

# Maintenance Condition Report

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## Acknowledgements

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# ***2012 Report on the Condition of the State Highway System***

## Table of Contents

	Page Number
Executive Summary	4
A - Highway System Growth and Funding	12
B - Requirements and Methodologies	20
C - Highway Routine Maintenance	26
C.1    Recurring Programs	26
C.2    Performance Based Activities	26
C.3    Pavement Maintenance	28
C.4    Survey Findings	28
D - Bridge Maintenance	29
D.1    Recurring Programs	29
D.2    Performance Based Activities	29
D.3    Large Pipes and Culverts	31
D.4    Bridge Preservation	31
D.5    Bridge Rehabilitation	32
D.6    Recent Funding Initiatives	33
E - Highway System Operations	35
E.1    Traffic Signal Systems Maintenance	35
E.2    Traffic Signal Operations	37
F - Pavements	39
F.1    Pavement Preservation	41
F.2    Contract Resurfacing	44
F.3    Pavement Rehabilitation	45
G - Summary	47
Appendix	50

## ***2012 Report on the Condition of the State Highway System***

### **EXECUTIVE SUMMARY**

#### **Introduction**

In 1915, the North Carolina Legislature established a State Highway Commission and appropriated funding in order to establish a network of roads across the state. Since that time, North Carolina's highway system has expanded to 79,478 miles and 18,265 bridges. These nearly 80,000 miles of roads are all maintained by the Department of Transportation and consist of the following road types:

**Interstates:** There are 1,299 miles of interstate which accounts for 2% of the highway system. These roads are considered essential to interstate commerce; they are controlled access, meaning they are accessed only by ramps and loops. Interstates carry the highest volume of traffic, including freight, and retain their road number across state lines. Examples include I-40, I-77, I-85, I-95 and I-485.

**Primary:** There are 13,754 miles of primary roads, including both US and NC routes, which accounts for 17% of the highway system.

- US - These United States routes typically have the highest volume of traffic for non-interstate roads, may have controlled access and retain their route number across state lines. Examples include US-1, US-17, US-21, US-64, US-70, US-148, US-158, US-220, US-221, US-321 and US-701.
- NC - These North Carolina roads vary in the amount of traffic carried and are typically accessed by driveways. These North Carolina roads retain their route number across county lines, but not state lines. Examples include NC-12, NC-27, NC-43, NC-55, NC-68, NC-73, NC-87, NC-90, NC-94, NC-96, NC-115, NC-133, NC-150, NC-152, NC-226, and NC-274.

#### **Secondary:**

- Paved - There are 60,068 miles of secondary paved roads which accounts for 76% of the highway system. These paved secondary roads are unique to each county,

## ***2012 Report on the Condition of the State Highway System***

typically carry local traffic and are designated with a 4-digit number. Each road is identified with a number such as SR 1026.

- Unpaved - There are 4,357 miles of secondary unpaved roads which accounts for 5% of the highway system. Like the paved secondary roads, these unpaved roads are unique to each county, carry local traffic and are designated with a 4-digit number. Each road is identified with a number such as SR 1026.

North Carolina is unique in that the Department of Transportation is required to maintain all road types with the exception of municipal and private roads. Most states only maintain the higher traveled roads like the interstate and primary systems and require county, municipal or local governments to maintain the lower volume roadways such as the paved secondary and unpaved secondary system.

### **Protecting the Investment**

With North Carolina's population increases over recent decades, the Department of Transportation focused both on building roads to meet demand as well as maintaining the existing highway network. This infrastructure investment is critical in meeting transportation and commerce needs. 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. Protecting infrastructure investment requires performing maintenance and preservation activities. **Maintenance** consists of both planned and reactive work that fixes problems on a road. **Preservation** consists of proactive work intended to prevent problems on a road. The majority of maintenance and preservation work is applied to 3 components of highways – Pavements, Bridges and Operational Features. The following are examples of activities which protect our infrastructure:

## ***2012 Report on the Condition of the State Highway System***

### **Pavement Activities:**

- **Crack Sealing** – seals pavements and prevents water from penetrating into the pavement which can result in deterioration. Water is the most damaging natural element to highway infrastructure.
- **Pot-Hole Repair** – corrects areas of pavement that have localized deterioration.
- **Retreating** – consists of applying a seal to protect pavement from water intrusion.
- **Resurfacing** – consists of applying a layer of asphalt to a road to provide a smooth riding surface and keep the integrity of the pavement.



