen locations.
2. Model role of road class (lanes, urban, rural, interstate, dividers, controlled-access, etc), traffic volume, speed limit, landscape variables, and driver characteristics in DVCs.
3. Determine driver knowledge, beliefs, and attitudes about DVCs.
4. Determine minimum reporting rates of DVCs to insurance companies and highway safety officers.
5. Determine the effect of DVCs on attitudes towards deer population levels and managers of transportation and wildlife resources.

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

Quarterly reports, a draft strategic plan for reducing DVCs and improving DVC education programs, and final strategic report based on steering committee reviews would be produced.

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

State and local agencies could use this information to target DVC hotspots for TIPs or improved signage, and to target high risk demographic groups for education efforts. These efforts would allow agencies to minimize costs associated with DVCs (both economic and in terms of human health and safety). Survey results also would allow estimates of actual DVCs based on reported DVC numbers.

How Will the Product Benefit the Department?

The survey results will improve both direct (road improvements, signage) and indirect (education) NCDOT efforts to reduce DVCs. Using the risk model NCDOT can strategically design TIPs to reduce future DVCs. Finally the risk model will facilitate optimal placing of expensive wildlife crossing structures. Survey results will allow NCDOT to validate current and future models based on voluntarily reported DVCs. Finally, by minimizing DVCs, NCDOT can reduce financial costs associated with them.

Other Comments:**Approval (Division official or Unit Head)**-----
Print Name-----
Signature-----
Title**Please FAX, Mail, or email to: Dr. Moy Biswas, Research & Analysis Group**104 Fayetteville St., Rm. 268, Raleigh, NC 27601
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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Ted Sherrod, PE

DATE: July 15, 2008

Branch / Unit: Roadside Environmental Unit-PDEA

TITLE of your Research Idea: Freeways to Fuel Program

Background: As fuel costs and right-of-way maintenance fees continue to rise, the use of interstate and highway right-of-ways for cultivation of energy crops is receiving attention. The Utah Department of Transportation has recently initiated a project (freeways to fuel) to explore the production of canola and soybeans in right-of-ways as a source of vegetable oil that can be converted to biodiesel.

What is the Specific Problem or Issue?

Canola is an annual variety of rapeseed, containing up to 50% vegetable oil. Canola is also an attractive right-of-way crop because of the aesthetic value of the yellow flowers produced by the plant in the months leading to harvest. As an economic comparison using 10ft implements, mowing currently costs approximately \$15/ac and the cost to cultivate canola is approximately \$225/ac. Based on current commodity prices and estimated regional grain yields, the approximate net return on the canola sold to a grain elevator would be \$75/ac and the approximate net return if the vegetable oil is used for biodiesel production is \$125/ac. The Biological and Agricultural Engineering Department at NC State proposes a project to investigate the feasibility of initiating a freeways to fuel project in North Carolina.

List Research Objectives and Tasks:

- 1) Develop an assessment criteria to identify right-of-way areas that are suitable for energy crop production and produce a GIS project to indicate these areas.
- 2) Assess the production, economic, and logistical parameters impacting oilseed production in right-of-ways to determine the optimal crop cultivation system.
- 3) Perform a series of plot trials to assess the yield potential of canola and soybeans in right-of-ways for various cultural practices.

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

Research production of canola and soybeans in right-of-ways as a source of vegetable oil that can be converted to biodiesel.

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

NCDOT will produce oilseed crops in the highway right-of-ways and then use the crop to produce biodiesel to fuel diesel vehicle fleets.

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 in diesel fuel costs throughout the state with long term cost benefits.

Other Comments:

Approval (Division official or Unit Head)

Print Name

Signature

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Donald Pearson

DATE: July 14, 2008

Branch / Unit: Roadside Environmental Unit – Field Operations

TITLE of your Research Idea: Effectiveness Comparisons of Hydraulically Applied Erosion Control Products

Background:

The prime objective in reducing erosion on highway construction projects in North Carolina is establishing permanent vegetation. This objective is accomplished by seeding and mulching bare ground areas within a prescribed time frame, typically 21 days. The method in which seeding and mulching is performed on highway construction involves agricultural type equipment. Cyclonic or drop/slit seeders are attached or pulled by farm tractors while mulch is applied on seeded areas by mulch spreaders towed by farm tractors.

The Department of Transportation prescribes the methods by which the seeding and mulching is to be performed by contractors through the Standards and Specifications Manual. History has proven these methods to be effective. However, lack of adequate rain and drought conditions are becoming more of an issue. Recent reductions in rain fall have affected the supply of straw available for seeding and mulching operations, and since the mulch cover is critical to meeting the regulatory requirements for groundcover as well as providing the physical benefit to the development of vegetation, the Department is taking a proactive approach to identifying alternatives to straw mulch.

The erosion and sediment control industry has developed a variety of hydraulic erosion control products. These products appear to have the potential to be an alternative to straw mulch and in some cases rolled erosion control products. The Department is interested in identifying the benefits of these products and assess them as alternatives to traditional mulching on highway construction projects.

What is the Specific Problem or Issue?

The availability of straw mulch is dependent on weather and other market demands. When this straw becomes in short supply on the market, it is necessary to have alternatives. The Erosion Control Industry is developing alternatives to straw mulch as well as other rolled erosion control products. As these products become available, it is necessary to determine their effectiveness on highway construction projects. Many of these products have been tested in a laboratory or in field settings in other states. However, the that remains is: How effective are these products on highway applications in North Carolina.

List Research Objectives and Tasks:

Determine the most effective product available for 3 target areas on highway construction projects, and determining the appropriate hydraulically applied product using the 4 categories of hydraulic products as identified by the Erosion Control Technology Council. These 4 categories are Fiber Reinforced Matrix (FRM), Bonded Fiber Matrix (BFM), Stabilized Mulch Matrix (SMM) and Hydraulic Mulch (HM). This determination should include the products availability, efficiency of application, cost, ability to reduce erosion, and ability to support the development of desirable vegetation. It is necessary that the research efforts in making these determinations be conducted on active construction projects to provide the appropriate environment where the products will ultimately be expected to perform. Consideration should be given to whether these products function better with seed and fertilizer included with the application or whether the seed and fertilizer should be applied prior to the product application. A cost analysis is also required. Target Areas include: 1)Cut slopes/ditchline back slopes 2)Fill slopes 3)Roadway shoulders

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

Fiber Reinforced Matrix (FRM), Bonded Fiber Matrix (BFM), Stabilized Mulch Matrix (SMM), and Hydraulic Mulch (HM)

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

The products will be applied through a hydroseeder by experienced operators. Locations will be determined by the representatives of the Department's Roadside Environmental Unit using the listed target areas mentioned above in each of the physiographic regions at a minimum, if not in all highway divisions.

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)

If the products perform at an acceptable level to the Department, then the potential benefits include being able to meet regulatory requirements when straw mulch is unavailable or in limited supply, possible improved stabilization in environmentally sensitive areas, and possible cost reductions in providing permanent groundcover to reduce or prevent erosion.

Approval (Division official or Unit Head)

Print Name

Signature

Title

CALL FOR NEW RESEARCH IDEA**Your Name:** Bob Holman & Matt Lauffer**DATE:** July 31, 2008**Organization / Branch / Unit:** Roadside Environmental & Hydraulics Units**TITLE of the Research Idea:** Long Term Water Quality Performance of Coastal Infiltration Systems**Background:**

One example of an infiltration system is with the Town of Kure Beach in New Hanover County. NCDOT began collaborating with the town to address the issue of stormwater outfalls. The 16 ocean outfalls carry runoff from US-421 and surrounding roads, parking lots, and rooftops. Town and NCDOT officials, through a research project with NC State University, developed a low-cost, effective alternative to treat this runoff. The alternative developed was the Dune Infiltration System. This new technology diverted and infiltrated stormwater beneath the dune systems.

