Maintenance Condition Assessment Report
December 1, 2008

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EXECUTIVE SUMMARY

Introduction

The North Carolina Department of Transportation has surveyed and evaluated the condition of the state's highway infrastructure. The purpose of this report is to provide the results of the survey, describe the current condition of the highway infrastructure, and estimate the funding needed to meet and sustain the established performance standards for routine maintenance and highway operations, system preservation, contract resurfacing and rehabilitation.

North Carolina's highway system consists of 79,261 miles of roadway and 18,018 structures. The Division of Highways within the Department of Transportation is responsible for maintaining this system. Since the 1989 Highway Trust Fund was enacted, the number of lane miles of North Carolina's paved highway system has increased by 24%; during the same time, bridge deck area has grown by 29%. While the system continues to grow, the traditional highway maintenance funds have increased, but not enough to keep up with inflation and system growth. Over the past year, there have been unprecedented increases in asphalt cement and other construction related materials.

Recognizing this gap between available funding and maintenance needs, the North Carolina General Assembly and the Department have worked together to not only increase maintenance funds, but to also find non-traditional funding sources to decrease this gap. Starting with the 2001 Session of the General Assembly, several alternative methods of funding maintenance have been identified. These alternative methods included the ability to use Highway Trust Fund cash balances to address highway maintenance and operation needs through Senate Bill 1005 (SB 1005) and North Carolina Moving Ahead! (NCMA) and to begin shifting the secondary road construction program from a paving program to a safety and modernization program. Thanks to these alternative methods, the Department has had the opportunity to improve the safety and maintenance condition on the highway system. However, with the expiration of SB 1005 and NCMA, additional funding sources will be needed to sustain the gains accomplished by these initiatives.

In addition, the Department has taken advantage of the flexibility in the Federal-Aid funding allotments to address highway maintenance and operational programs. The Transportation Improvement Program (TIP) includes approximately $ 44.6 Million per year to address existing programs areas. These non-traditional funding sources have been included in this report and the maintenance needs identified take into consideration the availability of these dollars.

Long Range Plans for Transportation Needs

In 2004, the Board of Transportation adopted a 25-year, long range transportation plan. This plan provides a blue print for greater investment in maintenance, preservation and modernization of the state's existing highway system. Through extensive public outreach, the Department worked to develop a plan which meets the total transportation demands of the 21st Century. The plan's Recommended Investment Scenario suggests the Department meet an additional 10% of its maintenance and preservation needs and nearly 25% more of its infrastructure modernization needs. The plan identifies three levels of transportation facilities: Statewide facilities such as interstates and major primary routes, Regional facilities such as NC and US routes, and Sub-regional facilities such as secondary roads. The designation of these three facility types allows DOT to focus its maintenance dollars on the highest priority systems with the largest volumes of traffic.

Legislative Requirement

Beginning in 1998, the North Carolina General Assembly required the Department to report on the maintenance condition and funding needs of the state highway system. In 2007 this legislation was modified and now requires NCDOT to establish performance standards for the maintenance and operation of the state highway system and report on the findings in a maintenance condition survey. The report is to provide quantitative and qualitative descriptions of the condition of the system and provide estimates of the following:

(1) The annual cost to meet and sustain the established performance standards for the primary and secondary highway system, to include: (i) routine

maintenance and operations, (ii) system preservation, and (iii) pavement and bridge rehabilitation.

(2) Projected system condition and corresponding optimal funding requirements for a seven-year plan to sustain established performance standards.

The revised statute also requires that on the basis of the report, the Department of Transportation develop a statewide annual maintenance program for the state highway system for funds available, which will be subject to the approval of the Board of Transportation and is consistent with performance standards.

The report on the condition of the state highway system and maintenance funding needs is to be presented to the Joint Legislative Transportation Oversight Committee by December 31 of each even-numbered year.

Survey Results

Three comprehensive statewide surveys were used to evaluate the condition of the state highway system: (1) the Maintenance Condition Survey, (2) the Bridge Condition Survey, and (3) the Pavement Condition Survey. These surveys reveal that while some of the highway features meet the established performance standards, many do not. In accordance with the legislative requirements, the Department has estimated the cost to meet and sustain these performance standards and project the optimal funding requirements for a seven year period. The costs for the first year of the funding plan are as follows:

Roadway Maintenance

The annual cost of routine maintenance in order to meet the established performance standards is $ 748.48 Million.

Bridge Maintenance and Preservation

The cost of routine bridge maintenance in order to meet the established performance standards is $ 89.12 Million and preservation is $25.85 Million.

Highway Operations

The cost of operating the state's 8800 traffic signals and various Intelligent Transportation System devices is $ 70.01 Million.

Pavement Preservation and Contract Resurfacing

The annual cost of pavement preservation activities is $283.11 Million and resurfacing is $443.85 Million.

Disasters and Emergencies

Recent years have been kind to North Carolina and there have been very few major storms, but this can change at any moment. North Carolina's volatile weather means that a major hurricane, flood, or a severe statewide winter weather event could strike. The annual anticipated need for disasters and emergencies is $15 Million.

Total Maintenance and Preservation Funding Need

The total maintenance funding need for FY 2009-2010 is $1,675.42 Million.

Pavement and Bridge Rehabilitation

The cost of pavement and bridge rehabilitation is $ 407.51 Million.

Comprehensive Management and Investment Approach

North Carolina stands at a cross roads of funding and system condition. This means that as funding remains constant system condition will begin to drop to unacceptable levels jeopardizing the safety and mobility of North Carolina's citizens. Additionally, maintenance funding alone will not restore some asset types that have fallen into poor condition. A comprehensive, balanced funding program of maintenance, preservation, rehabilitation, and replacement is necessary to operate and maintain the highway system at an acceptable condition.

2008 REPORT ON THE CONDITION OF THE STATE HIGHWAY SYSTEM

A - INTRODUCTION

Background

Since 1998, as required by G.S. 136-44.3, the North Carolina Department of Transportation (NCDOT) has submitted a report to the Joint Legislative Transportation Oversight Committee on the condition of the state system's roads and bridges and the funding level needed to maintain this system at a reasonable level of service. These reports have also estimated the cost to resurface the state system on a specific frequency as well as estimated the cost to eliminate the maintenance and resurfacing backlogs.

The 2007 session of the General Assembly revised General Statute 136-44.3 to require NCDOT to report the annual cost to meet and sustain established performance standards and to project the system condition and optimal funding requirements for a 7-year period. This document, the "2008 Maintenance Condition and Funding Needs for the North Carolina State Highway System", is intended to satisfy these requirements. This report is also intended to provide a clear link between maintenance objectives, activities, and service levels with budget and actual performance targets.

Highway System Growth

North Carolina has seen significantly increased growth in its highway system for over the last 20 years. Currently the system consists of 79,261 miles of roadway and 17,848 structures. Over the past 10 years, the number of paved lane miles has increased by almost 11% and the square footage of bridge deck area has grown by over 23%. As illustrated in Figures 1 and 2 the system continues to increase as roads are widened and new roads and bridges are constructed. Appendix A also lists the mileage and bridge deck area totals for the past 10 years.

