Maintenance Condition Assessment Report
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EXECUTIVE SUMMARY

Introduction

The North Carolina Department of Transportation 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 79,185 miles of roadway and 18,205 structures. The Division of Highways within the Department of Transportation is responsible for maintaining this system. Over the past 10 years, paved lane mile growth increased by 4% and bridge deck area grew by approximately 24%. While the system continues to grow, the traditional highway maintenance funds have increased, but not enough to keep pace with inflation and system growth.

Recognizing this gap between available funding and maintenance needs, the North Carolina General Assembly and the Department work together to not only increase maintenance funds, but 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 were identified. Thanks to these alternative methods, the Department has the opportunity to improve the safety and maintenance condition on the highway system.

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 $59 million per year to address existing programs areas. This report highlights one of the newest non-traditional funding streams, the Interstate Maintenance Preservation Program. This program is a planned strategy of cost-effective preservation treatments for bridges, pavements and roadside features that retard deterioration without adding structural or traffic capacity. These non-traditional

funding sources are included in this report, and the maintenance needs identified take into consideration the availability of these dollars.

Another non-traditional funding source this year is the American Recovery and Reinvestment Act of 2009 (ARRA). This $735 million in federal funding helped the Department improve highways and bridges throughout North Carolina.

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 the department to establish performance standards for the maintenance and operation of the state highway system and report on the findings. The report provides quantitative and qualitative descriptions of the condition of the system and 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. This annual maintenance program is 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 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 many of the highway features meet the established performance standards, some do not. In accordance with the legislative requirements, the Department 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 $668.47 million.

Bridge Maintenance and Preservation

The cost of routine bridge maintenance in order to meet the established performance standards is $71.65 million and preservation is $26.24 million.

Highway Operations

The cost of operating the state's 8,900 traffic signals and various Intelligent Transportation System devices is $74.49 million.

Pavement Preservation and Contract Resurfacing

The annual cost of routine and interstate pavement preservation activities is $207 million and resurfacing is $330 million.

Disasters and Emergencies

Recent years have been kind to North Carolina and there were 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, Preservation, and Contract Resurfacing Funding Need

Taking into consideration the maintenance benefits of $129 million in various non-traditional funds, the total maintenance funding need for FY 2011-2012 amounts to $1,263.85 million. As shown in Appendix D, estimated highway allocations of $933 million leave an annual shortfall of $330 million.

Pavement and Bridge Rehabilitation

The cost of pavement and bridge rehabilitation is $339.97 million.

Comprehensive Management and Investment Approach

North Carolina stands at a crossroads of funding and system condition. The Department recognizes that as funding has remained constant system condition decreases, possibly jeopardizing the safety and mobility of North Carolina's citizens. A comprehensive, balanced funding program of maintenance, preservation, rehabilitation, and replacement is necessary to operate and maintain the highway system at an acceptable condition.

The need for a comprehensive funding program and Governor Perdue's support of the Department's steps to transform how it does business led to the creation of the NCDOT "Policies to Projects" work program. This work program clearly defines department objectives with anticipated resources and sets clear goals. This "Policies to Projects" initiative ensures our limited funding is properly invested to achieve the best results possible for the citizens of North Carolina.

2010 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) 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.

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 "2010 Maintenance Condition and Funding Needs for the North Carolina State Highway System", is intended to satisfy these requirements. This report also intends to provide a clear link between maintenance objectives, activities, and service levels with budget and actual performance targets.

Highway System Growth

North Carolina's highway system has grown over the last 20 years. Currently the system consists of 79,185 miles of roadway and 18,205 structures. Over the past 10 years, paved lane miles have grown by 4% while bridge deck area grew approximately 24%. Appendix A lists the mileage and bridge deck area totals for the past 10 years.

While the country's recent recession slowed the rate of growth in vehicle miles traveled, it is anticipated this rate will return to pre-recession growth. Over the last two years, there was a dip in vehicle miles traveled, but this shows signs of growth again. During the period from

2001 - present, vehicle miles traveled increased by 15% while the paved lane miles have only increased by 4%. This VMT increase places a heavier burden on the existing infrastructure due to increased truck traffic as well as heavier trucks. Coupled with a greater volume of cars, this 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 caused by the increase in traffic.

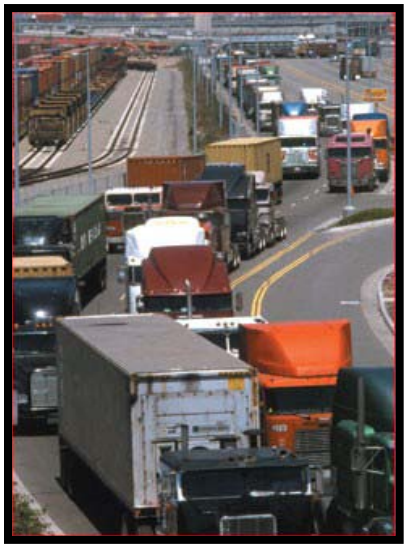
Freight

In addition to the growth in vehicular traffic, there is also expected to be an even faster rise in freight traffic. Following the 2009 "Statewide Logistics Plan for North Carolina"* report published by NC State University for the North Carolina Office of State Budget and Management, Governor Purdue established the Governor's Logistics Task Force. This task force was charged with:

- Conducting a thorough inventory and evaluation of existing public and private transportation and commerce assets, including ports, inland ports, airports, highways, railroads, major distribution centers, and business and industrial parks.
- Reporting on the current system for moving goods and people, including the condition of the system, its overall performance, and its safety.
- Projecting future needs for the state's multi-modal transportation system and explore challenges and opportunities in meeting those needs.
- Identifying relevant research and best practices in transportation and logistics from other states.
- Inventorying current laws, rules, policies, processes, and organizational structures that affect the movement of people and goods across the state and make recommendations for changes to improve the efficiency and safety of our transportation system.
- Exploring innovative ideas in transportation and economic development that can help support the state's logistics capacity, including public private partnerships.
- Making additional short-term and long-term recommendations to create an integrated logistics plan for North Carolina.

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

The Task Force continues meeting and reporting its progress, findings, and recommendations to the Governor every six months, or more frequently, if warranted.