Another example is the infiltration chambers that are located at Topsail Beach and Surf City in Pender County. There are 38 infiltration devices along NC 50 and were installed for flood control and water quality issues. These structures appear to be functioning properly but we have no idea of their water quality performance.

Therefore, while some limited water quality monitoring has been conducted, the long-term fate and transport of pollutants in these devices are still not understood.

What is the Specific Problem or Issue?

As populations increase near our beaches, new development and increased imperviousness generates more stormwater. Several coastal communities have stormwater discharges to the sound and beach, sometimes directly flowing into the ocean with little infiltration into the sand. Stormwater samples collected during 2005-2006 from two southern ocean outfalls had Enterococcus sp. levels that ranged from <10 CFU/100 ml to 4,010 CFU/100 ml with most of the samples exceeding 1,000 CFU/100 ml. Out of nearly 50 samples collected, only 3 did not exceed the state's single sample standard of 104 CFU/100ml for human contact waters. Stormwater contaminated with bacteria and other pollutants that discharges to ocean areas increases the risk of illness to swimmers.

List Research Objectives and Tasks:

These infiltration systems need to be carefully monitored before they can be recommended for further implementation along NC coast. Therefore, we propose to:

- Document the feasibility of routing flows from multiple stormwater pipes into one infiltration device and monitor the hydrologic performance. Also estimate the percentage of overall flow from the watershed that is diverted into the subsoil.
- Document and analyze the groundwater response beneath the devices with respect to hydrology and water quality parameters for up to 3 years following construction.
- Document and analyze the groundwater response beneath the infiltration devices with respect to hydrology and water quality parameters at already constructed devices.

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

Dissemination of the various infiltration basin design recommendations, procedures, and performance in the following formats: NCDOT reports and peer reviewed journal articles. Also present findings at NCDOT meetings, national and state conferences, coastal stormwater workshops, or other relevant training events in North Carolina.

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

We envision the utilization of these infiltration basins for other highway stormwater applications, especially in coastal areas. This technology should be implemented beyond the coast to Piedmont and mountain regions of NC.

How Will the Product Benefit the Department? (e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit) This technology could potentially be installed in multiple coastal locations, which will help meet the requirements of our NPDES Stormwater Permit. This type of stormwater control device will help protect the health and well being of both the citizens and the economy. In addition, NCDOT will benefit by not only contributing to the development of a potential new stormwater BMP, but we will have demonstrated the importance of continued research in such technologies before widespread recommendations or implementation is initiated.

Other Comments: NCDOT is willing to partner with other state and local governments for cooperative monitoring of these systems so that we can make the most accurate recommendations of how these systems should be utilized in NC. This presents a unique opportunity to gather a wealth of data to make sure these systems will have only a positive effect in sensitive environments.

Approval (Division official or Unit Head)

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Tim Gardiner

DATE: July 24, 2008

Branch / Unit: PDEA / Human Environmental Unit / Community Studies

TITLE of your Research Idea: Indirect Land Use Effects Matrices / Metrics

Background:

As the study of the indirect effects of transportation projects has evolved, different groups and studies nationally have determined characteristics and attributes that are indicators of or contributors to indirect land use effects. These characteristics include annual population growth, travel time savings, presence of water and sewer, among others. As these characteristics have been identified, the study of indirect effects has become more consistent, understandable, and defensible.

What is the Specific Problem or Issue?

NCDOT is moving to using two decision matrices, the indirect land use screening matrix and the land use scenario results matrix. These matrices are based on multiple national studies and research in all qualitative indirect land use studies. Although shown to provide valuable insight into how a project is likely to affect future development in an area, because of the evolutionary nature of the studies, the metrics used in matrix are not specifically tied to the original sources or research. Additionally, new attributes may have been determined that could provide more credibility to our studies.

List Research Objectives and Tasks:

Work would consist of reviewing the applicable literature for the most relevant research related to metrics currently used. Summary of support for the metrics used would be created and documented. Where new or more applicable characteristics or attributes are discovered, metrics shall be determined and a summary of support 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.")

A supported methodological summary for the indirect screening matrix

A supported methodological summary for the land use scenario assessment matrix

Additional supported metric for inclusion into indirect or cumulative tools

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

All future indirect land use studies completed by the department (in-house staff and consultant firms) will use the two matrices in reporting. The supported methodological summary will supply backing that NCDOT is providing and analyzing relevant data in these studies. The studies are reviewed and assessed by multiple environmental permitting agencies.

How Will the Product Benefit the Department?

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

Short term, the methodological summaries will increase the defensibility of NCDOT products and speed project delivery when impacts have been avoided or minimized. Long term, the clear connection of metrics to indirect land use changes will allow NCDOT to better predict projects where indirect issues are expected and adjust planning and schedules accordingly.

Other Comments:

Requested work would support efforts in the Project Development and Environmental Analysis Branch (Indirect Land Use Studies) as well work in Transportation Planning Branch (Comprehensive Transportation Plan).

Approval (Division official or Unit Head)

Drew Joyner, PE

Print Name

Signature

Unit Head – Human Environment

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

0106

Your Name: (PRINT) Bruce Ellis

DATE: 7/29/08

Organization / Branch / Unit:

TITLE of the Research Idea: "Trend Analysis of Submerged Aquatic Vegetation"

Background: Submerged Aquatic Vegetation (SAV) is an important component in the estuarine ecosystem. As such, it is regulated by federal and state agencies as a jurisdictional resource, where impacts to SAV are compensated through mitigation. NCDOT projects in coastal areas have the potential to impact SAV. Preparation of environmental documentation includes the identification of presence or absence of SAV in the project area. Upon completion of avoidance and minimization protocols, compensatory mitigation is addressed. Historically, traditional wetland mitigation methodologies have been proven to be ineffective or inappropriate for SAV mitigation. These tasks are further complicated in that the location and density of SAV can change from year to year depending on variances in weather and water quality.

What is the Specific Problem or Issue? The NCDOT desires to understand trends in the presence or absence of SAV in coastal areas of North Carolina. This information will provide NCDOT and regulatory agencies with information necessary to realistically assess impacts to SAV from proposed projects, and to determine appropriate avoidance, minimization, and compensatory mitigation alternatives. The dynamics (unpredictable presence or absence) of the SAV can lead to unintentional violations, as well as, over mitigating for the resource.

List Research Objectives and Tasks: Identify the historical presence (or absence) of SAV in Currituck Sound through the use of aerial photography and field surveys. Field verify SAV and determine the variability of the size and density of SAV beds over time. Ultimately, this information can be used to demonstrate the dynamics and variability of the resource, and identify factors that contribute to these dynamics.

What Would be the Product[s] of the Research? Deliverables areas follows:

- (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]?

This information would be very useful as part of the NEPA process. It will also aid in the selection of LEPA and contribute to avoidance and minimization of impacts to jurisdictional areas.

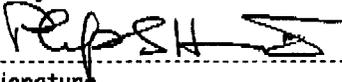
How Will the Product Benefit the Department? (e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)

- It is anticipated that the research will reduce permit processing time, streamline the mitigation process and reduce the potential for unintentional violations.

Other Comments:

Approval (Division official or Unit Head)

Philip S. HARRIS III
Print Name


Signature

NEU
Title

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CALL FOR NEW RESEARCH IDEA**Your Name:** Anne Burroughs **DATE:** August 20, 2008**Organization / Branch / Unit:** NCDOT/PDEA/Natural Environment Unit**TITLE of the Research Idea:** Deer-Vehicle Collision Reduction in North Carolina**Background:**

In 2006 there were over 17,000 documented deer-vehicle collisions (DVC) in North Carolina. It has been estimated that the actual number of DVCs is closer to twice the reported figure. Use of wildlife crossings and fencing are the only methods proven to be effective in decreasing wildlife-vehicle collisions (Hedlund et al., 2003 and Knapp et al., 2004). While the cost of wildlife crossing and fencing structures is a significant up-front expenditure, the hidden cost of DVC, is becoming better understood. Factors contributing to the cost of DVCs include human fatalities, human injury, public facility damage, private property damage, and carcass disposal (Donaldson, 2005).