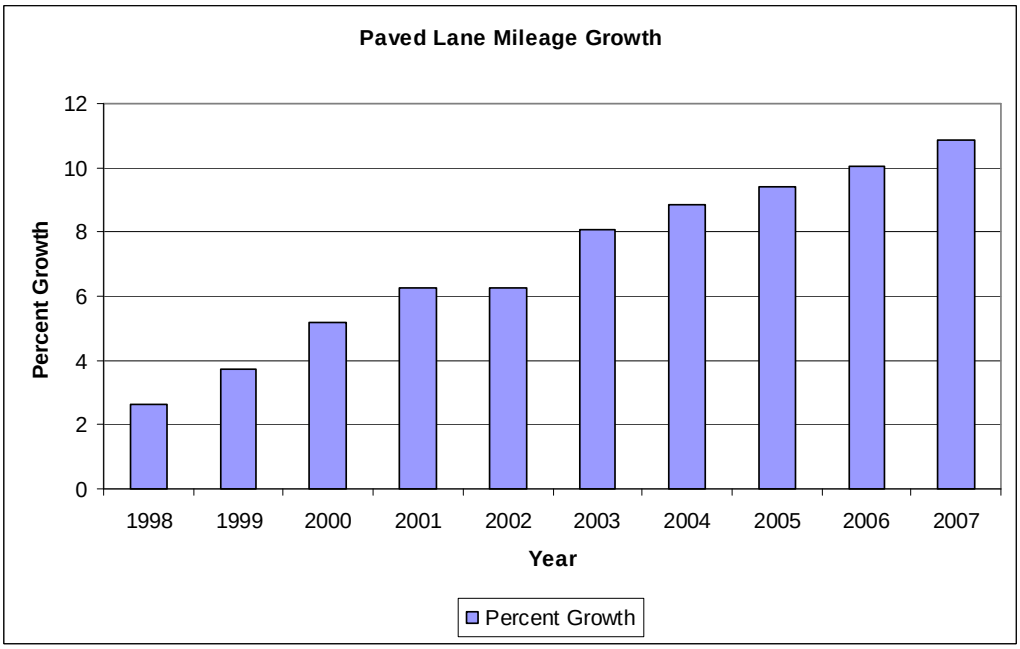


Figure 1 - Paved Lane Mileage Growth

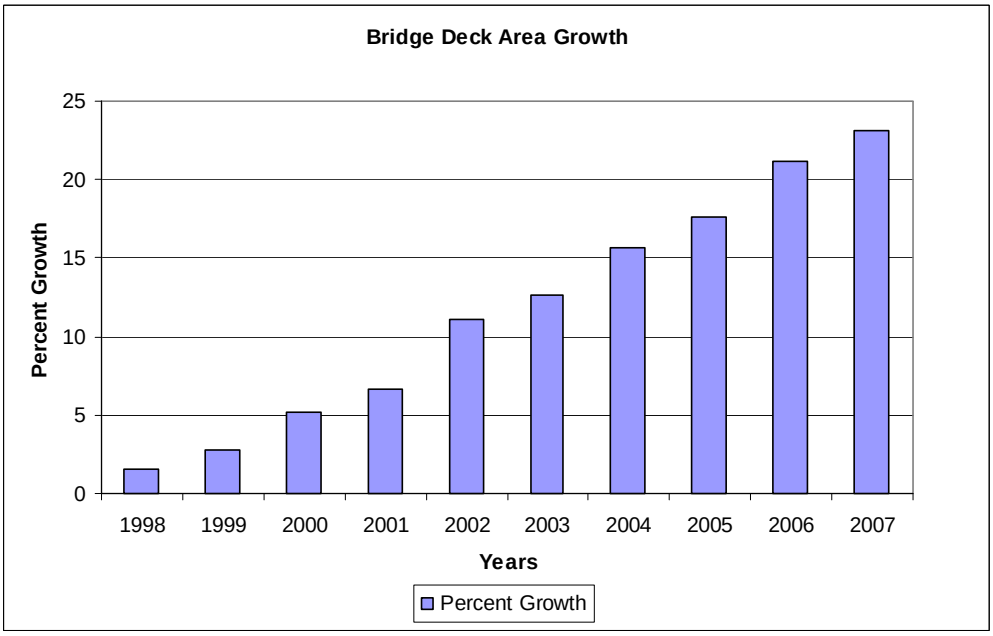


Figure 2 - Bridge Deck Surface Area Growth

In addition to the steady increase in the paved system, vehicular travel has also risen at an exponential rate. During this same 10-year period, vehicle miles traveled increased by over 26% while the paved lane miles have only increased by 11% as indicated in Figure 3. In other words, traffic volumes have increased by more than two and a half times as much as the travel lanes needed to carry them. This increase places a heavier burden on the existing infrastructure due to increased truck traffic as well as heavier trucks. This coupled with a greater volume of cars, leads to congestion which increases travel times and wastes fuel. All of these factors accentuate the need for adequate maintenance funding to address highway system maintenance and operations and the added deterioration created by the increase in traffic.

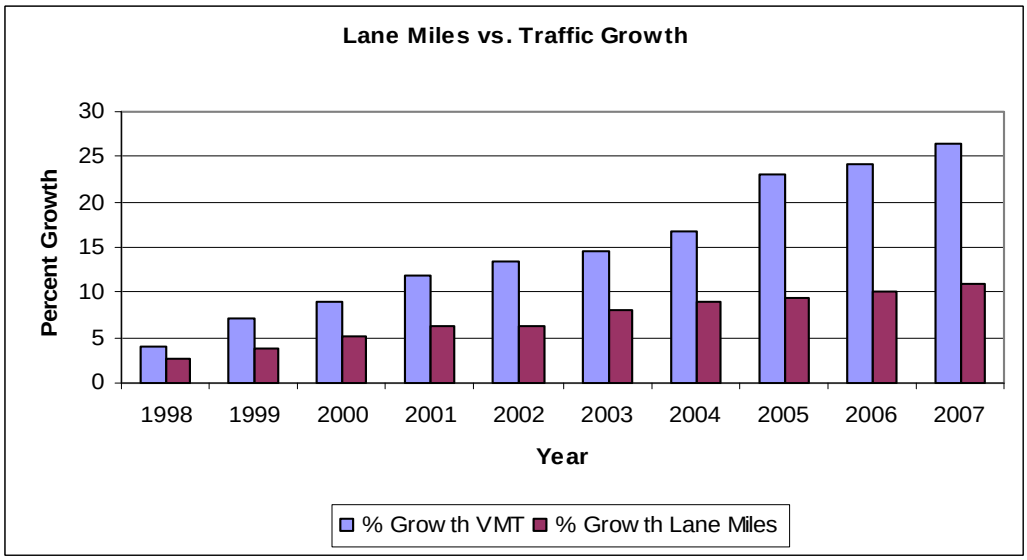


Figure 3 – Percentage Trends of System Inventory and Traffic Volumes

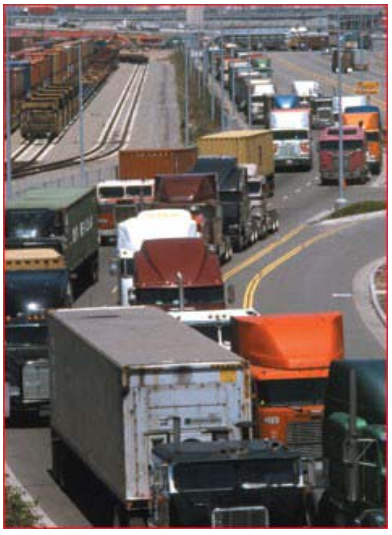
Freight

In addition to the growth in vehicular traffic there is also expected to be an even faster rise in freight traffic. In May of this year, NC State University published the "Statewide Logistics Plan for North Carolina" report for the North Carolina Office of State Budget and Management. This report presents a statewide logistics plan that addresses North Carolina's long term economic, mobility and infrastructure needs. Its three main components; identification of priority commerce needs, enumeration of transportation infrastructure actions, including multimodal solutions, and a timetable to meet the identified needs are based on inputs from a wide range of stakeholders including state agencies, shippers, and other private sector parties.

In this report,

> "The Department of Commerce identifies agriculture, textiles and defense related industries as key features of the future North Carolina economy. Other key sectors include information and communications technology, motor vehicles and heavy equipment, business and financial services and chemicals, rubber and plastics… In many ways, this is a vision of North Carolina's destiny that the state's infrastructure ought to be prepared to support. Consistent with One North Carolina, it mandates investments statewide to synchronize with and support this vision." *****

Other sources also support this vision of expanded freight movement across North Carolina. The Federal Highway Administration reports that freight movement across our state has increased by 580% since 1970. This freight growth comes with increased congestion and wear and tear on the states transportation system. Among the strategies to mitigate congestion are capacity improvements, good maintenance of roads and bridges, a balance between transportation modes and attention to system operation and maintenance.



***** North Carolina State University, "Statewide Logistics Plan for North Carolina" May 13, 2008 http://www.osbm.state.nc.us/files/pdf_files/05132008StatewideLogisticsPlan.pdf

History of Maintenance Funding

Although the size of the highway system has shown a steady increase in the last decade, the increase in total funds for maintenance has not kept pace with inflation, and since the 2006 Maintenance Condition Assessment (MCA) report, the inflation in construction and maintenance operations has been unprecedented. When the maintenance funding is adjusted by the All Urban Consumers table of the Consumer Price Index, the total dollar amount devoted to maintenance operations is only 18% higher than that of FY 1998 as indicated in Figure 4.