Other sources also support this vision of expanded freight movement across North Carolina. The Federal Highway Administration reports that in 2007, 281 million tons of freight was moved across our state. This number includes both imports and exports. FHWA also estimates that by the year 2030 more than 324 million tons of freight will be moved across our state annually. This freight growth comes with increased congestion and wear and tear on the state's 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. Trucks continue to be the single most-used mode to move freight across our country. Victor Mendez, Federal Highway Administrator, is quoted as saying "this confirms how critical our highway infrastructure is to the nation's economy."

History of Maintenance Funding

Much of North Carolina's highway system's growth came in the form of widening two-lane highways to four-lane facilities and constructing urban loops. While this type of roadway carries higher volumes of traffic, they are also more costly to maintain and preserve. When past maintenance funding is adjusted by the Consumer Price Index*, the total dollar amount devoted to maintenance operations is 22% higher than that of FY 2000, as indicated in Figure 1.

***** "All Urban Consumers" Table

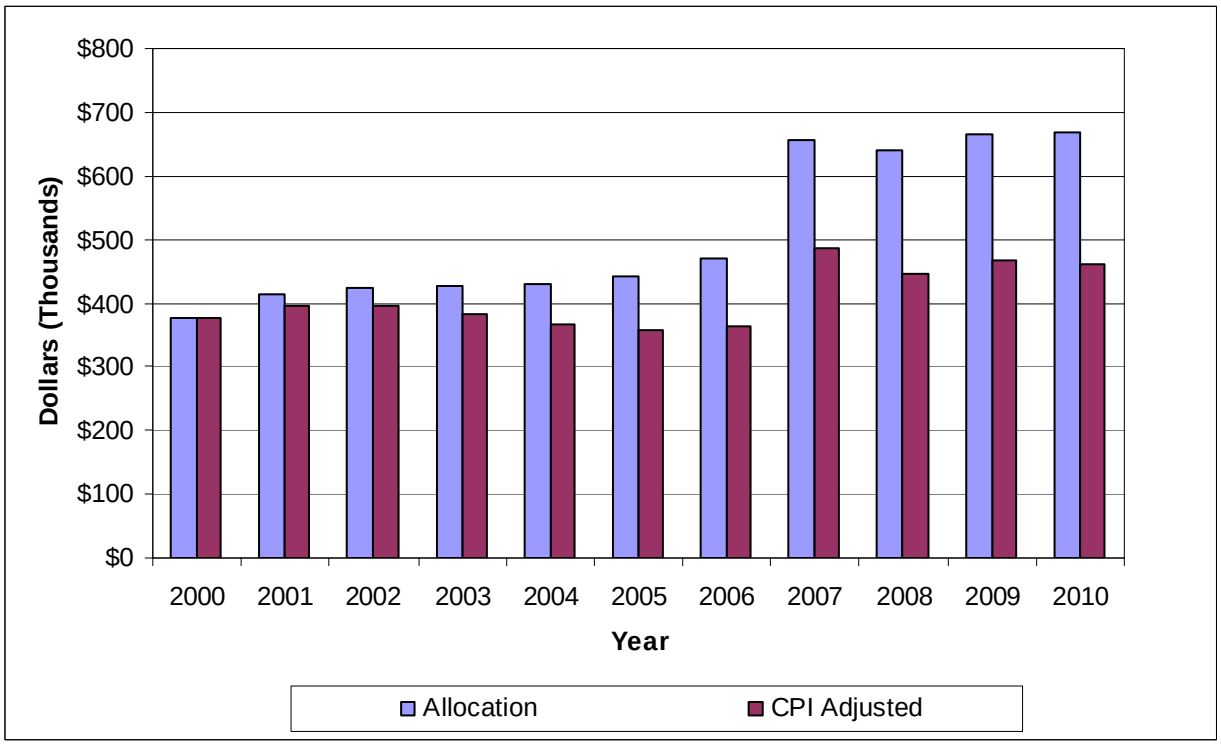


Figure 1 – Maintenance Funding, Adjusted by the All Urban Consumers Table (CPI)

Oil prices have a dramatic impact on the Department's programs including TIP construction, maintenance, resurfacing, and pavement preservation. The cost of liquid asphalt, a key component of pavement, saw wide variability in pricing. As an example, in 2008, NCDOT paid an additional $75 million in asphalt price adjustments due to the rising price of crude oil, only to turn around in 2009 and have a negative price adjustment of $41 million. As of this report, NCDOT is on track to pay an additional $85 million by the end of the year in asphalt price adjustments, indicating the volatile swings in the crude oil market. Gasoline also saw similar swings in pricing, but has not returned to the previous 2007 levels and is expected to remain high.

The impact of high liquid asphalt prices is counterbalanced by the effects of the ongoing economic downturn. The construction and paving industries have been hard hit by the slowdowns as well. The positive effect for the state is competitive bidding for almost all projects, and many projects came in at more than 10% below the original engineer's cost estimate.

For example, the 2007 version of this report quoted resurfacing costs for a secondary road at $62 thousand per lane mile and $79 thousand per lane mile for interstate and high volume primary routes. Recent bid prices for secondary road resurfacing are around $40 thousand per lane mile and $71 thousand per lane mile for interstates. These costs are broad estimates but show the impacts of both the asphalt prices and the recession.

Given these factors, one can see that while the amount of Contract Resurfacing funds almost tripled since 2000, when adjusted by the NC Highway Construction Cost Index table of the Consumer Price Index, the total dollar amount allocated for Contract Resurfacing is 57% higher as indicated in Figure 2. This results in a marked decline in purchasing power.