Including wildlife crossing designs during the planning phase of a project is the most cost effective way to achieve the safety and ecological benefits while minimizing costs. Bridges and culverts (both replacements and new locations) are ideal candidates. Either extending a bridge span or enlarging a culvert to include terrestrial passage which can accommodate deer, can benefit a wide range multitude of wildlife. Wildlife crossings also reconnect fragmented habitats. This connection can help rare species recover and help common species remain common.

While it is difficult to assign a monetary value to reconnecting wildlife habitats, it is possible to determine the loss in property damage caused by DVC. Bridget Donaldson of the Virginia Department of Transportation, reported that each DVC cost an average of \$2,530 in property damaged for 2003. She used this figure to find how many DVCs were equivalent to the cost of expanding a project to a wildlife crossing project. She calculated that the cost of 2.6 DVCs (for a 10'WX12'HX189'L box culvert) and 9.2 DVCs (for a 20'WX15'HX192'L box culvert) is equivalent to the additional expenditure of installing a wildlife crossing instead of installing a 60' drain pipe, using 2004 average construction costs. This data only considers loss to private property. Other factors contributing to loss can be difficult to quantify but range from as drastic as death to as minor as carcass disposal. Donaldson wrote "with regard to tax payer savings, one human fatality from a DVC can result in a loss of millions of dollars in damage, hospital costs, and lost wages (2005)."

Donaldson, Bridget. "The Use of Highway Underpasses by Large Mammals in Virginia and Factors Influencing their Effectiveness." Virginia Transportation Research Council ATRC 06-R2, 2005.

Hedlund, J.H., Curtis, P.D., Curtis, G., and Williams, A.F. "Methods to Reduce Traffic Crashes involving Deer: What Works and What Does Not." Insurance Institute for Highway Safety, Arlington, VA. 2003.

Knapp, K.K., Yi, X., Oakasa T. Thimm, W. Hudson, E. and Rathmann, C. "Deer Vehicle Crash Counter measures Toolbox: A Decision and Choice Resource ." DVCIC-02 Wisconsin Department of Transportation, Madison, 2004.

What is the Specific Problem or Issue?

Current increases in human population, development and white tail deer populations are likely to cause the rate of DVCs to continue to rise in North Carolina. Effective use of wildlife crossings can save lives, money and reduce habitat fragmentation. The challenge is finding the projects where the costs of installing a wildlife crossing outweigh the costs of using a larger structure than is needed to satisfy hydrological concerns.

List Research Objectives and Tasks:

1. Use existing data to evaluate the associated costs (human fatalities, human injury, public facility damage, private property damage, and carcass disposal) of deer-vehicle collisions in North Carolina.
2. Review existing data to determine the most cost-effective structures for deer-wildlife crossings in North Carolina. Compare and contrast bridge and culverts cost and deer passage criteria (structural dimensions, vegetation and site layout).
3. Use existing North Carolina GIS data layers of DVC location, deer habitat data, and land use (current and projected) to identify deer crossing hotspots.
4. If analysis of existing data is not sufficient to merit scientifically valid results, a detailed report on what is needed will either be provided or data collected to addresses insufficiency.
5. Identify 5 potential NCDOT projects (bridge/culvert replacements or new locations) where the additional cost of adding a deer passage is surpassed by the estimated cost in DVC. These target projects must be a sufficient length of time before construction from the date of the final report, so time is not wasted on redesign.

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

Quarterly reports, Draft final report at completion of study, Final report based on review of draft final by steering committee.

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

I would recommend NCDOT construct the recommended wildlife crossings to improve safety, & habitat connectivity while saving money.

How Will the Product Benefit the Department?

Building the recommended wildlife crossings benefits NCDOT by enabling NCDOT to provide safer roads while reducing the negative impact roads have on the environment. Recommended wildlife crossings will save money and represent an improved product for resource agencies consideration and streamline these projects in the merger process.

Other Comments: A more current and in-depth review of DVC related costs in Virginia, will shortly be available.

Approval (Division official or Unit Head)

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Gregory A. Smith**DATE:** August 15, 2008**Organization / Branch / Unit:** DOH/PDEA/ Human Environment Unit/Traffic Noise & Air QualitySection**TITLE of the Research Idea:** Modeling of On-Board and Drive-By Tire/Pavement Noise in North Carolina**Background:**

NCDOT is participating in a FHWA pooled fund study TPF-5(135) to determine where tire/pavement noise research is needed. Other states, some of which are involved in the pooled fund study, have On-Board Sound Intensity (OBSI) research data that is integral to the pooled fund study. The FHWA agreed to consider the use of "quieter pavements" as a means of traffic noise abatement if, and when, sufficient data is presented by the various states that justifies such consideration. This means of noise abatement can be considerably less costly than noise barriers now commonly used.

What is the Specific Problem or Issue?

The measurement of tire/pavement noise through using On-Board Sound Intensity (OBSI) data collection to determine the relatively quiet pavement types. The purpose of this research is to collect and document sufficient acoustical data on the most typical types of pavements used throughout the state to be able to obtain FHWA approval for the use of these pavements as traffic noise abatement in the TNM traffic noise prediction software. Some pavements are expected to be acoustically "quieter" than the FHWA "average" pavement now in TNM. The use/modeling of these "quieter" pavements could result in fewer noise impacts in noise-sensitive areas adjacent to highways and, thereby, reduce or eliminate the need for costly noise abatement such as noise barriers. Noise barrier costs currently approach approximately \$2 million per mile.

List Research Objectives and Tasks:

It will be highly beneficial for NCDOT to obtain pavement acoustical data for 1) comparison with similar data from other states and 2) inclusion in a nationwide quieter pavement database for future comprehensive research. This research can involve development of noise-compatible pavement types for use in urban areas and that may, with FHWA approval, be used as a cost-effective means of traffic noise abatement. FHWA is awaiting sufficient data before allowing such abatement actions by states. AASHTO and ASTM currently have draft standards for OBSI testing that are anticipated to be finalized in late 2008. This research will utilize either draft or final versions of these standards, whichever is available during the research.

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

A report in both hard and electronic formats presenting the collected data in a comprehensive comparison between various pavement types, their acoustical properties and their ages. Ideally, this data will be included in a national database comparing the acoustical properties of many pavement types among states with varying aggregate materials, construction methods and climates to develop several "quieter pavements" that meet FHWA traffic noise abatement criteria.

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

Initially, NCDOT can use this information to determine which pavement types are best suited for use near noise-sensitive areas along highways as an immediate benefit to the public. Ultimately, the collected information will be used to develop pavements that are acceptable to the FHWA as viable traffic noise abatement measures in lieu of expensive noise barriers.

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)

Potential long-term cost savings through use of quieter pavements as a noise abatement measure rather than noise wall construction, once approved by the FHWA, can easily surpass several million dollars per year. The Department can provide decreased tire/pavement noise in noise-sensitive areas and, subsequently, reduce adverse noise impacts to those who live, work and play alongside our highways.

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

Gregory A. Smith

Print Name

Signature

Traffic Noise & Air Quality Supervisor

Title

CALL FOR NEW RESEARCH IDEA**Your Name:** Mary Frazer and Melissa Miller**DATE:** September 19, 2008**Organization / Branch / Unit:** NCDOT/PDEA/Natural Environment Unit**TITLE of the Research Idea:** Effects of mowing on Virginia spiraea**Background:**

Virginia spiraea is listed as a federally threatened species. We need to look for this and adjust our activities accordingly where it occurs. The most important factor in maintaining this plant seems to be the removal of woody vegetation. V. spiraea is not tolerant of excessive shading from trees and invasive species (kudzu). Currently, there are accepted guidelines in use for managing "roadside" populations of V. spiraea. Most of these populations occur on steep stream and river banks where long arm mowers are used to remove vegetation.