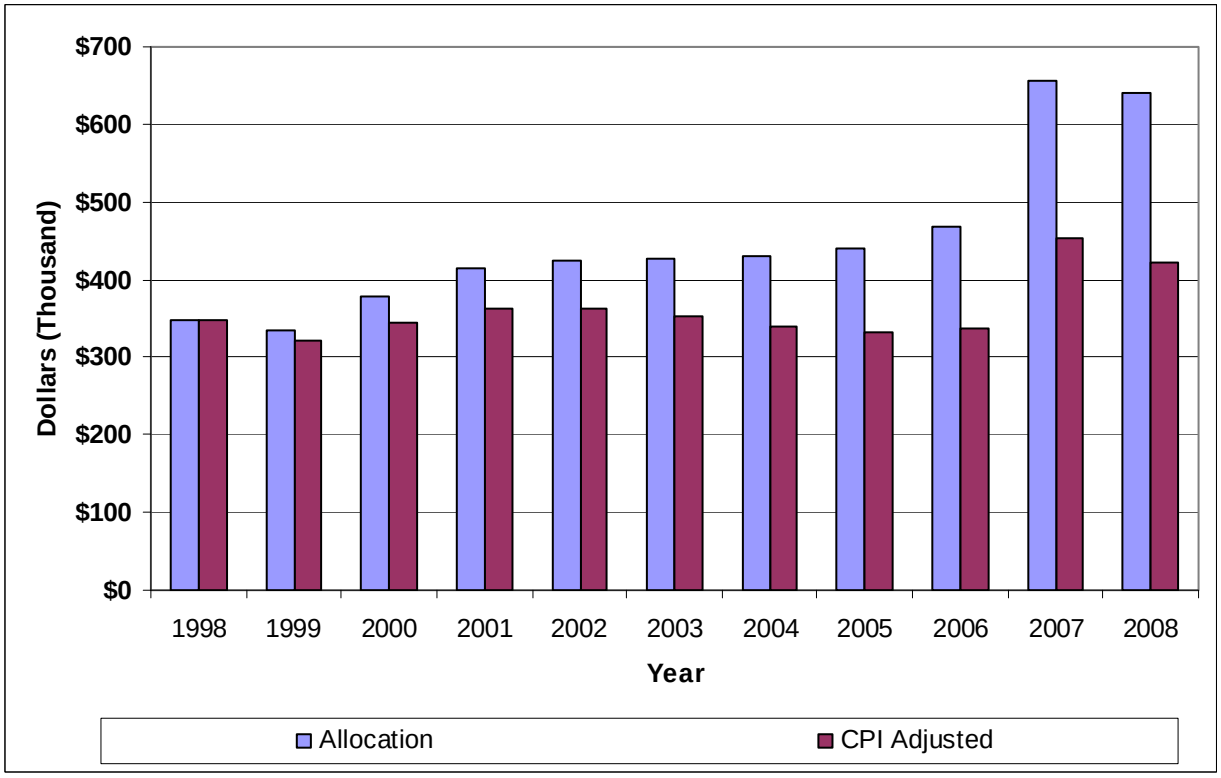


Figure 4 – Maintenance Funding, Adjusted by the All Urban Consumers Table (CPI)

Oil prices have had a dramatic impact on DOT programs including TIP construction, maintenance, resurfacing, and pavement preservation. The cost of liquid asphalt (which is a key ingredient in producing asphalt mix) in a one year period from July 2007 to July 2008 went from $334/ton to $546/ton. This 63.4% increase in the cost of liquid asphalt alone impacted all projects containing asphalt adjustment clauses. These asphalt price

adjustment clauses, intended to reduce the risk to the contractor thereby ensuring better pricing to the Department, have caused NCDOT to pay record amounts as prices skyrocket. During the 1-year period from July 2007 to June 2008 NCDOT paid an additional $25.5 Million on asphalt cement. During the extremely volatile period from July 2008 to September 2008 NCDOT has spent an additional $44.1 Million in asphalt cement due to the price adjustments. Recent economic conditions are starting to reverse this trend as asphalt prices begin to fall. This data clearly shows how economic factors have had a tremendous negative impact on NCDOT's spending capacity.

These asphalt price increases also impacted the number of miles that could be resurfaced through the contract resurfacing and interstate maintenance programs. Average resurfacing costs went from about $49 thousand per lane mile to $62 thousand per lane mile for traditional secondary roads and from roughly $64 thousand per lane mile to $79 thousand per lane mile for interstate and high volume primary routes. As total resurfacing dollars remain relatively constant and materials costs increase dramatically the result is fewer miles of roadway that can be addressed. These factors resulted in paving 17% fewer miles in 2008 as compared to 2007.

Given these factors, when resurfacing funds are adjusted by the NC Highway Construction Cost Index table of the Consumer Price Index, one can see that in FY 2008, the total dollar amount allocated for Contract Resurfacing is only 29.2% higher than that of FY 1998. This is indicated in Figure 5. Referencing the graph, one can also see that there is a dramatic decline in purchasing power.

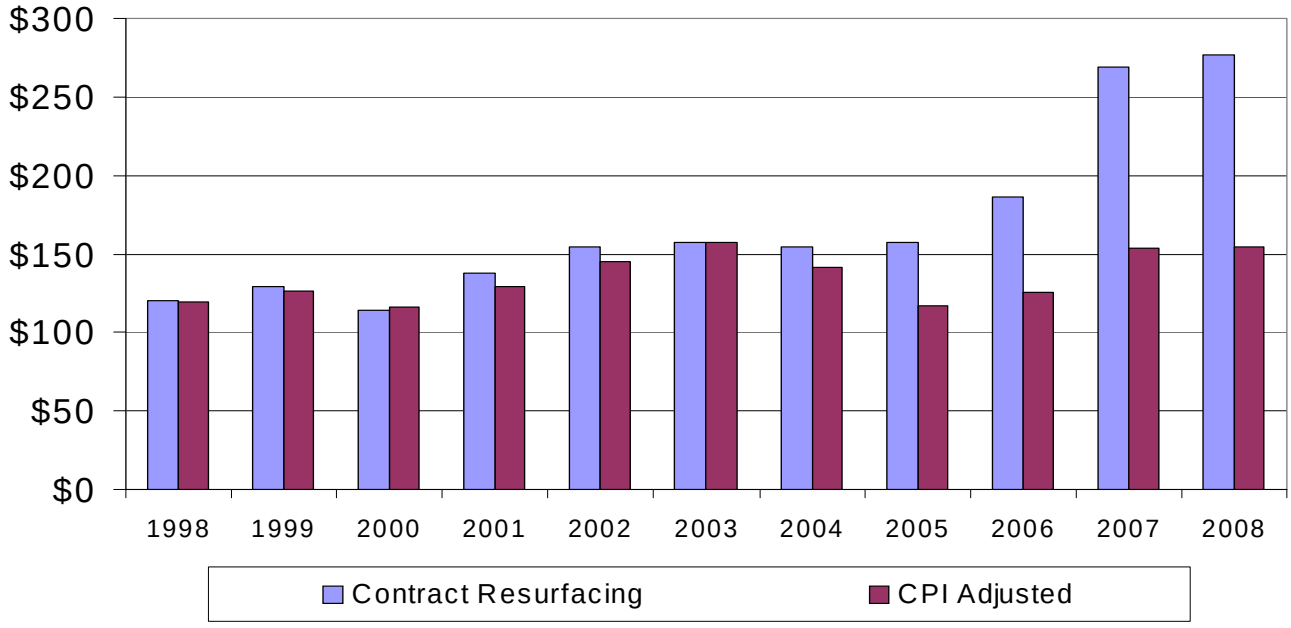


Figure 5 – Contract Resurfacing, Adjusted by the NC Highway Construction Cost Index

This increased cost of asphalt also impacts maintenance operations by increasing the cost of patching materials, pavement widening, and pavement preservation treatments. Dramatic cost increases in structural steel and concrete have also impacted the bridge maintenance, rehabilitation and replacement programs.

Non-Traditional Funding Sources

With the passage of ISTEA (Intermodal Surface Transportation Efficiency Act) and its subsequent legislation, SAFETEA-LU (Safe, Accountable, Flexible , Efficient Transportation Equity Act: A Legacy for Users) the United States Congress provided state and local transportation decision makers more flexibility for solving transportation problems in their communities.

Beginning in 2001, the Department started using non-traditional sources of funds to help offset the cost of maintenance. This allows North Carolina the flexibility to expand from a strictly “construction” program to include “maintenance and preservation” programs as well.

It has been estimated that the nation's investment in its transportation system is about $1 trillion in replacement value. From a business standpoint, it only makes sense to maintain and preserve this tremendous asset.