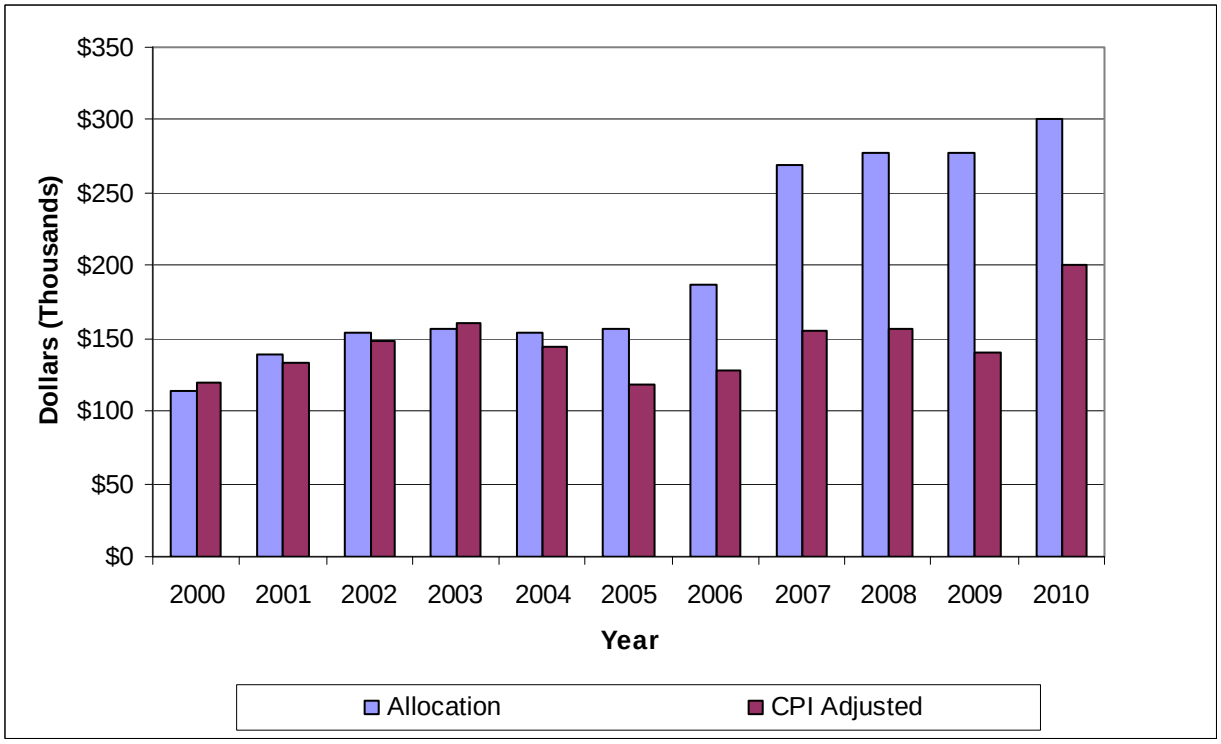


Figure 2 – Contract Resurfacing, Adjusted by the NC Highway Construction Cost Index

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

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

American Recovery and Reinvestment Act (ARRA)

In February 2009, President Obama signed the American Recovery and Reinvestment Act into law and the Department received $838 million in federal funding - $735 million for highway and bridge improvements and $103 million for transit. The legislation required states to obligate the first half of funding within 120 days of receipt, and the remaining half to projects within a year.

As of October 1, 2010, the department advertised 266 contracts representing $584 million in ARRA funding which indirectly effects maintenance operations. More than 230 of these have been completed. These projects include bridge improvements and replacements, pavement improvements and pavement widening and safety and traffic management contracts. Of the $584 million that was obligated, $393 million has been expended to date.

Bids have come in approximately 22 percent, or $100 million, lower than estimated, allowing the Department to stretch funds further. Being proactive, the Department programmed additional projects and was able to make additional improvements to our transportation system that normally would have waited years to be funded.

The overarching goal of ARRA was to create and sustain jobs for a wide range of industry partners throughout the country, meaning the projects ultimately selected must be diverse in size, type and geography.

Nationally, the US Department of Transportation committed $26.60 billion to more than 12,000 road, highway and bridge projects across the country. In addition to putting our fellow citizens back to work, these projects make our communities safer, greener, more livable, less congested and economically stronger.

Secondary Road Construction Funds

Since creation of the State Highway Trust Fund in 1989, the Department paved over 11,000 miles of unpaved secondary roads in North Carolina, with only 4,500 miles now remaining unpaved. In view of the fact that the paved secondary road system did not keep up with the demands 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 allowed these funds to be spent on the paved secondary road system to improve its functionality through safety, modernization and condition improvements. The Department now has the ability to address more of the paved secondary road needs in addition to the traditional secondary road paving program. Currently about half of the $140 million funds are programmed for traditional paving projects, and the other half programmed for paved system improvements. Therefore, it is estimated that about $70 million of these funds will have a positive effect on the maintenance condition of the paved secondary road system.

Interstate Maintenance Preservation Program (IMPP)

The Interstate Maintenance Preservation Program is a planned strategy of cost-effective treatments to Interstates; including bridges, pavements and roadside features that prevent or retard future deterioration without increasing structural or traffic capacity. The IMPP is to be used in conjunction with an effective interstate maintenance program to extend the life of bridges, pavements and roadside features.

The IMPP is managed by division and central NCDOT personnel with oversight from the North Carolina FHWA Division Office. Projects eligible for these funds include deck preservation activities, girder painting or repairs, crack sealing, diamond grinding, drainage system repairs and pavement marking or sign replacement, among others.

Summary of Non-Traditional Funding

The following funding sources are identified that help address or supplement current operational programs.

Project	Description	FY 2010-2011 Allocation
ITS Traffic Operations	Funds are used for operation and maintenance of Incident Management and ITS Programs	$ 18 M
Positive Guidance Program	Funds are used to improve pavement marking lane lines and symbols to provide better traffic guidance and visibility on the primary roadway system	$ 6 M
Traffic System Operations Program	Funds are used for operation and maintenance of traffic signal systems	$ 20 M
Bridge Preventative Maintenance Program	Funds are used to address bridge preservation needs such as deck and joint repair, and bridge painting	$ 5 M
HB 1825 Secondary Road Improvement Program	Funds are used to make improvements to the paved secondary road system	$ 70 M
Interstate Maintenance Preservation Program	Funds used as part of a planned strategy of cost effective treatments to Interstates; including bridges, pavements and roadside features that prevent or retard future deterioration on the interstate system	$ 10 M

The projects shown above which 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.

Policies to Projects

NCDOT recognized the need for a comprehensive funding approach to all aspects of its operations. When Governor Perdue took office, she heard the public demand for politics

to be removed from transportation planning in North Carolina and supported the Department's steps to transform how it does business.

This led to the creation of the NCDOT Work Program, entitled "Policies to Projects." This initiative defines clearly what the Department will do with anticipated resources, based on a data-based prioritization process, ensuring limited funding is properly invested to achieve the best results possible for the citizens of North Carolina.

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. 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 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

Since the 2008 Condition of the Highway System Report, a working group of upper level field personnel was assembled to fine tune the performance measures and targets for the various features of the highway system. This fine tuning process was necessary to ensure the features measured and the targets identified were realistic and accurately reflected field conditions and budget needs. 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 looks forward to continued refinement and institutionalization of this management approach.