What is the Specific Problem or Issue?

When endangered and threatened plants occur within the ROW, maintenance activities have to be geared towards maintaining the population as well as improving habitat for existing and future plants. How do we maintain road safety and reduce woody vegetation without affecting V. spiraea? The effects of mowing on Virginia spiraea are not well known. Will benefits of removing competition via mowing be outweighed by the effects of accidentally mowing spiraea plants? Guidelines currently in use need to be improved for departmental costs and public safety issues. The use of long arm mowers is used to eliminate unwanted vegetation on steep banks; this is where V. spiraea typically occurs. Avoiding V. spiraea in these areas is difficult when using a long arm mower. Removal of some vegetation (kudzu, Japanese knotweed) is necessary to maintain safe sight distance and guardrail, signage and lane marking visibility.

List Research Objectives and Tasks:

To examine potential beneficial, neutral or adverse effects of long arm mowing on V. spiraea
 -does severe mowing (i.e.: 25%-50%) of the plant have adverse effects on spiraea?
 -if so, are negative effects ameliorated by the removal of competition that mowing provides?

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

Improved guidelines for management of V. spiraea.
 Quarterly reports
 Draft final report at completion of study.
 Final report reviewed by steering committee that highlights findings and explains potential improved guidelines

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

To tailor a cost and time effective roadside maintenance regime for V. spiraea that will enhance survival of populations. This will reduce excess funding spent on management of this particular species.

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)

Mowing spiraea is an issue at several locations in both Division 14 and Division 11. USFWS has raised concerns regarding how NCDOT maintains ROW where spiraea is found, but developing guidelines that allows for adequate mowing while protecting the spiraea is impossible, as no-one has ever studied how mowing affects the species. The final product will allow NCDOT to better develop mowing guidelines which will in turn eliminate case by case consultations with the USFWS and streamline ROW mowing in these divisions.

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

Print Name

Signature

Title

CALL FOR NEW RESEARCH IDEA**Your Name:** W. David Hinnant**DATE:** 8/20/2008**Organization / Branch / Unit:****TITLE of the Research Idea:** Transpo Industries-Bodan Highway/Railroad Grade Crossing System**Background:**

Transpo Industries has an existing at grade crossing system referred to as the "Bodan Highway/Railroad Crossing System. This crossing system is unique to existing crossings currently in existence in North Carolina as its precast polymer concrete panels "bridge" between the rails and eliminates any need to fasten to the underlying cross ties. This system is billed to withstand heavy vehicular, and more importantly, heavy truck traffic, in a very efficient and long term duration.

We propose to test this product at the existing at grade crossing of the Wilmington Terminal Railroad on Shipyard Blvd as it enters the North Carolina State Port in Wilmington, North Carolina.

What is the Specific Problem or Issue?

The NCDOT has an existing Highway/Rail Maintenance Policy which states the responsibilities of both the Railroad and NCDOT in maintaining existing at grade crossings on our State Maintained Highway System. In doing so, the NCDOT has and continues to try and upgrade current conditions at selected crossings with modular type crossing surfaces to improve the conditions for the traveling public. The NCDOT's goal is to install quality crossings that will withstand current conditions for an appreciable time period. The main criteria for these improvements involve traffic volumes and type of traffic volumes, i.e. heavy truck, industrial etc..

List Research Objectives and Tasks:

Objective: Evaluate reliability and effectiveness of crossing at the proposed test site location. This location is under constant heavy truck traffic and will be an excellent location to determine the reliability of this product.

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

Findings for presentation to the two class one railroads, and approximately twenty two plus short line railroads that operate in this state, for targeted uses.

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

If this product proves to be worthy, it will be targeted for but not limited to existing at grade highway/rail crossings that endure heavy industrial type traffic.

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)

- Costs Savings to NCDOT via Maintenance and Replacement costs
- Safety and quality of life improvements for travelling public and surrounding communities

Other Comments:

Heavy vehicular and industrial truck traffic provides tremendous wear and tear on existing highway/rail crossings. As our population and growth increases, finding quality products in this area that will meet these challenges of sustained periods will increasingly become more important from a safety and fiscal standpoint.

Approval (Division official or Unit Head)-----
Print Name W. David Hinnant-----
Signature-----
Title State Railroad Agent

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Todd Whittington, P.E. (919-329-4060)**DATE:** July 25, 2008**Branch / Unit:** Materials and Tests Unit**TITLE of your Research Idea:** Investigation of the Effect of N_{design} Values on Performance of Superpave Mixtures**Background:**

There is a concern that the current N_{design} levels do not maximize field performance. In order to validate the current N_{design} levels, an extensive NCHRP study was conducted to relate N_{design} to the in-place densification of pavements under various traffic loadings while monitoring field performance. One of the major findings of this study was that the ultimate in-place densities of the pavements were approximately 1.5 percent less than the densities of the laboratory compacted samples. Based on the densification and performance data, this study suggested that N_{design} levels should be reduced for higher traffic levels, and new N_{design} levels were proposed for different traffic levels.

What is the Specific Problem or Issue?

Asphalt mixture volumetric properties are very sensitive to the N_{design} values. Therefore, there is a need for a detailed study on the impact of lower N_{design} values on volumetric properties of mixtures. The use of lower N_{design} levels will tend to increase optimum asphalt contents and therefore affect the VMA. This will result in modifications of minimum VMA requirements. It has been reported that reducing N_{design} would also reduce mixture shear stiffness and will affect the rutting and fatigue characteristics. Therefore, a detailed study is needed to find which compaction level produces an appropriate compaction effort for field conditions.

List Research Objectives and Tasks:

The primary objectives are:

1. Evaluate the sensitivity of asphalt volumetric properties to different N_{design} levels.
2. Investigate the effect of changes in N_{design} values on mixture stiffness and performance characteristics.

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

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

Modifications in Superpave mix design methodology and criteria.

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

The Department and asphalt contractors will use the modifications to current mix design practices to design mixes that are easier to compact and more durable.

How Will the Product Benefit the Department?

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

The product will give the Department a direct economic benefit through more durable & longer lasting asphalt pavements.

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

Cecil Jones, P.E.

Print Name

Signature

State Materials Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Todd Whittington, P.E. (919-329-4060)**DATE:** July 25, 2008**Branch / Unit:** Materials and Tests Unit**TITLE of your Research Idea:** Long Term Performance Evaluation of Warm Mix Asphalt Mixtures**Background:**

Hot Mix Asphalt (HMA) mixtures require heat to allow asphalt binder to completely coat aggregates and to have sufficient workability during lay down and compaction. This heat exceeds 300°F at the production plant. Warm Mix Asphalt (WMA) is a new technology used to reduce production and compaction temperatures by as much as 50°F in asphalt pavement construction. Benefits of the WMA technology include energy savings, lower exposure to fumes, lower greenhouse gas emissions, and less oxidative hardening. Increased moisture susceptibility is also a concern with warm mix asphalt procedures.

What is the Specific Problem or Issue?

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

List Research Objectives and Tasks:

The primary objectives are:

1. Investigate the WMA technologies available and determine the preferred WMA technology for use by NCDOT.
2. Investigate the moisture susceptibility associated with WMA technologies and apparent fixes (anti-stripping agents, hydrated lime, etc.)
3. Investigate how much RAP can be used without affecting the performance of these mixtures.
4. Explore how the use of WMA affects the predicted performance of asphalt concrete mixtures using Superpave testing methods and equipment including the Simple Performance Tester.
5. Perform an economic analysis to determine any life cycle cost benefits or liabilities associated with the incorporation of these new WMA technologies.

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

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

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

How Will the Product Benefit the Department?

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

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

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

Cecil Jones, P.E.