Since creation of the State Highway Trust Fund in 1989, the Department has paved over 10,000 miles of unpaved secondary roads in North Carolina with only 3,400 miles remaining to be paved. In view of the fact that the paved secondary road system has not kept up with the demands being placed on it by increased urbanization and traffic, the 2006 Session of the General Assembly approved changes in the General Statutes that govern the use of secondary road construction funds. House Bill 1825 allows the use of these funds on the paved secondary road system to improve its functionality through safety, modernization and condition improvements. It is estimated that approximately $68.67 Million of these funds will have a positive effect on the maintenance condition of the paved secondary road system.

The following projects have been identified which help address or supplement current operational programs.

Project	Description	FY 2008-2009 Allocation
ITS Traffic Operations (R-4049)	Funds are used for operation and maintenance of Incident Management and ITS Programs	$18.0 M
Positive Guidance Program (R-4067)	Funds are used to improve pavement marking lane lines and symbols to provide better traffic guidance and visibility on the primary roadway system	$ 5.5 M
Traffic System Operations Program (R-4701)	Funds are used for operation and maintenance of traffic signal systems	$18.0 M
Bridge Preventative Maintenance Program (B-4700)	Funds are used to address bridge preservation needs such as deck and joint repair, and bridge painting	$ 5.0 M
HB 1825 Secondary Road Improvement Program	Funds are used to make improvements to the paved secondary road system	$68.67 M

The projects that would help meet the estimated highway maintenance funding needs have been taken into consideration in the total estimated funding cost and are reflected in Appendix D.

B – REQUIREMENTS AND METHODOLOGIES

Requirements of G.S. 136-44.3

Revised NC General Statute 136-44.3, ratified by the 2007 General Assembly, requires NCDOT to establish performance standards for the maintenance and operation of the State highway system and report on the findings of a condition survey. The report is to provide both quantitative and qualitative descriptions of the condition of the system and provide estimates of the following:

(1) The annual cost to meet and sustain the established performance standards for the primary and secondary highway system, to include: (i) routine maintenance and operations, (ii) system preservation, and (iii) pavement and bridge rehabilitation.

(2) Projected system condition and corresponding optimal funding requirements for a seven-year plan to sustain established performance standards.

The revised statute also requires that on the basis of the report, the Department of Transportation develop a statewide annual maintenance program for the state highway system for funds available, which will be subject to the approval of the Board of Transportation and is consistent with performance standards.

The report on the condition of the state highway system and maintenance funding needs is to be presented to the Joint Legislative Transportation Oversight Committee by December 31 of each even-numbered year.

In accordance with the requirements of this statute, this report describes the survey methodology and annual costs needed to meet and sustain the established performance standards for the primary and secondary highway system. This report includes costs for routine maintenance and operations, system preservation and pavement and bridge rehabilitation. These annual cost figures are then projected for a 7-year optimal funding

strategy. To satisfy the requirements of this legislation, a detailed assessment was conducted of the state's pavements, structures and roadway features.

Survey Methodology

Three statewide surveys were used to assess the condition of the state highway system: (1) the Maintenance Condition Survey, (2) the Bridge Condition Survey, and (3) the Pavement Condition Survey. Along with the results of these surveys, historical funding and expenditure data were used to estimate the annual costs to meet and sustain the established performance standards.

Performance Measures

In 2005 working groups of upper level field personnel were assembled under the direction of the Chief Engineer of Operations to develop performance measures and targets for the various features of the highway system. These individual targets for items such as guardrail, drainage features, signs, bridges, etc. were summarized along with bridge and pavement data into overall ratings for the Statewide, Regional and Subregional tiers.

Because NCDOT has only recently begun to look at system management based on Statewide, Regional and Subregional tiers and G.S. 136-44.A requires the data be reported in terms of Primary and Secondary, all data in this report has been configured so that Statewide and Regional data represent the Primary system and Subregional data represents the Secondary system.

This data serves as a report card on the condition of individual elements as well as categories of elements such as roadside features, bridges and pavements. Finally, an overall score has been developed for each system. These report cards are provided with number grades which correspond with target levels of service as shown in Appendix C.

As with any new performance based management system, it is expected to take several iterations to refine the methodology. The Department is excited about the progress made in this area and is looking forward to continued refinement and institutionalization of this management approach. The Department believes this management approach will give each manager the flexibility to achieve the performance objectives without being prescriptive on how to get there.

The methodologies used in the preparation of these survey reports, along with the results and conclusions, are accepted practices used in other state transportation departments throughout the United States.

Performance Based Management

The Performance Based Management approach, developed in 2005 by Division of Highways-Operations, has been used as a model by the Department's Transformation Management Team to develop department-wide performance expectations intended to demonstrate to the public how the Department rates itself in various measures. These report cards also provide a feedback loop to infrastructure managers on deficiencies in asset types and the overall condition of the network. The Department believes this change provides each manager with the information they need to achieve the outcomes established by the Department. This change has led to local managers focusing more on a network approach to the highway system and management looking for ways to improve system condition over the long term while being more efficient with the resources available to them.

Performance Based Maintenance Contract

As NCDOT embarked on the development of performance measures for its internal workforce, a separate but related effort was underway which helped to validate the performance targets the Department had established. This evaluation was needed to determine if the targets were reasonable both in scope and in cost. As a separate effort, NCDOT decided to include the established performance targets in its first ever Performance

Based Maintenance Contract in the Charlotte area. This pilot contract is the first of its kind in North Carolina and was made possible by the 2005 General Assembly SB 622 which gave NCDOT the authority to let up to two performance based contracts. These innovative contracts require the contractor to meet specific performance standards for a set price rather that pay for units of work through a traditional "line item" contract.

In 2007, NCDOT entered into a contract with Infrastructure Corporation of America (ICA) to maintain 131 miles of interstates in Cleveland, Gaston, and Mecklenburg counties. This 5 year $28 Million dollar contract tasks the contractor with achieving the same performance targets as the Department has set in order to determine if these standards are in fact reasonable and at what cost. This contract, now in its second year of operation, is providing good data for the evaluation of the performance targets.

C – ROADWAY MAINTENANCE

Routine maintenance may be described as those work activities that are performed on a recurring basis to provide the traveling public with a safe and reliable highway facility. However, before the first dollar can be allocated to satisfy routine maintenance activities, several Million maintenance dollars are set aside each year to fund specific statewide programs. Some of these programs are mandated while others are allocated by need. Once these statewide program needs are satisfied, the remaining dollars are allocated by division and county to fund routine maintenance activities.

Roadway maintenance consists of those work activities associated with the maintenance and upkeep of the roadway. These work activities can be subdivided into two categories: (1) Recurring Programs and (2) Performance Based Activities.

C.1 – RECURRING PROGRAMS

Recurring programs are those activities necessary for the operation of the highway system that do not have direct performance measures associate with them. Examples of these programs include: historical markers, state park road maintenance, railroad signal maintenance, weigh station maintenance, maintenance and technical training, major events, rest area restorations, roadway hazard removal, roadway and sign lighting, unpaved road maintenance, snow and ice control and emergency repairs in non-declared events. The overall expenditures of these programs are approximately $66.14 Million.

C.2 PERFORMANCE BASED ACTIVITIES

Examples of performance based activities include maintenance to pavements, shoulders and ditches, drainage, mowing, litter, guardrail, signs, pavement markings, rest area and welcome centers, plant beds, and storm water devices. A detailed survey was conducted through the Maintenance Condition Assessment Program to assess the condition of these roadway features. The major categories in which items were categorized are pavements, shoulders and ditches, drainage, roadside features, traffic control devices, and

environmental items such as rest areas. The following photographs illustrate some of the features recorded during the survey.

Pavement

Shoulders and Ditches

Drainage

Roadside

Traffic Control Devices

Rest Areas

Brush and Tree Control

This survey assesses the condition of each tier (Statewide, Regional and Subregional) using statistical sampling and collects enough samples to project highway condition to the county level. To satisfy the intent of the general statute this data was then collapsed into Interstate, Primary and Secondary categories. The sites were randomly selected and survey teams assessed the condition of these 0.2-mile sections for the features shown in

Appendix C. The amount of deficient conditions were recorded during the survey and a maintenance condition rating was calculated. This rating, as compared to the target rating also shown in Appendix C, is used to calculate an estimated cost to achieve the target. The estimated cost is shown in Appendix D. For the purposes of this report, the data has been rolled up to a statewide-level and does not include individual division or county condition data.

C.3 Pavement Maintenance

Pavement maintenance is defined as routine scheduled or emergency activities on pavements to correct defects and patch potholes. Items assessed in this category included paved shoulders, patching, crack sealing, faulting, spalling, and slab repair. These items were reviewed as part of the MCAP survey and show average pavement maintenance scores falling below the target values on all systems.