These individual targets for items such as drainage features, signs, and roadside vegetation are summarized, along with bridge and pavement data, into overall ratings for the Interstate, Primary and Secondary systems. 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 is developed for each system. These report cards are provided with number grades which correspond with target levels of service shown in Appendix C.

The Department believes this management approach gives each manager 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, is a key component of the Department's Performance Dashboard which demonstrates 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 needed to achieve the outcomes established by the Department. This change has led local managers to focus 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.

C – ROADWAY MAINTENANCE

Routine maintenance may be described as work activities performed on a recurring basis to provide the traveling public with a safe and reliable highway facility. However, before the first dollar is 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 work activities associated with the maintenance and upkeep of the roadway. These work activities are subdivided into two categories: (1) Recurring Programs and (2) Performance-Based Activities.

C.1 – RECURRING PROGRAMS

Recurring programs are 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 annual expenditures of these programs are approximately $ 98.03 million.

C.2 PERFORMANCE BASED ACTIVITIES

Examples of performance-based activities include maintenance to pavements, shoulders and ditches, drainage, signs, pavement markings, rest areas and welcome centers, plant beds, and storm water devices. A detailed survey conducted through the Maintenance Condition Assessment Program assesses the condition of these roadway features. The major categories 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 system using statistical sampling and projects highway condition at the county level. The randomly selected sites and survey teams assess the condition of these 0.1-mile sections for the features shown in Appendix C. The amount of deficient conditions is recorded during the survey and a maintenance condition rating is calculated. This rating, as compared to the target rating also shown in Appendix C, is used to calculate an estimated cost to achieve a predetermined target performance. The estimated annual cost for these performance based activities is $271.41 million.

C.3 PAVEMENT MAINTENANCE

Pavement maintenance is defined as routine scheduled or emergency activities on pavements to correct defects and patch potholes. A funding amount needed for pavement maintenance activities is derived from the Pavement Condition Survey. Maintenance treatment activities includes; patching, crack sealing, faulting, spalling, and slab repair. The estimated annual cost of these operations is $299.03 million.

C.4 SURVEY FINDINGS

The survey results are 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 roadway features. These figures indicate that some activities are 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 work activities associated with the maintenance and upkeep of bridges, structures, 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 greater than 20 feet in length, and 2) inspections of large pipes and culverts, 54 inches in diameter up to 20 feet in length. Pipes and culverts 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 addresses the funding needed for each of these treatments except for replacement. First, bridge and structure maintenance work activities are addressed under the two categories of (1) Recurring Programs, and (2) Performance Based Activities. Large pipe and culvert needs are then discussed, followed by bridge preservation and rehabilitation needs.

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 $20.92 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 conducted through the Bridge Condition Survey. In accordance with this survey, inspections 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 receives a detailed inspection 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 $44.58 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 and up to 20 feet in length. These assets consist of various

material types such as aluminum, steel, concrete and plastic. While not classified as bridges or structures by FHWA standards, these drainage items are inspected and maintained by the division's bridge maintenance staff, and funding is provided as part of the bridge maintenance budget. The annual cost of this item is estimated at $6.15 million.

D.4 BRIDGE PRESERVATION

Bridge Preservation activities are minor, low-cost treatments performed on 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 $26.24 million.

D.5 BRIDGE REHABILITATION

Bridge Rehabilitation activities are 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 are rehabilitated without having to replace the entire bridge. The estimated annual cost is $133.97 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 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 work activities associated with the maintenance and operation of approximately 8,900 traffic signals across North Carolina. The Department maintains and operates a variety of traffic signal systems. 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.

Traffic signal maintenance is 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. 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. Emergency response involves timely response to calls for assistance, replacing missing displays, and repairing signal knockdowns.

The performance target for Statewide Traffic Signal Maintenance is a "Good" or Level-Of-Service "B." Based upon the latest available data from the Annual Report of Traffic Signal Operations, NCDOT is operating at an overall Statewide Level-Of-Service "C." Preventative maintenance should be performed on each traffic signal in the state every 6 months. Currently it is performed on 61% of the traffic signals statewide every 6 months. These preventative maintenance activities ensure the signal equipment functions properly for the safety of the motoring public. Regular preventative maintenance also decreases the likelihood of performing more expensive emergency maintenance activities. Traffic signal timing plans and event schedules should be evaluated at least once every 18 months. Currently, NCODT evaluates timing plans on 37% of the signals annually. Periodically evaluating and re-timing traffic signal systems is beneficial. Improved signal operations are achieved for lower costs and in shorter time frames than other capital-intensive transportation improvement options.

With improved signal operations and well maintained traffic signal systems, the need for additional road capacity may be postponed or eliminated. Moving goods more efficiently stimulates economic growth, allows for shorter commute times, improves air quality and improves the motorist's perception of the highway system.

Funding for the performance needs identified in this study is shared between highway maintenance funds and Federal dollars. The highway maintenance funding level is currently at $6 million per year and the Federal Aid funding is $20 million per year. Meeting the identified performance goals requires approximately $50.49 million. The Department adds approximately 150 signals annually to its maintenance inventory, and meeting the established performance measures for these additional signals would require an annual increase of approximately $1.54 million.

E.2 INTELLIGENT TRANSPORTATION SYSTEM (ITS) DEVICES

Planned activities including maintenance, construction and special events and unplanned activities including accidents, disabled vehicles, inclement weather and fatalities adversely affect North Carolina's roadways. Incidents cause congestion and waste time, fuel and money. Secondary accidents due to backups account for 30% of all accidents and 18% of the fatalities on our roadways. ITS operations minimize congestion, delays, accidents and fatalities through the efficient and effective use of traveler information, driver and responder education and incident management.

The Department has a robust network of intelligent transportation system devices, includes portable changeable signs, closed caption televisions, overhead dynamic message signs, highway advisory radios, speed detection stations, reversible lanes and road weather information stations across the state. These devices 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 that motorists utilize for finding accurate, up-to-date information on road conditions for planned activities as well as wrecks and weather events. Transit information is also available, and this system connects with other states systems, providing motorists with valuable information as they travel through North Carolina.