Crack Sealing Operation



Contract Resurfacing Operation



Retreatment (Chip Sealing) Operation

### **Bridge Activities:**

- **Joint Repair/Replacement** – seals joints in bridges to keep water from causing rust on steel components.
- **Concrete Deck Repair** – corrects damage to the bridge's riding surface.
- **Overlays** – consists of applying a new riding surface to a bridge.
- **Painting** – corrects and prevents areas susceptible to rusting.



Bridge Deck Joint Repair Operation



Bridge Deck Overlay Operation



Newly Painted Bridge Girders

## ***2012 Report on the Condition of the State Highway System***

### **Operational Activities:**

- **Drainage** – involves leveling road shoulders, unclogging pipes, cleaning ditches, and cleaning curb & gutter sections in order to allow water to drain away from the road.
- **Vegetation Management** – involves mowing roadway shoulders and medians, cutting trees and wildflower planting. These activities improve obstructed views and beautify the road.
- **Traffic Pavement Markers and Symbols** - involves keeping road lines painted and reflective markers present to guide the motorist especially in wet weather and nighttime conditions.
- **Signals** – involves maintaining and upgrading traffic signals.



Vegetation Management at Interchange and Freshly Painted Lines on Pavement



Shoulder Mowing Operation



Traffic Signal Operating

### **Current Maintenance Funding Sources**

The Department uses both state and federal funds to address maintenance concerns. State Highway Maintenance funds and Contract Resurfacing funds have long been considered the backbone of the Department's maintenance funding. In 2001, North Carolina began using traditional "construction" program funds to defray the cost of infrastructure needs. These funds come from various federally aided Transportation Improvement Program (TIP) areas. Table 1 summarizes the sources of funds used to address maintenance programs.

## 2012 Report on the Condition of the State Highway System

Funding Program	Description	FY 2012-2013 Allocation
Highway Maintenance (State Funds)	Funds are used for planned and reactive work to correct problems on roads. Maintenance funds address needs on pavements, bridges and roadside features.	\$ 385 M
Contract Resurfacing (State Funds)	Funds are typically used to resurface roads on the Primary and Secondary Paved system. Activity consists of applying 1-2 layers of hot-mixed asphalt.	\$ 427 M
System Preservation (State Funds)	Funds are currently allocated to address bridge preservation and replacement needs. Historically, funds were utilized for pavements, bridges and roadside features; however over the last two years, \$450 Million is allocated exclusively for bridge needs.	\$ 235 M
General Maintenance Reserves (State Funds)	Funds are used to make improvements on any system to address maintenance needs identified by the Maintenance Condition Assessment Program. Reserves allow Divisions to apply funding to their greatest individual need.	\$ 140 M
HB 1825 Secondary Road Improvement Program (State Funds)	Funds are used to make improvements to the paved and unpaved secondary road system. Prior to 2006 these funds were exclusively used for paving unpaved secondary roads, but now can be used on paved and unpaved roads.	\$ 66 M (Paved) \$ 12 M (Unpaved)
<b>Total State Maintenance &amp; Preservation Funds</b>		<b>\$ 1,265 M</b>
ITS Traffic Operations (Federal TIP Funds)	Funds are used for operation and maintenance of Incident Management and Intelligent Transportation System Programs. Items include electronic message boards, video camera systems, traffic speed sensors and the Incident Management Assistance Patrol (IMAP)	\$ 13 M
Positive Guidance Program (Federal TIP Funds)	Funds are used to improve pavement marking lane lines and symbols to provide better traffic guidance and visibility on the primary roadway system	\$ 4 M
Traffic System Operations Program (Federal TIP Funds)	Funds are used for operation and maintenance of traffic signal systems to provide more efficient signal lengths and reduce motorist delays	\$ 26 M
Bridge Preventative Maintenance Program (Federal TIP Funds)	Funds are used to address bridge preservation needs such as joint repair, deck overlays and bridge painting	\$ 5 M
Low Impact Bridge Replacement (Federal TIP Funds)	Funds are used to replace small bridges, typically on the paved secondary system, that have low impact on the environment, right of way, utilities and the public	\$ 28 M
Interstate Maintenance Preservation Program (Federal TIP Funds)	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
<b>Total Federal TIP Maintenance &amp; Preservation Funds</b>		<b>\$ 86 M</b>