C.4 Survey Findings

The survey results have been summarized in Appendix C. This table shows the element rated, the target value and the statewide average score for the Interstate, Primary, and Secondary systems. Also shown, is an average overall score for the system. These figures indicate that some activities are being maintained at or above the target level of service, while others are not. In order to bring these below target elements up to an acceptable condition, additional funding is needed. It is also important to remember, some features must be maintained at a high level of service due to safety concerns and considerations.

D – BRIDGE AND STRUCTURE MAINTENANCE

Bridge and structure maintenance consists of those work activities associated with the maintenance and upkeep of bridges, structures, and large pipes and culverts. The conditions of these assets are evaluated through two separate survey methods: 1) the FHWA required bi-annual bridge inspection program for bridges and large structures, and 2) inspections of large pipes and culverts that are 54 inches in diameter up to 20 feet in length. Pipes and culverts that are less than 54 inches are included in the Roadway Maintenance section of this report.

A comprehensive sustainable infrastructure management approach that provides a level of asset performance over a multi-year time frame at the lowest cost consists of a strategy that incorporates a mix of treatments of maintenance, preservation, rehabilitation and replacement. This section will address the funding needed for each of these treatments except for replacement. First, bridge and structure maintenance work activities will be addressed under the two categories of (1) Recurring Programs, and (2) Performance Based Activities. Then large pipe and culvert needs will be discussed, and lastly, bridge preservation and rehabilitation needs will be covered.

D.1 RECURRING PROGRAMS

These activities consist of drawbridge maintenance, small bridge replacements, large culvert installation and maintenance, and scour/slope protection. The annual estimated funding needs for these programs are approximately $27.04 Million.

D.2 PERFORMANCE BASED ACTIVITIES

These activities consist of maintenance and repairs to bridge items such as timber and steel handrails, timber, concrete and steel decks, expansion joints, steel and concrete beams, support piles, and footings. A detailed analysis of these elements is made through the Bridge Condition Survey. In accordance with this survey, inspections are conducted to assess the condition of the state highway system bridges for five major elements: railings,

decks, expansion joints, superstructure, and substructure. The photographs below illustrate some of the conditions observed during the survey.

Every bridge in the state is inspected in detail once every two years. Survey teams assess the condition of the elements for each bridge. Element conditions are then determined for each bridge and summarized into a statewide Bridge Condition rating. In addition, the survey teams determine the quantity and type of repair needed. This information is used to calculate the statewide bridge maintenance needs. The result of this survey is shown in Appendix C and provides the level of service for Decks, Superstructure, Substructure, Rails and Expansion joints. The estimated annual cost to maintain these features at an acceptable level is $62.08 Million.

Railings

Decks

Expansion Joints

Superstructures

Substructures

D.3 LARGE PIPES & CULVERTS

There are approximately 25,000 state owned pipes, culverts and drainage structures which range from 54” in diameter to 20 feet in size and consist of various material types like

aluminum, steel, concrete and plastic. While not classified as bridges or structures by FHWA standards, these drainage items are inspected and maintained by the Transportation Division's Bridge Maintenance staff and funding is provided as a part of the bridge maintenance budget. The annual cost of this item is estimated at $5.69 Million.

D.4 BRIDGE PRESERVATION

Bridge Preservation activities are those minor, low cost treatments that are performed to bridges in relatively good condition to extend their life. The type of activities included in this work is painting structural steel, cleaning bearings, repairing and replacing expansion joints, applying materials that slow corrosion, waterproofing decks and resurfacing decks. It is important to make minor improvements to good bridges regularly, because it delays much more expensive and time consuming major repairs. The estimated annual cost of this is $25.85 Million.

D.5 BRIDGE REHABILITATION

Bridge Rehabilitation activities are those treatments that restore bridge components to a "like new" condition. These activities are much more expensive than preservation treatments, but are more cost effective than replacing the entire bridge. This type of work is most cost effective when some portions of a bridge are in good to fair condition, but other elements of the structure are in poor condition. The poor elements can be rehabilitated without having to replace the entire bridge. The estimated annual cost of this is $116.20 Million.

E – HIGHWAY SYSTEM OPERATIONS

Highway system operations includes those items that affect traffic flow and overall efficiency of the highway system. These operational items would include traffic signals and ITS devices such as electronic dynamic message boards, video camera systems, and traffic speed sensors.

E.1 TRAFFIC SIGNAL SYSTEMS MAINTENANCE

Traffic signal maintenance consists of those work activities associated with the maintenance and operation of the approximately 8,800 traffic signals across North Carolina. The Department has a variety of different types of traffic signal systems to maintain and operate. These systems include: 1) time-based signals systems, 2) traffic responsive "closed loop" systems where several signals communicate with each other, and 3) large municipal integrated coordinated traffic systems throughout a city's core area.

In July 2000, the Department began a comprehensive study of its operation and maintenance of traffic signals across North Carolina. As a part of this initiative, a course of action was prepared similar to the other performance based activities in this report with the expected outcome to determine the cost to operate and maintain the various traffic signal systems at a "Good" level of service.

Traffic signal maintenance can be divided into three categories: (1) Signal Routine Maintenance, (2) Signal System Operations, and (3) Emergency Response. Signal Routine Maintenance activities include performing scheduled preventative maintenance

activities, certifying conflict monitors, and repairing traffic loops. Emergency response involves timely response to trouble calls, replacing missing displays, and repairing knockdowns. Signal system operations involves monitoring the signal system operation and evaluating and updating timing plans when necessary, including developing timing plans for special events and detour routes for incident management.

Preventative maintenance should be performed on each traffic signal in the state every 6 months. Traffic Services personnel are currently performing this activity on 32% of the traffic signals. These preventative maintenance activities ensure the signal equipment is functioning properly for the safety of the motoring public. Regular preventative maintenance activity also decreases the likelihood of having to perform more expensive emergency repairs. Traffic signal timing plans and event schedules should be evaluated at least once every 18 months. Currently this evaluation is performed on 33% of the signals annually. Periodically evaluating and re-timing traffic signal systems can be especially beneficial for efficient movement of traffic. Benefit cost ratios can be as high as 40 to 1 for this activity.

Funding for the performance needs identified in this study would require approximately $46.51 Million for fiscal year 2009-2010. With the increased urbanization of North Carolina approximately 300 signals are added to the state highway system every year. To meet the established performance measures for these additional signals would require an annual increase of approximately $1.35 Million.

The benefits of maintaining traffic signal systems at a good level of service are improved safety, reduction in stops and delays, reduction in fuel consumption, improvement in air quality, and lastly, from an economic standpoint it makes sense to keep traffic moving efficiently. With improved signal operations, the need for additional road capacity can be postponed or eliminated with a well maintained traffic signal system. The ability to move goods more efficiently can stimulate economic growth, allow for shorter commute times, and can improve the motorist's perception of our highway system.

E.2 ITS DEVICES

Planned activities such as maintenance, construction and special events and unplanned situations like accidents, disabled vehicles, inclement weather and fatalities both plague the 79,000 plus miles of roadway in North Carolina. They cause unnecessary congestion, waste time, fuel and money. Secondary accidents due to backups account for 30% of all accidents and 18% of the fatalities on our roadways. The purpose of ITS operations is to minimize congestion, delays, accidents and fatalities through the efficient and effective use of traveler information, driver and responder education and incident management.

NCDOT has a robust network of intelligent transportation system devices, which includes 175 portable changeable signs, 403 closed caption televisions, 193 overhead dynamic message signs, 44 highway advisory radios, 447 speed detection stations, 31 reversible lane devices and 4 road weather information stations across the state. These devices are used to monitor conditions on the roadways, detect issues, dispatch responders, and notify the public to enhance safety and efficiency of travel.

The Traveler Information component incorporates activities through multiple resources. The Department's traveler information hotline, 511, is a toll free number where motorists can find accurate, up-to-date information on road conditions for planned activities as well as wrecks and weather events. Information on transit from a variety of sources is also available and this system ties in with other states systems to provide motorists with valuable information as they travel in and through North Carolina.

Incident Management Assistance Patrols, or IMAP Units, are trained personnel that drive vehicles equipped with arrow boards, traffic cones, push bumpers, winches, fuel, tire changing equipment and other various devices to clear debris and vehicles from the

roadway and set up emergency traffic control for short duration incidents. They patrol 500 miles of the most congested roadways in the Triangle, Triad, Metrolina and Asheville regions along with 20 miles of I-40 near the Tennessee State Line. Half of these first responders calls are cleared within 30 minutes and 75% are cleared within an hour. IMAP is an effective means of responding to incidents to relieve congestion and minimize secondary incidents since they can provide quicker response and coordination to unexpected issues that arise. In 2008 IMAP drivers responded to over 65,000 calls for service to the motoring public or response agencies. Studies have shown this program has a benefit to cost ratio of as high as 22 to 1, which makes it an extremely cost effective means of minimizing traffic congestion.