Incident Management Assistance Patrols, or IMAP Units, consist of trained personnel driving vehicles equipped with arrow boards, traffic cones, push bumpers, winches, fuel,

tire-changing equipment and other various devices for clearing debris and vehicles from the roadway and setting up emergency traffic control for short duration incidents. IMAP patrols 500 miles of the most congested roadways in the Triangle, Triad, Metrolina and Asheville regions, as well as 20 miles of I-40 near the Tennessee state line. Department statistics show half of these first responder 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 provide quicker response and coordination to unexpected issues that arise. Thus far, in 2010, IMAP drivers responded to over 63,000 calls servicing to the motoring public or response agencies. Studies show this program has a benefit-to-cost ratio of as high as 22 to 1, which makes it a 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 incidents on our roadways, we can more efficiently manage work zones, handle incidents and coordinate with all involved responders and the traveling public.

F – PAVEMENTS

One of the most valuable assets in the state's transportation network is pavement. The most cost-effective method for maintaining pavements is through a combination of treatments including maintenance, pavement preservation, resurfacing and rehabilitation. The 2010 Pavement Condition Survey is used to determine the condition of this asset and 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 ARRA, IMPP, contract resurfacing, and pavement preservation, pavement conditions in North Carolina has improved over time as shown in Figure 3. The challenge in the future is sustaining these gains as resources become scarce.

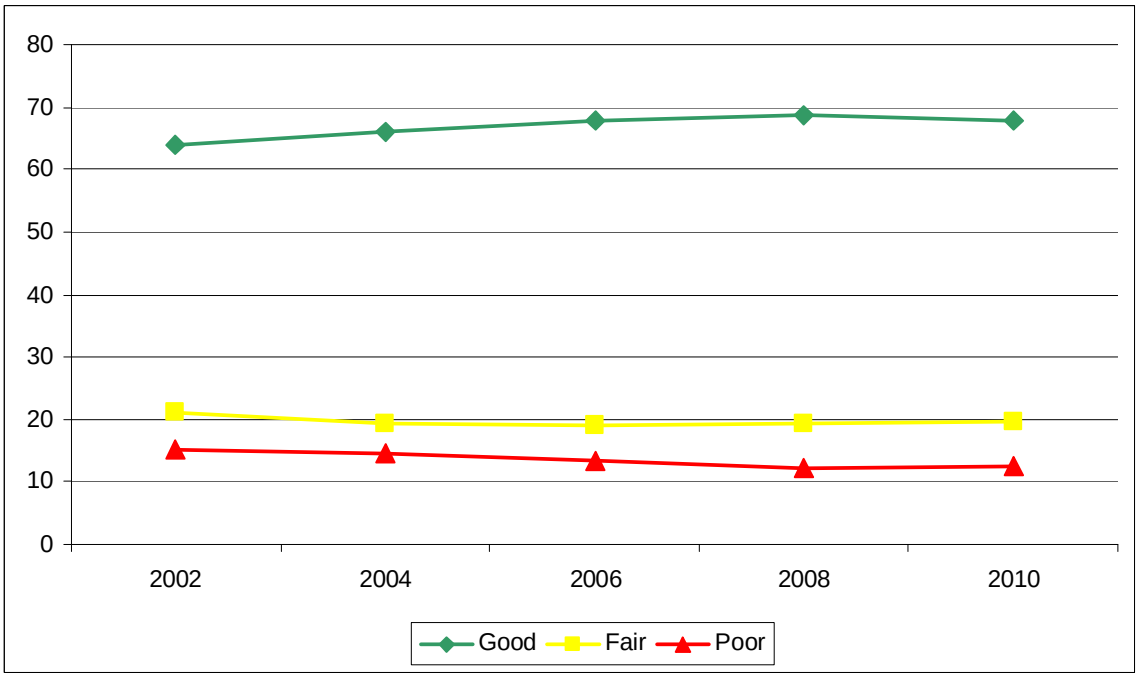


Figure 3 – Overall Pavement Condition Rating

F.1 Pavement Preservation

Pavement preservation treatments are applied early in the pavement life, when the pavement is in fair to good condition thus prolonging the time the pavement remains in good condition and extending its life. Pavement preservation activities include crack

sealing, chip seals, and thin hot mix asphalt overlays applied to pavements in better condition.

The Department 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 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 prevents 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 improving the performance of surface treatments and expanding their use to higher traffic volume roadways. Recent Department-funded research on the

performance of surface treatments using polymer modified emulsions demonstrates a cost savings if the service life of pavements is extended by two years. As a result, the Department is using more polymer modified emulsions. The estimated annual cost for preservation activities is $150 million.

The Department is also beginning to develop preservation projects for interstates through its Interstate Maintenance Preservation Program. These activities are meant to address a wide variety of preservation needs including ride quality issues on concrete pavements. A recent example is the diamond grinding project on I-40 in Orange County, which improved ride quality. The estimated annual cost of these interstate preservation activities is $57 million.

Preservation Diamond Grinding

F.2 CONTRACT RESURFACING

Resurfacing is necessary when 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 to fair condition.

The contract resurfacing program provides funding for resurfacing the paved road system with hot mixed asphalt. Resurfacing provides a renewed driving surface and improves ride quality, and must occur intermittently to avoid costly patching and frequent maintenance. Research shows 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 pavement infrastructure. The increased population causes both an increase in automobile traffic and a larger and heavier freight industry. The estimated cost of contract resurfacing needs annually is $206 million.

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 or extensive concrete repairs. An example of a rehabilitation treatment is milling out existing cracked asphalt, replacing it with a larger stone mix, and overlaying with two lifts of surface course. Failure to use a program of maintenance, preservation, resurfacing and rehabilitation results in widespread pavement failure requiring reconstruction. Moving through this series of treatment classes depicted in Table 1, costs increase dramatically so it is more economical to maintain and preserve a pavement in good condition than letting it fall into a state of disrepair that results in costly rehabilitation and reconstruction.

[6]

Rehabilitation

Reconstruction

The Department calculates the funding required for bringing 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 pavements does not include any funds for capacity expansion (widening).

The Department utilizes the funds from legislative initiatives such as Senate Bill 1005 and NC Moving Ahead to rehabilitate and modernize both primary and secondary routes throughout North Carolina. These programs have invested over $1 billion for improving and preserving the state's road and bridges. The Department also utilized funds from ARRA to let shovel-ready projects, including resurfacing and rehabilitation on federal aid eligible roadways. Many of these projects provide much needed strengthening of the pavement structures to address current and future traffic volumes. The challenge is to protect this investment with timely follow-up maintenance and preservation. The estimated annual need for pavement rehabilitation activities is $263 million.