Print Name

Signature

State Materials Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith Corley-Lay (250-4094)**DATE:** July 31, 2008**Organization / Branch / Unit:** Operations/Asset Management/ Pavement Management Unit**TITLE of the Research Idea:** Performance of Higher Fines Aggregate Base Course with Low Levels of Cement, Lime or Fly Ashe**Background:**

Quarries produce large quantities of fine materials in generating aggregate for asphalt and portland cement concrete. It would be desirable to identify ways to use some of this material for lower traffic volume roadways without sacrificing performance.

What is the Specific Problem or Issue?

Can the performance of higher fine contents in aggregate base course be sufficiently improved with one to two percent cement, lime or fly ash to allow its use for low volume or mid-volume roads?

List Research Objectives and Tasks:

This research will determine the performance of higher fine content aggregate base course without improvement, and the performance improvement as a result of addition of low levels of cement, lime or fly ash. As a minimum, the following tasks are involved:

1. Literature search both nationally and internationally.
2. Quantify the performance of higher fine content aggregate base course and the performance of aggregate base course from the same source(s) that meet existing specifications.
3. Determine the performance of the higher fine content ABC when stabilized with varying low levels of cement, lime and or fly ash. Determine the suitability of the material regarding traffic levels.
4. Provide a field plan to test the results of the laboratory study. Conducting the field plan is not a part of this research.
5. Provide a draft specification for the "improved performance higher fines ABC."
6. A final report will outline all research activities and findings.

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

Quarterly reports will track progress and identify issues. The field plan will provide a template that NCDOT can use on one or more local roads to test the process and the performance of the higher fines improved aggregate base pavements. The draft specification will assist us in implementing the findings.

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

Results of this study will provide a tool for county maintenance engineers to use to improve the performance of local roads. Could change our pavement design criteria or our secondary road requirements.

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 goal is to provide longer service life even with a "marginal" aggregate base materials by using low levels of stabilizing materials. This could decrease costs and reduce the frequency of maintenance. This research will also assist our efforts to reduce waste associated with construction and production of construction materials.

Other Comments:**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 IDEA

Your Name: Judith B. Corley-Lay

DATE: August 4, 2008

Organization / Branch / Unit: Operations/Asset Management/ Pavement Management

TITLE of the Research Idea: Evaluation of Crash Rates versus Time since Paving and Pavement Macrotexture

Background: NCDOT has a mission of moving people and goods safely, and metrics associated with improved safety. We have data regarding existing pavement macrotexture in a "snapshot" fashion. This project will seek a time rate of change of pavement macrotexture to determine if crash incidence is affected by changes in macrotexture following resurfacing or pavement rehabilitation.

What is the Specific Problem or Issue? Compaction during construction results in a particular void ratio and surface macrotexture. Once the project is opened to traffic, the void ratio is expected to decrease over time to around 4%. During this post-construction trafficked compaction, the macrotexture may change which could effect the crash incidence for a roadway. This project will look at the time rate of change of macrotexture following resurfacing and the impacts on crash rates.

List Research Objectives and Tasks: At least two approaches can be considered as well as a combination of the two. One approach is a data mining approach that looks at crash data versus time since resurfacing, regardless of location. The other selects particular sites and monitors macrotexture at intervals following resurfacing. Any crashes can be linked to particular points in time.

At a minimum, the research will consist of the following tasks:

1. Conduct a literature review, both national and international, on time rate of change of macrotexture and crash incidence. Identify key factors that influence the macrotexture and the rate of change of macrotexture under traffic.
2. Identify approaches that may address the issue and select the most promising one or combination to pursue.
3. Collect data to support the selected approach(es).
4. Analyze data and identify critical factors impacting macrotexture and crash incidence in North Carolina.
5. Prepare final report on all aspects of this study.

What Would be the Product[s] of the Research? Quarterly reports will be submitted as specified by the Research and Development Unit. A report will be submitted on the results of the literature review. The final report will outline the complete study, results and conclusions. It will identify key factors that impact macrotexture and crash incidence, and the rate of change of macrotexture following opening to traffic. The key findings will be summarized in a one page "technical brief" that can be distributed to DOT personnel for their consideration.

How Will You or Others Use the Product[s]? The products of this research will identify key factors that may help design and operations engineers reduce crashes.

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 goal of this project is to enhance safety by identifying factors that lead to "unsafe" changes in pavement macrotexture.

Approval (Division official or Unit Head)

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith Corley-Lay**DATE:** August 4, 2008**Organization / Branch / Unit:** Operations/Asset Management/Pavement Management**TITLE of the Research Idea:** Frequency and severity of centerline joint separation in flexible pavements in NC.

Background: Centerline joints are created in flexible pavements whenever multiple longitudinal pulls are made during paving. Over time following construction, the joint may open, allowing water to infiltrate the pavement. The joint may degrade over time, with potholes and debonding, resulting in a hazard to motorcycles and automobiles when changing lanes. While we collect pavement condition data regarding alligator cracking, transverse cracking, rutting and other distresses, we do not collect data about centerline joint separation. We have anecdotal evidence of the issue, but no concrete evidence to support improved construction techniques in discussions with the contracting industry.

What is the Specific Problem or Issue? Is centerline joint separation a statewide, a regional, or a local problem in North Carolina? How quickly does the joint separation occur following paving? What is the frequency and the severity? Are particular asphalt mix types more susceptible to centerline joint separation? What methods and criterion are recommended for identifying and tracking this distress, perhaps as part of the Pavement Condition Survey?

List Research Objectives and Tasks: Please note that this research DOES NOT require that the research team do a complete statewide survey of centerline joint separation. The research will consist of at least the following tasks:

1. Conduct a literature search on incidence of centerline joint separation and factors contributing to it. Determine whether and how other states are monitoring this distress and their criterion for severity ratings.
- 2.. Select a methodology for identifying the frequency and severity of centerline joint separation in NC.
3. Identify two counties in each climatic region and survey these counties regarding joint separation.
4. Using the six sample counties, evaluate frequency and severity of centerline joint separation. Identify road categories that are most "at risk".
5. Develop a recommended procedure for NCDOT to use to evaluate centerline joint separation statewide, including extent and severity, and prioritization of roads for the survey.
6. Identify ten roadways in the Raleigh area that were resurfaced during the year preceding this project. Select a one mile section of each roadway and monitor it every quarter for development of centerline joint separation. It may be that the distress does not develop within the time frame of the project, and if it does not, then develop a monitoring plan for NCDOT to use in continuing the monitoring of the ten sections. If the distress develops during the research period, analyze findings regarding time rate of development.
7. Prepare a final report detailing the complete research effort.

What Would be the Product[s] of the Research? This research will provide the first data regarding frequency and severity of centerline joint separation. It will provide a recommended procedure for conducting a statewide survey, perhaps as part of the pavement condition survey. It will identify regions and road classes most at risk for this distress, and will initiate data collection on time rate of development of centerline joint separation. The research team will submit quarterly reports, a report on the literature review and survey of states regarding centerline joint separation monitoring, and a final report detailing the complete work effort.

How Will You or Others Use the Product[s]? NCDOT will use this report to determine whether and how to monitor centerline joint separation statewide. We will use this information to strengthen discussions with contractors, and project inspection to reduce the frequency, severity, and rate of development of centerline joint separation.

How Will the Product Benefit the Department? (e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit) This project is aimed at the department goal of making our infrastructure last longer, reducing maintenance costs, and perhaps improving motorist safety.

Approval (Division official or Unit Head)

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Judith Corley-Lay**DATE:** August 4, 2008**Organization / Branch / Unit:** Operations/Asset Management/Pavement Management**TITLE of the 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 two or more treatments that can be placed prior to the overlay to enhance the pavement performance. Of specific interest is the mat and seal surface treatment and the geosynthetic fabric. Other options may also be evaluated. Each option increases the incremental project cost. Is the improved performance sufficient to warrant the cost increase?

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?

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 at least two 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. 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? (e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit) If successful, this could reduce maintenance costs and decrease the frequency of maintenance activities.