Other Incident Management activities include providing support in communications, coordination and cooperation with other response agencies such as the State Highway Patrol, local law enforcement, Emergency Management, Towing, Fire and Rescue, the medical community and media. By properly coordinating how we handle incidents on our roadways, we can more efficiently manage work zones, handle incidents and coordinate with all involved responders and the traveling public.

The Department's goals are to reduce incident duration, secondary incidents and fatalities and properly inform the traveling public of activities along our roadways.

F – PAVEMENTS

One of the most valuable assets in the state's transportation network is the pavement. The most cost effective method to maintain pavements is through a combination of treatments including maintenance, pavement preservation, resurfacing and rehabilitation. To assess the condition of this asset the 2008 Pavement Condition Survey was used to determine the actual pavement conditions and then to generate broad program needs as defined in Table 1 below:

Pavement Condition Rating (PCR)	Treatment Category	Flexible Pavements	Rigid Pavements
PCR 75-90	Preservation	Crack Sealing or Chip Seal	Clean and Reseal Joints and/or diamond grind
PCR 60-75	Resurfacing	1.25 to 2" single lift of surface course	Spall repairs, minor patching, overlay with ultra thin bonded wearing course
PCR 45-60	Rehabilitation	Mill 2.5", Replace with Intermediate Course, Overlay with 2 lifts of surface course.	Significant spall repairs, slab replacements, corner break repairs, overlay with ultra thin bonded wearing course
PCR <45	Reconstruction	Remove all asphalt layers, repair base course, replace asphalt to meet 20 year design life.	Remove and replace concrete pavement with jointed dowelled concrete pavement to provide a 30 year design life; construct shoulder drains.

Table 1 – Pavement Treatments

The treatments shown above are "typical" treatments. Specific treatments for each roadway are determined based on the projected traffic and the type and severity of distress. Failure to apply the necessary treatment to correct a specific deficiency may result in a short term increase in Pavement Condition Rating, but will not prevent the

distress from reappearing. Each of these treatment types will be discussed in detail throughout the remainder of this section.

By using a comprehensive pavement management approach and investment strategy of SB 1005, NCMA, contract resurfacing, the FHWA Interstate Maintenance Program and pavement preservation, pavement conditions in North Carolina have improved over time as shown in Figure 6. The challenge in the future will be to sustain the gains accomplished through SB 1005 and NCMA.

Figure 6 – Overall Pavement Condition Rating

F.1 Pavement Preservation

Pavement preservation treatments are applied early in the pavement life, when the pavement condition is fair to good thus prolonging the time the pavement remains in good condition. Pavement preservation includes crack sealing, chip seals, and thin hot mix asphalt overlays applied to pavements in better condition.

The Department has expanded its preventative maintenance and preservation programs by using chip seals, slurry seals, microsurfacing, and thin (less than 1") hot mix asphalt. These treatments are most effective if applied when the pavement is in fair to good condition. Selection of sites for preservation activities is frequently based on the routine pavement condition survey ratings shown in Table 1.

These relatively low-cost treatments seal off the pavement surface, recondition the underlying asphalt, and provide a refreshed driving surface for about one-third the cost of a hot mixed asphalt surface. The average life of these treatments is about 6 to 9 years; however, some are performing adequately for over 12 years.

Crack sealing of flexible pavements and cleaning and resealing of joints in rigid pavements are also cost-effective preservation strategies. Crack sealing can prevent water intrusion into the material below the asphalt layers. This water intrusion can soften the base materials or subgrade, resulting in full depth pavement failures and more costly repairs.

Preservation
Crack Sealing

Preservation
Bituminous Surface Treatment

In its chip seal operations, the Department has begun using asphalt emulsions with polymer additives to improve the performance of surface treatments and to expand their use to higher traffic volume roadways. The Department is also beginning to develop preservation projects for rigid pavements, often to address ride quality issues on concrete pavements that are otherwise performing well.

F.2 CONTRACT RESURFACING

Resurfacing is necessary when the pavement condition falls to the fair category and some full depth patching may also be required to restore the pavement structure. Resurfacing increases the pavement thickness, usually by 1 to 2 inches and is cost effective for low to medium levels of traffic and on high volume roads where the pavement is in good condition.

The Contract Resurfacing Program provides funding for the resurfacing of the paved road system with hot mixed asphalt. Resurfacing provides a renewed driving surface and improved ride quality, and must occur intermittently to avoid costly patching and frequent maintenance. Research has shown that roadways deteriorate very slowly when initially constructed, but that the rate of deterioration increases with increasing age and traffic loading. The goal is to resurface roads prior to the sharp downward trend in pavement condition rating. The high rate of population growth experienced in North Carolina in the last 10 years translates into higher traffic volumes and vehicle miles traveled (VMT), both of which put additional strain on our pavement infrastructure. The increased population has caused both an increase in automobile traffic and a larger and heavier freight industry.

Resurfacing

Resurfacing

F.3 PAVEMENT REHABILITATION

Pavement rehabilitation generally restores pavement condition and increases pavement structure by the addition of multiple lifts of hot mixed asphalt. An example of a rehabilitation treatment would be to mill out existing cracked asphalt, replace it with a larger stone mix, and overlay with two lifts of surface course. Failure to use a program of maintenance, preservation, resurfacing and rehabilitation will result in widespread pavement failure requiring reconstruction. As one moves through this series of treatment classes, costs increase dramatically so it is more economical to maintain and preserve a pavement in good condition than to let it fall into a state of disrepair that would result in costly rehabilitation and reconstruction.

Rehabilitation

Reconstruction

NCDOT has calculated the funding required to bring the road network to the established performance targets. This calculation does not include funding for the Interstate System as it is anticipated that the Transportation Improvement Program will address these needs. The funding needed to maintain, preserve, resurface and rehabilitate our pavements does not include any funds for capacity expansion (widening).

NCDOT utilized the funds from the legislative initiatives, SB 1005 and NCMA, to rehabilitate and modernize both primary and secondary routes throughout North Carolina. These programs invested over $1 billion to improve and preserve our state's road and bridges. Many of these projects provided much needed strengthening of the pavement structures to address current and future traffic volumes. The challenge will be to protect this investment with timely follow-up maintenance and preservation.

G. SUMMARY AND CONCLUSIONS

As has been shown, the revised G.S. 136-44.3, requires the Department of Transportation to demonstrate the costs to meet and sustain performance targets for the primary and secondary highway systems including routine maintenance, system preservation and rehabilitation projects. This report is intended to provide the Joint Legislative Transportation Oversight Committee with an accurate analysis of the condition of the state highway system and the funding needed to provide the Department's target levels of service. Throughout this report, the annual cost to meet and sustain the established performance standards are identified and described. These performance standards drive the Department's road and bridge maintenance operations funding needs.

Each year, the completion of new and wider freeways along with the paving of approximately 200-300 miles of secondary roads a year places an additional burden on the maintenance budget. Add to that the rising cost of materials, and it becomes clear that as funding remains constant the level of service on our highways begins to deteriorate. As shown in the following charts, when funding remains stagnate, the percent of pavements in good condition drops from 70% to 47% in a seven year period. And likewise, roadway performance falls from 82 to 72 while bridge performance falls from 68 to 60.