G. SUMMARY AND CONCLUSIONS

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 intends to provide the Joint Legislative Transportation Oversight Committee an accurate analysis of the condition of the state highway system and the funding needed to meet the Department's target levels of service. Throughout this report, the annual cost to meet and sustain the established performance standards is 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 65 miles of secondary roads a year, places an additional burden on the maintenance budget. Add to that, with the rising cost of materials, and it becomes clear that as funding remains constant, the level of service on North Carolina's highways begins to deteriorate. The following charts demonstrate when funding remains stagnate, the percent of pavements in good condition drops from 68% to 50% in a seven-year period. Similarly, bridge performance drops from 61% good to 54% good and roadway performance falls from and overall grade of 84 to 76.

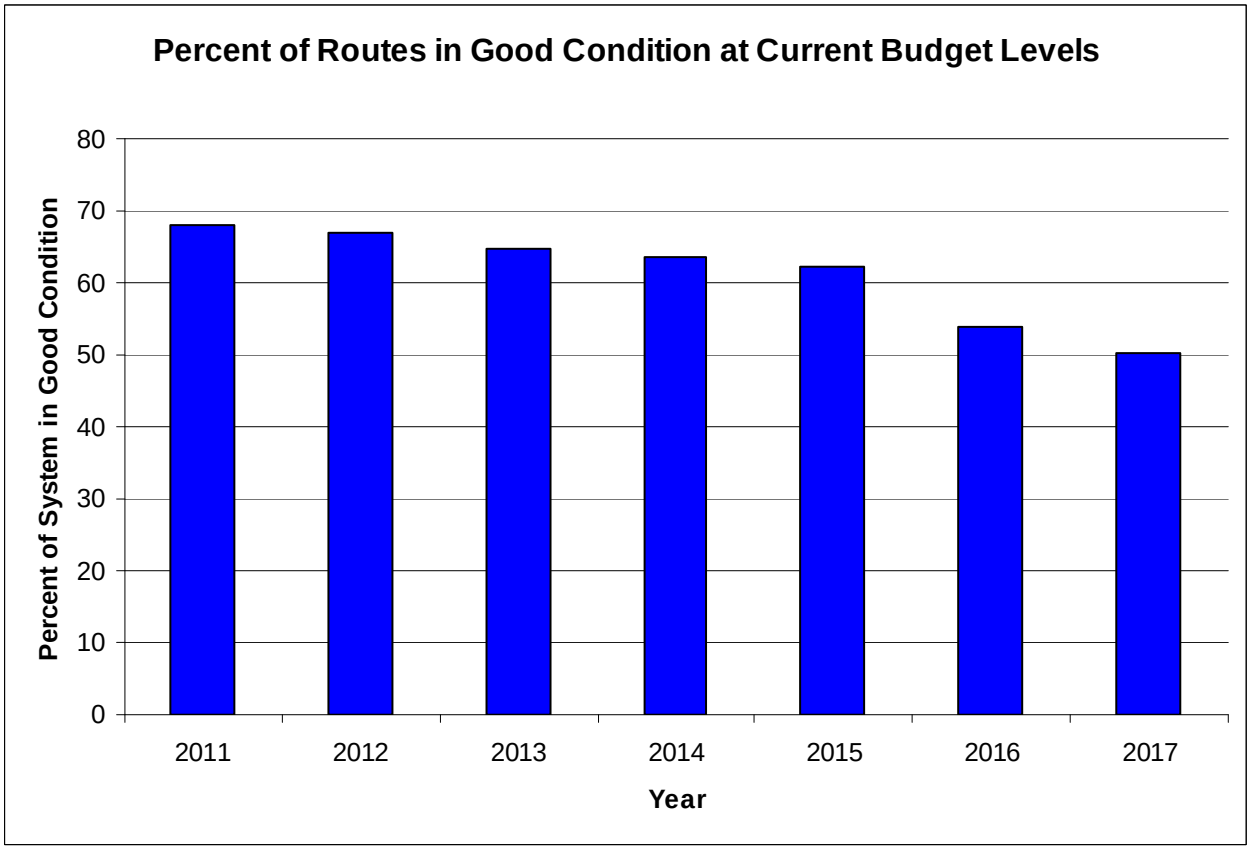


Figure 7 – Projected Pavement Ratings

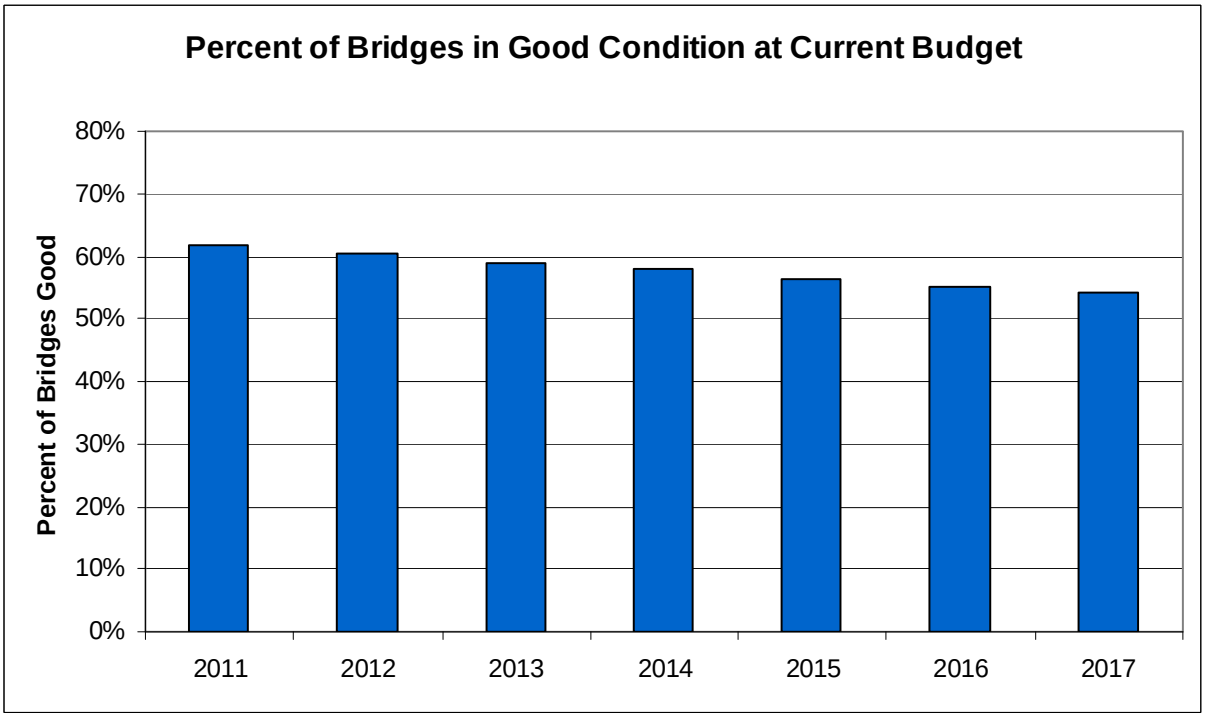


Figure 8 – Projected Bridge Condition

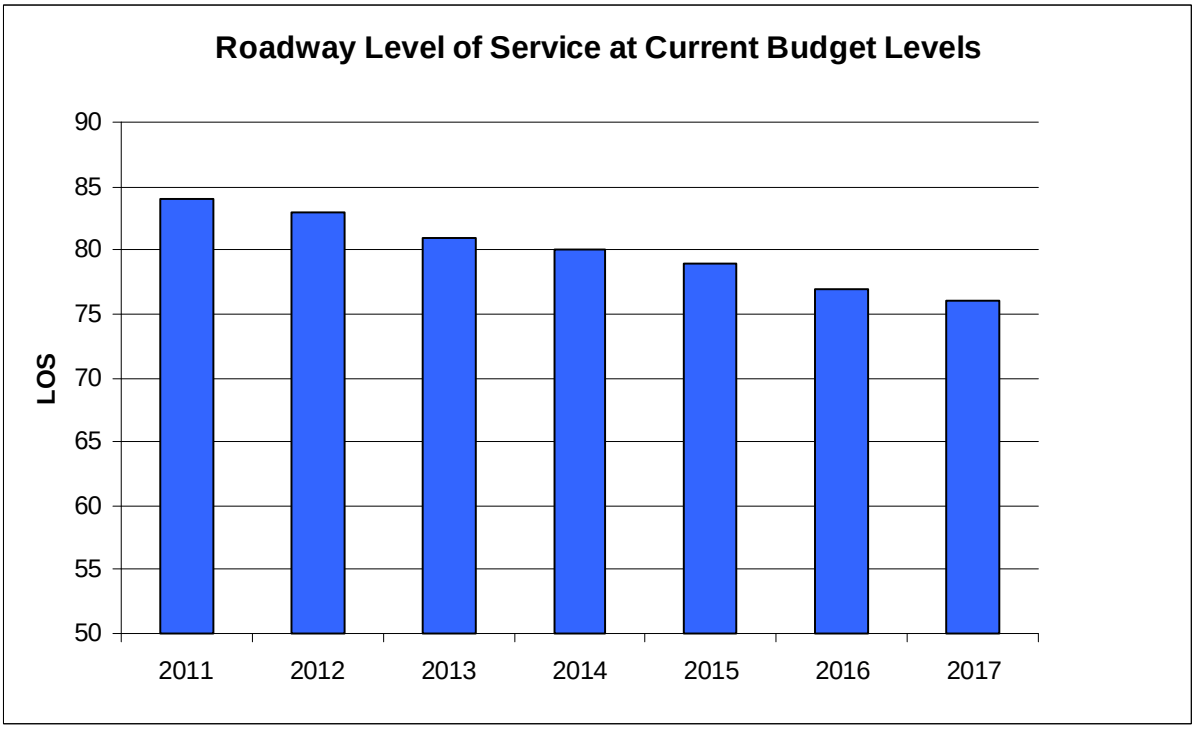


Figure 9 – Projected Roadway Level of Service

Providing the established level of service indicated in this document requires adequate funding. Table 2 below summarizes the annual funding needs 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	$668.47
Bridge Maintenance	$71.65
Highway Operations	$74.49
Disasters & Emergencies	$15.00
Contract Resurfacing	$330.00