Approval (Division official or Unit Head)

Judith Corley-Lay

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

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Judith Corley-Lay, Y. Richard Kim

DATE: August 6, 2008

Organization / Branch / Unit: Operations/Asset Management/Pavement Management

TITLE of the Research Idea: Causes of Fatigue Cracking in North Carolina

Background: Fatigue and rutting are the two largest distresses for flexible pavements. Superpave mix design is focussed on eliminating rutting, but the result may be a shift toward mixes that are more prone to cracking. This project will use field, laboratory and modelling efforts to identify the causes of cracking. Recent issues with premature cracking point to the need to evaluate our mixes, processes, and measures to assure that our mixes balance the desire to prevent cracking and to have minimal rutting.

What is the Specific Problem or Issue? Fatigue cracking is the dominant distress in asphalt pavements. What can be done, through design, specification, quality assurance or laydown to reduce the likelihood of fatigue cracking? Are there specific designs which are more susceptible to cracking? Are the aggregates currently being produced sufficiently similar to the aggregates used to develop mix designs to allow use of the same mix design over extended periods of time? Are our mixes "too dry", and if so, what mechanism should be used to increase the liquid asphalt?

List Research Objectives and Tasks: The objective of this research is to improve the resistance of flexible pavements in NC to fatigue cracking. This will be done by determining the causes of current cracking. The tasks in this project will involve at least the following:

1. literature review on causes of fatigue cracking and on maintaining a balance between rutting and cracking.
2. use cores in cracked and uncracked sections to determine differences that may result in cracking.
3. evaluate mix designs, aggregate production gradations and other mix characteristics that may contribute to cracking.
4. identify mixes that appear to be crack prone and crack resistant and verify their performance in the laboratory.
5. determine if current mixes are "too dry" and if so, how best to reduce their brittleness.
6. Detail the work effort in the final report, including recommendations for changes to specifications, processes, etc.

What Would be the Product[s] of the Research? This research will provide key factors, and how we might control them, to reduce cracking in our flexible pavements. The research will produce quarterly reports, a report following the literature review, and a final report. The final report will include recommendations for changes to specifications, methods, processes, etc.

How Will You or Others Use the Product[s]? This research could impact all those in DOT who specify, design or construct asphalt pavements. In the near term, the Pavement Technical committee will use the results to consider possible changes to our specifications, mix design processes, and construction methodology.

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 fatigue cracking will reduce the frequency of pavement repair, improve durability of pavements, and decrease patching during overlay operations. This could significantly reduce costs.

Approval (Division official or Unit Head)

Judith Corley-Lay

State Pavement Management
 Engineer

 Print Name

 Signature

 Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Judith Corley-Lay

DATE: August 29, 2008

Organization / Branch / Unit: Asset Management/Pavement Management

TITLE of the Research Idea: Improved Freight Model for Strategic Multi-modal Planning

Background: NCDOT is in the final stages of a project to develop a statewide truck model that is based on the FHWA FAF dataset, national averages, and limited NC data. This new truck model is a major step toward a statewide transportation model, but additional refinements are needed to the datasets as well as the model itself. The results of the improvements will enhance regional and North Carolina highway planning and provide a foundation for multi-modal interactions with ports, airports and truck and rail freight terminals. It will support strategic planning for highway maintenance and pavement rehabilitation, as well as assisting in scenario testing based on TIP projects.

What is the Specific Problem or Issue? Detailed information and datasets regarding the types and numbers of freight movements are needed to strategically plan the North Carolina road system and to set priorities for pavement and bridge maintenance and rehabilitation. The information and datasets and associated analysis need to be integrated with the NC truck network model (NCDOT HWY 2006-09) to refine the model and prepare it for "production runs" at NCDOT.

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

1. Acquire the 2006 Transearch database* for NC and one forecast year.** Acquire on-hand surveys and external station counts from NC MPOs***. Conduct surveys at major trip generators and employers to augment existing datasets.
2. Evaluate the original NC truck network model using the new data and identify areas that can be improved by conducting comparisons of model results using the original FAF2 data and the to-be-acquired 2006 Transearch data versus on-hand statewide traffic counts in the original model. Address the key questions: (a) Is the public domain FAF2 data good enough or is expensive Transearch data necessary? (b) Can sophisticated data improvement techniques use the traffic counts to improve the FAF data? (c) Is Transearch data actually representative of NC freight flows? (d) Should Transearch data be purchased every so often?
3. Make improvements**** and provide a guidelines for NCDOT to use the improved freight model.
4. Develop training tools that will allow users to work with the new model and to update the model.
5. Prepare a final report detailing all aspects of the project.

* Year 2006 data corresponds to the FAF2 data embedded in the NC Truck Network Model.

** Coordinate with NC DOC which has an existing contract with Global Insight (Transearch) for state data.

*** For example, new survey data for the Triangle Regional Model will be available in June 2009.

**** By enriching the model inputs with additional data, the algorithms can now be enriched.

What Would be the Product[s] of the Research? The products would consist of (1) an improved freight model that overcomes the current limitations+, (2) training for new users, (3) training on how to update the model, and (4) the final report. Quarterly reports will be submitted as required by the Research Unit.

+ The NC truck network model currently does NOT include: (a) future employment information to enable strategic planning, (b) total vehicles (passenger cars plus trucks) to forecast traffic diversions and delay caused by TIP highway and bridge projects, (c) freight flows by vehicle class and commodity on highways to support pavement impact assessment, and (d) advanced traffic assignment algorithms based on traffic diversion.

How Will You or Others Use the Product[s]? The Transportation Planning Branch will use the model to examine highway system improvements and to plan the necessary detours. The improved statewide model can help coordinate and show the impacts of TIP projects. Maintenance may use the models to prioritize pavement and bridge rehabilitation in consideration of future freight needs. The model can further serve as a foundation for multi-modal logistics planning as recently assessed by the NC OSBM-funded Statewide Logistics Study.

How Will the Product Benefit the Department Having an improved statewide network model supported by good freight data helps NCDOT plan for economic development and coordinate project planning and implementation. This project is part of strategic planning and would result in using funds in areas with significant economic impact.

Approval (Division official or Unit Head)

Judith Corley-Lay

State Pavement Management
Engineer

Print Name

Signature

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA**Your Name:** Emily McGraw**DATE:** August 14, 2008**Branch / Unit:** State Road Maintenance Unit**TITLE of your Research Idea:** Fog Seal Effectiveness on Bituminous Surface Treatments**Background:**

For the past 7 years, NCDOT has placed a greater emphasis on pavement preservation. The Department has formally trained field personnel on the importance of "placing the right treatment on the right road at the right time." One of the most cost effective preservation treatments is the chip seal. NCDOT has expanded its chip sealing operation and is paving approximately 3,000 centerline miles annually with its force account labor. In July 2006, the General Assembly added a line item to the NCDOT budget which specifically funds "System Preservation." With this great interest and emphasis on pavement preservation, there is a need to further research preservation treatments, including the effectiveness of placing a fog seal on NCDOT chip seals.

What is the Specific Problem or Issue?

One of the great concerns of chip seals is the presence of loose stone. A fog seal is an emulsified product placed on top of a chip seal and its purpose is to "lock down" the top layer of stone. Other states have employed the use of fog seals in their respective chip sealing operations and most recently, FHWA and the Foundation for Pavement Preservation co-sponsored a research project that evaluates spray applied polymer surface seals. The research results showed that sealers add new asphalt to seal the surface, and rejuvenators soften age-hardened asphalt to restore desired mixture mechanical properties in the upper 3/8 to 1/2 inch of the pavement surface. At this time, NCDOT does not use fog seals in conjunction with its chip sealing operation.

List Research Objectives and Tasks:

- Determine optimal fog seal rates on single, double and triple seals
- Determine appropriate criteria for fog seal placement (traffic level(s), existing pavement condition, etc.)
- Determine skid resistance issues associated with fog seals

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

Route selection criteria and fog seal application rates for single, double, and triple seals.