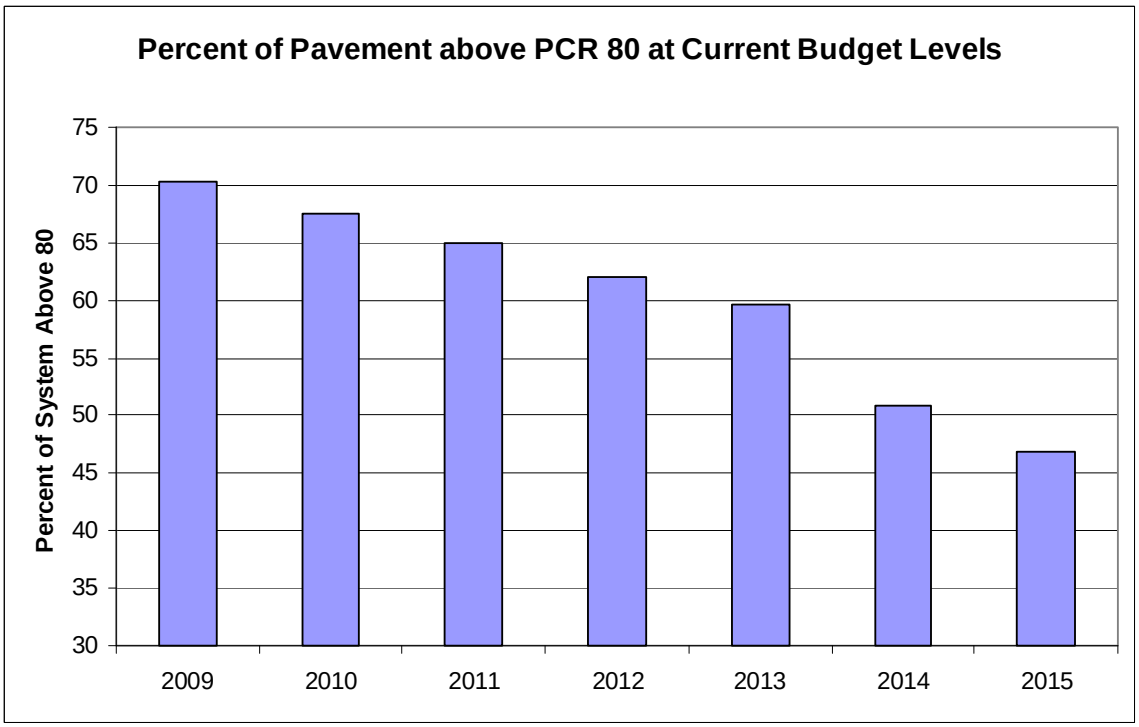


Figure 7 – Projected Pavement Ratings

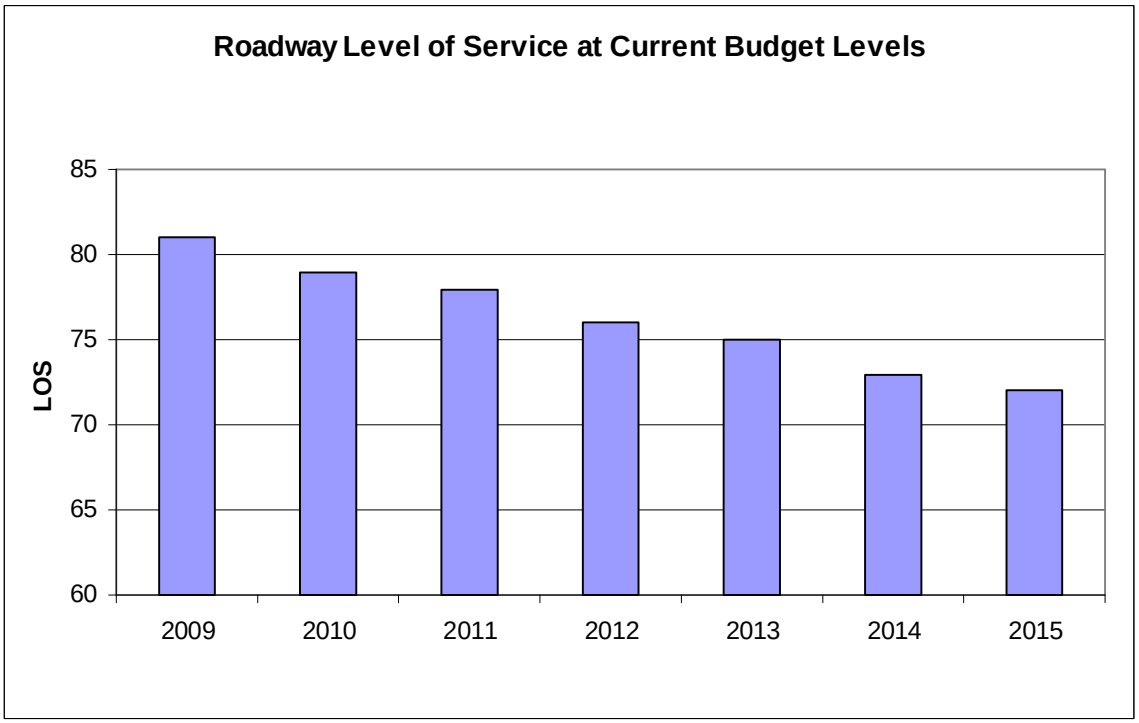


Figure 8 – Projected Roadway Level of Service

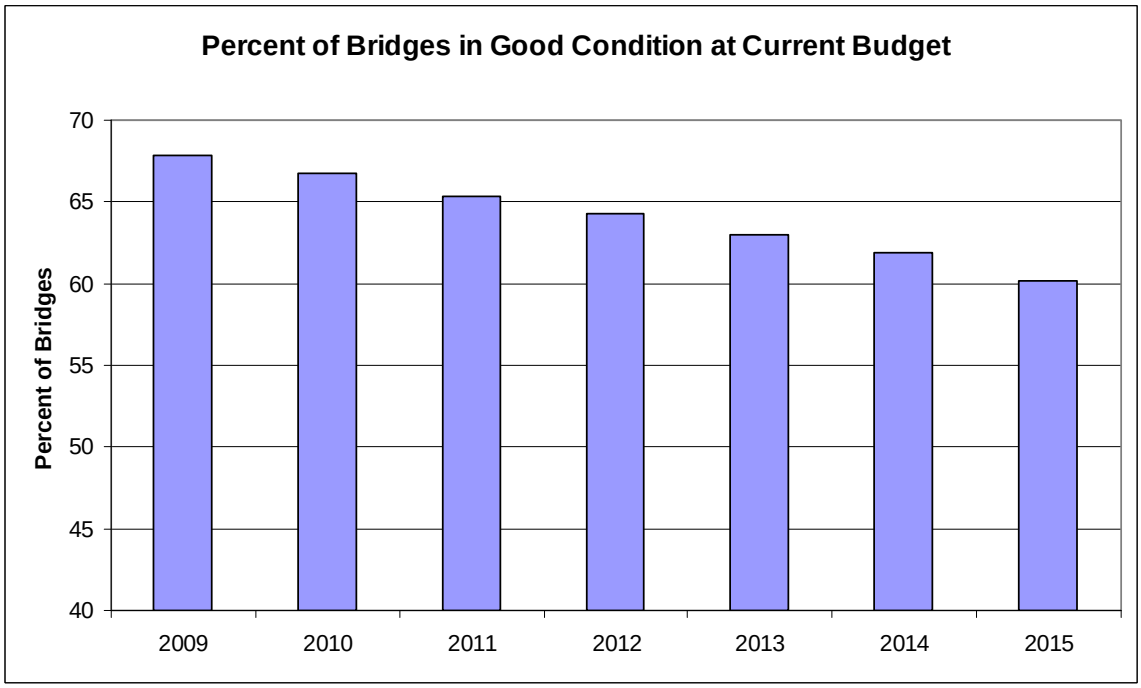


Figure 9 – Projected Bridge Condition

To provide the established level of service indicated in this document, adequate funding levels must be available. Table 2 below summarizes the funding levels needed to meet and sustain the established performance standards for maintenance and operations of the primary and secondary highway systems as required by G.S. 136-44.3.

Category	**Funding Needs (Millions)**
Roadway Maintenance	$748.48
Bridge Maintenance	$89.12
Highway Operations	$70.01
Disasters & Emergencies	$15.00
Contract Resurfacing	$443.85
Pavement & Bridge Preservation	$308.96
Total Maintenance & Preservation Needs	$1,675.42
System Rehabilitation	$407.51

Table 2 – Funding Needs

Based on this funding level, the Department would propose to develop a statewide annual maintenance funding plan consistent with the funding shown in Appendix D. This plan would not only allow the Department to sustain the established levels of service, but would also address some of the major highway rehabilitation needs identified by this report.