Pavement & Bridge Preservation	$233.24
Total Maintenance & Preservation Needs	$1,392.85
System Rehabilitation	$339.97

Table 2 – Funding Needs

Based on this funding level, the Department proposes developing a statewide annual maintenance funding plan consistent with funding shown in Appendix D. This plan allows the Department to sustain the established levels of service, and addresses some of the major highway rehabilitation needs identified by this report.

APPENDIX INDEX

Paved Lane Miles

	Lane Miles			Cumulative	
Year	Primary	Secondary	Total	Mileage	Percent
2000	37,483	116,877	154,360		
2001	37,791	118,169	155,960	1,600	1.0%
2002	37,791	118,169	155,960	1,600	1.0%
2003	38,093	120,499	158,592	4,232	2.7%
2004	38,444	121,339	159,783	5,423	3.5%
2005	38,698	121,911	160,609	6,249	4.0%
2006	40,678	120,830	161,508	7,148	4.6%
2007	40,960	121,780	162,740	8,380	5.4%
2008	40,978	122,633	163,611	9,251	6.0%
2009	39,961	120,845	160,806	6,446	4.2%

Bridge Deck Area

			Cumulative Change		Yearly Change	
Year	Total Bridges	Bridge Deck Area	Square Feet	Percent	Square Feet	Percent
2000	17,410	71,298,167				
2001	17,463	72,290,160	991,993	1.4%	991,993	1.4%
2002	17,526	75,342,236	4,044,069	5.7%	3,052,075	4.2%
2003	17,635	76,391,052	5,092,885	7.1%	1,048,817	1.4%
2004	17,775	78,399,401	7,101,234	10.0%	2,008,349	2.6%
2005	17,848	79,750,414	8,452,247	11.9%	1,351,013	1.7%
2006	17,979	82,154,308	10,856,141	15.2%	2,403,894	3.0%
2007	18,018	83,507,651	12,209,484	17.1%	1,353,343	1.6%
2008	18,159	86,693,671	15,395,504	21.6%	3,186,020	3.8%
2009	18,205	88,124,479	16,826,312	23.6%	1,430,807	1.7%