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

Bituminous Supervisors, Maintenance and Operations Engineers will use this product in the development of their annual chip sealing programs.

How Will the Product Benefit the Department?

This product will allow Division personnel to select most appropriate treatments for pavement preservation candidate routes.

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

Emily McGraw

Print Name

Signature

Maintenance Operations Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Dan Holderman, Dave Henderson, Greg Perfetti **DATE:** July 31, 2008
Branch / Unit: Operations/Bridge Management, DOH/ Hydraulics, DOH/Structures

TITLE of your Research Idea: NC Bridges Vulnerable to Coastal Storms

Background:

Recent Hurricanes Ivan and Katrina demonstrated the vulnerability of bridges to wave forces and storm surges. As a result of a TPF Project, of which NCDOT participated, "Guide Specifications for Bridges Vulnerable to Coastal Storms" and a "Handbook of Retrofit Options for Bridges Vulnerable to Coastal Storms" have been developed and are available for the state's use in the design of new bridges and to determine which bridges in an inventory are, potentially, most vulnerable to coastal storm events.

What is the Specific Problem or Issue?

Eastern NC contains an inventory of existing bridges which are vulnerable to being damaged during a coastal storm event. The extent of this inventory needs to be identified, and vulnerability for each site determined. Also, for the design of new location structures, no guidance is available as to when coastal storm effects should be taken into account.

List Research Objectives and Tasks:

Identify extent of existing inventory that is vulnerable
 Evaluate identified inventory to determine specific vulnerabilities and whether further analysis is necessary
 Identify extent of Eastern NC that is subject to coastal, non-riverine hydraulic events

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

*(Note: Progress reports and the Final report are **NOT** considered a "product," but "deliverables.")*
 Prioritized list of vulnerable inventory, map identifying vulnerable areas

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

Knowledge of existing inventory can be used to determine whether replacement, retrofit or acceptance of risk is appropriate. For replacement bridges, or new location bridges, designers will know when to apply the Guide Specification.

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)
 Risk assessment of existing inventory will enable appropriate decision making with regard to cost expenditures, and ensure evacuation and rescue/recovery of an affected area after a coastal storm.

Other Comments:

Approval (Division official or Unit Head)

Holderman/Henderson/Perfetti
 Print Name

Signature

St Br Mgt/St Hydraulic/St Br Des Engr
 Title

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

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION

CALL FOR NEW RESEARCH IDEA

Your Name: Greg Perfetti, P.E.

DATE: July 25, 2008

Branch / Unit: DOH / Structure Design Unit

TITLE of your Research Idea: Lateral Flange Bending in Heavily Skewed Bridges: Part II**Background:**

Lateral torsional bending is commonly observed in heavily skewed steel girder bridges during construction; usually during the deck pour. As such, the current research project titled *Lateral Flange Bending in Heavily Skewed Bridges* was initiated to quantify the effects of lateral torsional bending (deflections & rotations), establish a method to predict the effects, and develop strategies to mitigate the undesirable effects during the design stage. These effects are observed during construction and should be accounted for during design and/or mitigated during construction. Part II of this research project will investigate and propose erection analyses and techniques to mitigate the effects of lateral torsional bending during construction; in particular the trend to erect girders in an initially out of plumb position.

What is the Specific Problem or Issue?

There is concern that stresses induced by lateral torsional bending reduce the capacity of the girder. As a result, there is a growing trend to erect girders in an out-of-plumb position, with the expectation that after the deck is poured the girders will deflect/rotate into the plumb position. This research will investigate the implications and effectiveness of this approach, and evaluate the long term effects regarding performance and durability of bridges with out-of-plumb girders.

List Research Objectives and Tasks:

- Validate the predicted deflections and rotations from models developed in the current research project.
- Investigate the implications/feasibility of erecting girders in an out-of-plumb position such that they rotate/deflect to plumb in the final state.
- Evaluate stresses induced when girders are initially erected in a plumb position but rotate to out-of-plumb after deck placement, and provide a design example that explains how to account for the resulting warping stresses.

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

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

- Recommend threshold when lateral torsional bending stress should be accounted/designed for.
- Recommend design and detailing strategies to mitigate lateral torsional bending.
- Recommend how finite element programs, such as STAAD, could be used to model the lateral bending effects.
- Recommend erection analyses and strategies for ensuring plumb girders after the deck is poured.

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

The results of this study will be implemented in steel girder designs, plans and specifications.

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)

Benefits to NCDOT could be realized in improved constructability of steel plate girder structures and future cost savings in the durability of girders and bridge elements.

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

Greg Perfetti, P.E.

Print Name

Signature

TED I

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Greg Perfetti, P. E.

DATE: July 25, 2008

Branch / Unit: DOT / DOH / Structure Design Unit

TITLE of your Research Idea: Predicting Camber, Deflection & Prestress Losses of Prestressed Concrete Members

Background:

Currently, the NCDOT Structure Design Unit calculates the camber and deflection for prestressed concrete girders and cored slab units based on a 1963 article published in the PCI Journal (Volume 22, No.1). Also, long-term prestress losses are determined using the "Approximate Estimate of Time-Dependent Losses" section in AASHTO. With the development and increased use of the bulb tee girder shapes, the increased use of 28 day concrete strength in the 8000 – 12000 psi range and the possibility of obtaining a better estimate of prestress losses using specific time-dependent factors, there is a need to evaluate the effectiveness of the current methods for determining camber, deflection and prestress losses.

What is the Specific Problem or Issue?

The models used to predict camber, deflection and prestress losses in prestressed concrete girders and cored slab units may be outdated. Determine whether the prediction models need to be modified in order for design predictions to match constructed results.

List Research Objectives and Tasks:

- 1) Literature review of methods for determining camber and deflection, quantify the camber and deflection for the different AASHTO girder shapes through design examples and verify results with field measurements.
- 2) Update/Revise multipliers for determining camber and deflection in prestressed members.
- 3) Compare/Contrast the effect of the "Approximate Estimate" and the "Refined Estimate" on prestress losses, camber and deflection, and recommend/discount benefits of including specific time-dependent losses.

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

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

The product of this research will update models used to predict camber, deflections and prestress losses of precast prestressed concrete girders and cored slab units.

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

The results of this study will be implemented in prestressed concrete girder and cored slab unit designs, plans and specifications.

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 benefit to NCDOT will be more accurate information on the contract plans, which will minimize construction problems, ensure proper deck thickness and provide a smooth riding surface.

Other Comments:

Approval (Division official or Unit Head)

Greg Perfetti, P. E.

Print Name

Signature

State Bridge Design Engineer

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Reese Briley

DATE: July 30, 2008

Branch / Unit: Division 5 Bridge

TITLE of your Research Idea: Repair of Decayed Timber Structural Members of In-Service Structures.

Background:

Presently the Department frequently jacks up existing structures, cut out and remove large sections of timber structure due to decay and section loss. These timbers members when spliced do not function as one structural component but sections that provide poor connections between remain portions of the structure. This provides a reduce capability to transfer loading. These repairs now performed are very extensive, invasive, time consuming and expensive and do not provide a quality repair.

What is the Specific Problem or Issue?

Repair of in-service timber structures including: removal of decayed portion of timber structure, treatment of remaining timber with fungicide or antibacterial treatment, treatment of good material with wood preservative and the replacing of decayed material using materials injected or placed by hand or other means in the field.

List Research Objectives and Tasks:

In field stabilization of decayed timber structural members (arresting decay) and the structural repair by means of utilizing materials either injected or formed and placed that are minimize invasive repairs (Minimize the need to remove entire sections of timber structural members) rehabilitation

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

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

Epoxies or other synthetic materials that can be used above and below water that can treat, preserve and repair areas of decay will bond and provide structural properties that will continue too allow structure to remain in-service without reducing weight postings while improving overall structural integrity of structure.