APPENDIX INDEX

Paved Lane Miles

	Lane Miles			Cumulative Total	
Year	Primary	Secondary	Total	Mileage	Percent
1997	36,547	110,221	146,768	-	
1998	36,900	113,706	150,606	3,838	2.6%
1999	36,978	115,279	152,257	5,489	3.7%
2000	37,483	116,877	154,360	7,592	5.2%
2001	37,791	118,169	155,960	9,192	6.3%
2002	37,791	118,169	155,960	9,192	6.3%
2003	38,093	120,499	158,592	11,824	8.1%
2004	38,444	121,339	159,783	13,015	8.9%
2005	38,698	121,911	160,609	13,841	9.4%
2006	40,678	120,830	161,508	14,740	10.0%
2007	40,960	121,780	162,740	15,972	10.9%

Bridge Deck Area

			Cumulative Change		Yearly Change	
Year	Total Bridges	Bridge Deck Area	Square Feet	Percent	Square Feet	Percent
1997	17,077	67,794,862				
1998	17,145	68,829,594	1,034,732	1.5%	1,034,732	1.5%
1999	17,263	69,679,605	1,884,743	2.8%	850,011	1.2%
2000	17,410	71,298,167	3,503,305	5.2%	1,618,562	2.3%
2001	17,463	72,290,160	4,495,298	6.6%	991,993	1.4%
2002	17,526	75,342,236	7,547,374	11.1%	3,052,075	4.2%
2003	17,635	76,391,052	8,596,190	12.7%	1,048,817	1.4%
2004	17,775	78,399,401	10,604,539	15.6%	2,008,349	2.6%
2005	17,848	79,750,414	11,955,552	17.6%	1,351,013	1.7%
2006	17,979	82,154,308	14,359,446	21.2%	2,403,894	3.0%
2007	18,018	83,507,651	15,712,789	23.2%	1,353,343	1.6%

Lane Miles vs. Traffic Growth (1997 Base Year)				
Years	**Actual VMT (Millions)**	**Actual Lane Miles**	**% Growth VMT**	**% Growth Lane Miles**
1997	81,893	146,768		
1998	85,282	150,606	4.1%	2.6%
1999	87,760	152,257	7.2%	3.7%
2000	89,254	154,360	9.0%	5.2%
2001	91,571	155,960	11.8%	6.3%
2002	92,893	155,960	13.4%	6.3%
2003	93,763	158,592	14.5%	8.1%
2004	95,627	159,783	16.8%	8.9%
2005	100,861	160,609	23.2%	9.4%
2006	101,648	161,508	24.1%	10.0%
2007	103,598	162,740	26.5%	10.9%

Roadway			Interstate		Primary		Secondary	
	ELEMENT	PERFORMANCE MEASURE	2008 Target	State Avg. Score	2008 Target	State Avg. Score	2008 Target	State Avg. Score
SHLD & DITCH	Low Shoulder	No dropoff's greater than 2 inches	**95**	90	**95**	86	**92**	90
	High Shoulder	No shoulders higher than 1 inch	**95**	82	**95**	92	**92**	93
	Lateral Ditches	No blocked, eroded or non functioning ditches	**95**	93	**95**	93	**92**	92
DRAINAGE	Crossline Pipe (Blocked) < 54"	Greater than 50% diameter open	**95**	97	**90**	87	**85**	86
	Crossline Pipe (Damaged) < 54"	No damage or structural deficiency	**95**	99	**90**	96	**85**	93
	Curb & Gutter (Blocked)	No obstruction greater than 2 inches for 2 feet	**95**	94	**92**	94	**92**	96
	Curb & Gutter (Damaged)	No damage	**95**	99	**92**	98	**92**	98
	Drop Inlets, CB's, etc (Blocked)	Grates and inlets not blocked greater than 50%	**98**	86	**95**	90	**92**	91
	Drop inlets, CB's, etc (Damaged)	Inlets and outlets are not damaged	**98**	93	**95**	95	**92**	96
ROADSIDE APPURT	Guardrail/Cable/Median Barrier/Conc	Rail is functional	**99**	100	**97**	99	**95**	99
	ROW Fence	Functioning as designed and undamaged	**94**	96	**94**	98	**N/A**	N/A
	Stormwater Devices	Functioning as designed	**90**	89	**N/A**	N/A	**N/A**	N/A
	Impact Attenuators	Properly functioning as designed and operational	**99**	98	**97**	94	**N/A**	N/A
ROADSIDE	Mowing	Grass height not to exceed 15 inches	**90**	59	**85**	65	**80**	69
	Brush & Tree Control	Vertical clearance of 15 feet over roadway and 10' back of ditch or shoulder point	**90**	85	**85**	71	**80**	67
	Turf Condition	Free of bare, dead, diseased, distressed, or weedy areas	**90**	73	**85**	83	**80**	88
	Uncontrolled Growth	Vegetation height around guardrail does not exceed bottom of rail, and uniform with roadside at signs	**70**	71	**65**	47	**60**	43
	Litter & Debris Control	Less than 100 pieces of litter or debris	**90**	45	**85**	72	**80**	84
	Landscape Beds	Free of dead or damaged plant material, decomposed mulch, unwanted vegetation	**90**	79	**90**	80	**N/A**	N/A
	Rest Areas & Welcome Center	Condition Rating	**90**	91	**90**	92	**N/A**	N/A
TRAFFIC/ITS	Long line pavement markings	Present, visible and reflective at night	**95**	58	**90**	69	**80**	52
	Words % Symbols	Present, visible and reflective at night	**95**	92	**90**	83	**80**	76
	Pavement Markers	Present and reflective	**95**	37	**85**	50	**N/A**	N/A
	Signs ground	Visible and legible	**92**	94	**85**	89	**85**	86
	Overhead Signs	Visible and legible	**92**	99	**85**	95	**N/A**	N/A
PVMT	Pvm't Shoulder Condition	Pavement failures are repaired	**90**	79	**85**	83	**80**	71
	Asphalt pavement repair	Potholes fixed, rut depths <.25", cracks >.5" sealed	**95**	73	**90**	68	**85**	62
	Total		**93**	**83**	**90**	**83**	**86**	**81**

Red – Did not meet target; **Green** – Met or exceeded target; **Gray** – Element was not rated

Bridges			Interstate		Primary		Secondary		Statewide
	ELEMENT	PERFORMANCE MEASURE	2008 Target	State Average Score	2008 Target	State Average Score	2008 Target	State Average Score	State Average Score
Bridge Deck	Concrete	% of decks rating less than or equal to 6	**85**	84	**80**	79	**75**	83	81
	Timber		**85**	N/A	**80**	83	**75**	86	86
	Steel Planks		**85**	N/A	**80**	69	**75**	85	85
	Open Grid Steel		**85**	N/A	**80**	55	**75**	N/A	50
Superstructure	Concrete	% of superstructure rating less than or equal to 6	**90**	84	**85**	63	**80**	66	65
	Steel Planks		**90**	90	**85**	83	**80**	82	83
	P/S Concrete		**90**	97	**85**	96	**80**	93	94
	Timber		**90**	N/A	**85**	52	**80**	65	65
Substructure	Timber	% of substructure rating less than or equal to 6	**90**	N/A	**85**	23	**80**	45	44
	Concrete Pile		**90**	85	**85**	79	**80**	84	81
	Steel Pile		**90**	92	**85**	90	**80**	92	91
	Concrete Piers		**90**	92	**85**	81	**80**	87	85

Red – Did not meet target; **Green** – Met or exceeded target; **Gray** – Element was not rated

Fiscal Year Funding Need (Million dollars)

Maintenance Programs	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16
Roadway Maintenance	$ 748.48	$ 779.90	$ 812.63	$ 846.74	$ 882.28	$ 919.32	$ 957.91
Bridge Maintenance	$ 89.12	$ 92.74	$ 96.51	$ 100.43	$ 104.53	$ 108.79	$ 113.23
Highway Operations	$ 70.01	$ 71.96	$ 74.00	$ 76.12	$ 78.33	$ 80.63	$ 83.03
Disasters & Emergencies	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00
Contract Resurfacing	$ 443.85	$ 462.49	$ 481.92	$ 502.16	$ 523.25	$ 545.22	$ 568.12
Pavement and Bridge Preservation	$ 308.96	$ 321.94	$ 335.46	$ 349.55	$ 364.23	$ 379.53	$ 395.47
Total Maintenance and Preservation Needs	$ 1,675.42	$ 1,744.02	$ 1,815.51	$ 1,890.00	$ 1,967.61	$ 2,048.49	$ 2,132.76
System Rehabilitation	$ 407.51	$ 442.46	$ 461.04	$ 480.41	$ 500.58	$ 521.61	$ 543.52
Supplemental Funds	$ 115.17	$ 115.17	$ 115.17	$ 115.17	$ 115.17	$ 115.17	$ 115.17
Estimated Highway Allocations	$ 943.42	$ 943.42	$ 943.42	$ 943.42	$ 943.42	$ 943.42	$ 943.42
Total Projected Budget Shortfall	$ 616.83	$ 685.43	$ 756.92	$ 831.41	$ 909.02	$ 989.90	$ 1,074.17