Lane Miles vs. Traffic Growth (2000 Base Year)				
Years	Actual VMT (Millions)	Actual Lane Miles	% Growth VMT	% Growth Lane Miles
2000	89,254	154,360		
2001	91,571	155,960	2.6%	1.0%
2002	92,893	155,960	4.1%	1.0%
2003	93,763	158,592	5.1%	2.7%
2004	95,627	159,783	7.1%	3.5%
2005	100,861	160,609	13.0%	4.0%
2006	101,648	161,508	13.9%	4.6%
2007	103,598	162,740	16.1%	5.4%
2008	101,463	163,611	13.7%	6.0%
2009	102,590	160,806	14.9%	4.2%

Roadway			Interstate		Primary		Secondary	
			2010	State Average	2010	State Average	2010	State Average
	ELEMENT	PERFORMANCE MEASURE	Target	Score	Target	Score	Target	Score
DRAINAGE	Unpaved Shoulders	No dropoffs greater than 3 inches and no shoulders higher than 2 inches	95	91	90	89	85	91
	Ditches (Lateral Ditches)	No blocked, eroded, or nonfunctioning ditches	95	98	90	94	85	94
	Crossline Pipe (Blocked)	Greater than 50% diameter open	95	87	90	78	85	74
	Crossline Pipe (Damaged)	No damage or structural deficiency effecting functionality	95	93	90	95	85	91
	Curb & Gutter (Blocked)	No obstruction greater than 2 inches for 2 feet	95	97	90	96	85	96
	Boxes (Blocked or Damaged)	Grates and outlet pipes of boxes blocked <50%. Inlets and outlets of boxes are not damaged, and grates are present and not broken.	95	82	90	87	85	85
ROADSIDE	Vegetation (Brush & Tree)	Freeways: 45' from travelway, 5' behind guardrail, not blocking signs; Non-Freeways: Vertical clearance of 15' over roadway and 10' back of ditch centerline or shoulder point	90	90	85	85	80	80
	Vegetation (Turf Condition)	Areas free of erosion	95	84	90	83	85	86
	Stormwater Devices (NPDES)	Functioning as designed	90	94	90	94	90	94
	Landscape Plant Beds	Achieving a score of 2 or higher on the inspection form	90	90	80	90	N/A	N/A
	Rest Areas & Welcome Centers	Condition Rating of 90	90	96	90	95	N/A	N/A
TRAFFIC	Long Line Pavement Markings	Present, visible	90	93	85	90	80	81
	Words and Symbols	Present, visible	90	73	85	85	80	77
	Pavement Markers	Present and reflective	90	84	85	59	N/A	N/A
	Ground Mounted Signs	Visible and legible	90	94	85	91	85	85
	Overhead Signs	Visible and legible	92	93	85	80	85	100
BRIDGE	NBIS Culverts	Condition Rating >= 6	85	86	85	86	85	89
	Non-NBIS Culverts	Condition Rating = Good	80	84	80	74	80	56
	Overhead Sign Structures	Condition Rating = Good	95	95	95	93	95	88
	Totals		**91.27**	**89.79**	**87.28**	**86.04**	**84.49**	**85.04**

Red – More than 10% below the target; Yellow – Within 10% of the target, **Green** – Met or exceeded target; **Gray** – Element was not rated

Bridges			Interstate		Primary		Secondary		Statewide
	ELEMENT	PERFORMANCE MEASURE	2010 Target	State Average Score	2010 Target	State Average Score	2010 Target	State Average Score	State Average Score
Bridge Deck	Concrete	% of decks rated greater than or equal to 6	**85**	85	**80**	79	**75**	84	82
	Timber		**85**	NA	**80**	86	**75**	88	88
	Steel Planks		**85**	NA	**80**	71	**75**	84	84
	Open Grid Steel		**85**	NA	**80**	50	**75**	33	47
Superstructure	Concrete	% of superstructure rated greater than or equal to 6	**90**	81	**85**	60	**80**	65	62
	Steel		**90**	89	**85**	82	**80**	81	82
	P/S Concrete		**90**	96	**85**	95	**80**	94	94
	Timber		**90**	NA	**85**	43	**80**	69	68
Substructure	Timber	% of substructure rated greater than or equal to 6	**90**	NA	**85**	40	**80**	42	42
	Concrete Pile		**90**	80	**85**	75	**80**	81	77
	Steel Pile		**90**	91	**85**	84	**80**	81	82
	Concrete Piers		**90**	91	**85**	81	**80**	82	82

Pavements		Interstate		Primary		Secondary	
ELEMENT	PERFORMANCE MEASURE	2010 Target	State Average Score	2010 Target	State Average Score	2010 Target	State Average Score
Pavement Condition Rating	% of pavements in GOOD condition (PCR of 80 or better)	**85**	85	**80**	66	**75**	67

Red – More than 10% below the target; Yellow – Within 10% of the target, **Green** – Met or exceeded target; **Gray** – Element was not rated

Projected Cost and Funding Need (in millions)							
Maintenance Programs	**2011-12**	**2012-13**	**2013-14**	**2014-15**	**2015-16**	**2016-17**	**2017-18**
Roadway Maintenance	$ 668.47	$ 696.52	$ 725.76	$ 756.22	$ 787.96	$ 821.03	$ 855.49
Bridge Maintenance	$ 71.65	$ 72.53	$ 75.54	$ 78.67	$ 81.93	$ 85.33	$ 88.87
Highway Operations	$ 74.49	$ 76.61	$ 78.82	$ 81.12	$ 83.52	$ 86.02	$ 88.63
Disasters & Emergencies	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00	$ 15.00
Contract Resurfacing	$ 330.00	$ 343.86	$ 358.30	$ 373.35	$ 389.03	$ 405.37	$ 422.40
Pavement and Bridge Preservation	$ 233.24	$ 243.04	$ 253.24	$ 263.88	$ 274.96	$ 286.51	$ 298.54
Total Maintenance and Preservation Needs	$ 1,392.85	$ 1,447.56	$ 1,506.66	$ 1,568.24	$ 1,632.41	$ 1,699.27	$ 1,768.93
Supplemental Funds	$ 129.00	$ 129.00	$ 129.00	$ 129.00	$ 129.00	$ 129.00	$ 129.00
Estimated Highway Allocations	$ 933.55	$ 933.55	$ 933.55	$ 933.55	$ 933.55	$ 933.55	$ 933.55
Total Projected Budget Shortfall	$ 330.30	$ 385.01	$ 444.11	$ 505.69	$ 569.86	$ 636.72	$ 706.38
System Rehabilitation	$ 339.97	$ 354.25	$ 369.13	$ 384.63	$ 400.79	$ 417.62	$ 435.16