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

Daily maintenance, refurbishment and repair of in-service timber structures.

How Will the Product Benefit the Department?

(e.g., increase operational efficiency, decrease costs, enhance safety, etc. Indicate short term and/or long term benefit)
Increase public and employee safety, Minimize impacts to structures and public, Increase productivity of repairs while reducing cost. Increase life span of structures.

Other Comments:

Approval (Division official or Unit Head)

Print Name

Signature

Title

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NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
NEW RESEARCH IDEA

0501

Your Name: Joseph Ishak, PE (919-250-4159)

DATE: July 23, 2008

Branch/Unit: Preconstruction/Work zone Traffic Control Unit

Title of Research Idea: Corridor-Based Forecasts of Work-Zone Impacts for Freeways and Multi-lane Highways

Background:

This research idea has evolved from an NCDOT Technical Assistance project involving the Work Zone Traffic Control Unit (WZTCU) and the Institute for Transportation Research and Education (ITRE) at North Carolina State University. The WZTCU contacted ITRE because it had identified shortcomings in the outdated MS-DOS based analysis tool QUEWZ that is currently used to predict queuing impacts from work zones. The initial technical assistance request was geared at identifying other software tools capable of analyzing work zone impacts. The QUEWZ analysis tool was originally developed in Texas (not calibrated for use in North Carolina) and only allows a simplistic analysis of a basic freeway section, ignoring the impact of ramps, weaving segments, or signalized intersections. Additionally, experience with the existing tool has shown that it tends to predict unrealistically high queues and delays and is further difficult to customize for present year user cost or local capacity adjustments. The objective of the initial technical assistance request (TAR) was to update analysis procedures used for work zone planning and learn about the capabilities of modern software tools for work zone analysis, including simulation. Deliverables of the technical assistance include a decision matrix relating work zone strategies to operational impacts and the capabilities of software tools. The research further focuses on documenting the complexity and coding requirements of different tools and outlines analysis criteria as a function of work zone classification. From this initial research, WZTCU has come to realize that there is a need for an up-to-date, but user-friendly, software tool that can be used within the unit to accurately predict work zone impacts at the corridor level. While the unit acknowledges that some high-impact projects ultimately require the use of sophisticated micro- or mesoscopic simulation models, there is oftentimes a need to decide on construction staging with little turn-around time. Specifically, work zone impact analyses need to be performed with a quick turnaround time to narrow down broad-level work zone decisions up front and prevent scope creep. With these time constraints it is infeasible and inefficient to utilize complicated simulation techniques. Through the TAR, one particular tool was identified as having good potential for the type of analysis WZTCU intends to do. The tool FREEVAL was originally developed by NCSU under contract from FHWA for analysis of freeway facilities. The spreadsheet-based tool has received national attention for its ability to model oversaturated conditions and queuing patterns across different segment types (basic, ramps, weave) and across multiple analysis time intervals. It is included in its original form in the HCM2000 software implementation and closely mirrors the Freeway Facilities chapter in the 2000 Highway Capacity Manual. This research idea proposes to expand FREEVAL and validate the tool for North Carolina specific work zone analysis applications needed by WZTCU.

What is the Specific Problem or Issue?

The existing analysis software tool used by WZTCU for work zone analysis is outdated, overly simplistic and is not calibrated for driver behavior in NC. The unit is in need of a modernized tool for in-house work zone impact analysis that fits within the general analysis scope. While other commercially available tools are available, they typically involve a steep learning curve, extensive coding effort and high cost to the unit and are generally inappropriate for the desired level of analysis. With this research idea, WZTCU seeks to develop a customized tool that fits the need of the unit, is user-friendly and can quickly assess impact of work zone strategies. The goal of the software is to compare different work zone staging scenarios. It further allows to move from an operational level of analysis as a project progresses & more detailed analyses are necessary.

List Research Objectives and Tasks:

The overall goal of this research is to expand and customize the FREEVAL software tool for use in work zone planning and to calibrate model assumptions for driver behavior in North Carolina. The final tool should be user-friendly and customizable to allow for early planning-level, as well as, more in-depth operational analysis. Specific research tasks are: 1). Compile specific requirements for improved software tool and prioritize a list of improvements that should be included in the model. Some examples include longer analysis periods, modeling of multi-lane highways, modeling of signalized intersection effects, incorporation of user cost based on Bureau of Labor statistics, accounting for work-zone capacities and work-zone speed impacts, separate planning and operational analysis options, and incorporating of work-zone diversion rates to alternate routes. 2). Review literature on work zone operations and compile list of national findings on work zone impacts (speed reductions, capacity impacts, and diversion rates), particularly as they relate to NC. 3). Modify software code and make additions to VisualBasic-based FREEVAL program. 4). Demonstrate software capabilities with one or more case studies in North Carolina and compare queuing impact to field estimates. Depending on the availability of case studies, model validation may also occur using more sophisticated software tools including VISSIM and DYNASMART-P. 5). Compile final report and software documentation, including a user guide, a 1-2 software training class and initial software support.

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

The main deliverable of this research would be the customized software tool, FREEVAL-WZ. The product will be MS-Excel based with VisualBasic programming and will include options for both rough planning-level and in-depth operational analysis of work zone impacts. The software will be supplemented by a user guide that explains the software capabilities and the final research report. The final report will include the results of the literature review and guidance for adjusting default values in FREEVAL-WZ to local conditions. It will further include documentation for several example scenarios to illustrate software capabilities. The electronic files for these examples will also be made available and will further be demonstrated to WZTCU in a 1-2 day training class.

Who in NCDOT Will Use the Product[s]

This product will be used by project engineers in the Work Zone Traffic Control Unit for in-house analysis of work zone impacts and evaluation of work zone strategies. It will further be available for other units within NCDOT for a segment-based analysis of freeways & multi-lane highways.

How Will NCDOT Customers Use the Product[s]

Use the product to assist in the development of work zone traffic control plans and offer decision support for work zone construction staging.

How Will the Product[s] Benefit the Department:

The FREEVAL-WZ product will facilitate planning and evaluation of work zone strategies. It will be of great benefit to the NCDOT Preconstruction units as it will allow for a quicker and more accurate analysis of work zone impacts. With an improved up-front analysis of these impacts for high-profile work zones, construction delays related to work-zone staging can be minimized. A more efficient forecasting of impacts and development of work zone schedules will ultimately benefit the general public and the stakeholders impacted by the construction.

Other Comments: Estimated Period of Performance: 15 Months' Estimated Budget for 15 month project: \$70,000

Approval (Division official or Unit Head)

Stuart Bourne, PE

Print Name

Signature

State Work Zone Traffic Engineer

Title

NORTH CAROLINA DEPARTMENT OF TRANSPORTATION
CALL FOR NEW RESEARCH IDEA

Your Name: Anthony D. Wyatt

DATE: August 15, 2007

Organization / Branch / Unit:

Traffic Safety Unit & Highway Design/Location & Surveys

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

Background: The Department of Transportation is responsible for over 78,000 centerline miles of roads and highways and over 18,000 structures (the second largest State Maintained Highway System in the United States). To protect the investments made in the design, construction, maintenance, modernization, and management of our highways and features the Department needs critical condition analysis and documentation capability to ensure and protect the safety of the traveling public and our highway workers and to verify the quality and service of the projects that public funds are invested in. High Density Surveys (HDS) is one of the emerging tools that offers the enhanced capability of providing a highly accurate “three dimensional digital model” of the conditions present along our facilities (before, during, &/or after a project). Utilization of helicopters in Low Altitude Photogrammetry or LiDAR are other technologies that can provide some lesser degrees of high density data. With the premiums the Department is paying for materials and construction of critical infrastructure (highways, bridges, appurtenances, and traffic controls) 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 Asset Management, Operations, Construction, Preconstruction and the State Highway Administrator to determine: (1) If NCDOTs 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.