**Table 1 - Maintenance and Preservation Funding Sources with Descriptions for Fiscal Year 2013 Allocation**



## ***2012 Report on the Condition of the State Highway System***

### **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.

As previously stated, North Carolina's highway system consists of 79,478 miles of roadway and 18,265 bridges. 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 10% and bridge deck area grew by approximately 21%. While the system continues to grow, the traditional highway maintenance funds have increased, but not enough to keep pace with inflation and system growth.

## ***2012 Report on the Condition of the State Highway System***

Recognizing the 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 alternate funding sources such as ARRA to decrease the gap. In addition, the Department has taken advantage of the flexibility in the Federal-Aid funding allotments to address highway preservation and operational programs. The Transportation Improvement Program (TIP) includes approximately \$86 million per year to address existing programs areas which is detailed in Table 1. These alternative methods allow the Department to improve the safety and condition of the highway system.

### **System Evaluation and Assessment Needs**

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. The Department conducted a Roadway Review to refine the performance measures used for these surveys and to reflect the public's view on how well the Department meets performance expectations. The Roadway Review, completed in October 2011, involved over 300 participants from 61 communities who reviewed Interstates, Primary roads (US and NC), and Paved Secondary Roads. In general, the public's assessment of performance appears to be slightly higher than NCDOT's internal performance assessment.

In accordance with the legislative requirements, the Department estimated the cost to meet and sustain established performance standards and project the optimal funding requirements for a seven-year period. The needs for the first year of the funding plan are in Table 2.

## ***2012 Report on the Condition of the State Highway System***

<b>Maintenance Program</b>	<b>2013-14 Projected Need (Millions)</b>
Highway Routine Maintenance	\$614.40
Bridge Maintenance	\$85.26
Highway Operations	\$66.31
Disasters & Emergencies	\$15.00
Contract Resurfacing	\$427.16
Pavement & Bridge Preservation	\$195.59
<b>Total Maintenance &amp; Preservation Need</b>	<b>\$1,403.72</b>
System Rehabilitation	\$320.81

**Table 2 - Maintenance and Preservation Need in Millions (includes programs addressed through federal funds)**

### **Considerations**

In order to meet established performance standards, it would be beneficial to restore the Department's flexibility to use State System Preservation funds on pavements as well as on bridges.

## ***2012 Report on the Condition of the State Highway System***

### **A – HIGHWAY SYSTEM GROWTH AND FUNDING**

#### **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 "Maintenance Condition Report - 2012", 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**

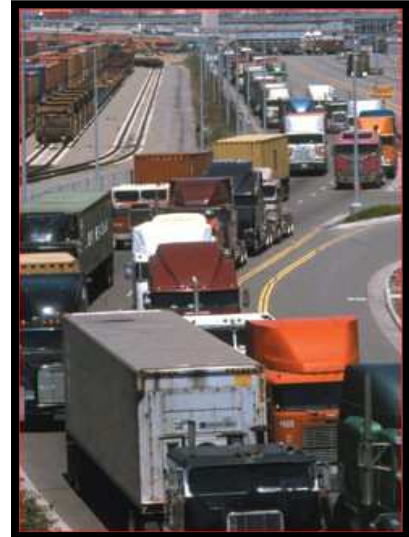
North Carolina's highway system has grown over the last 20 years. Currently the system consists of 79,478 miles of roadway and 18,265 bridges. Over the past 10 years, paved lane miles have grown by 10% while bridge deck area grew approximately 21%. Appendices 1 and 2 list the mileage and bridge deck area totals for the past 10 years.

The country's recent recession slowed the rate of growth in Vehicle Miles Traveled (VMT); however current rates indicate vehicles miles traveled are rising to pre-recession levels. During the period from 2002 - present, vehicle miles traveled increased by 12% while the paved lane miles have increased by 10%. The 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.

## ***2012 Report on the Condition of the State Highway System***

### **Freight Impacts**

In addition to the growth in vehicular traffic, there is also expected to be an even faster rise in freight traffic. The Federal Highway Administration reports that in 2010, 435 million tons of freight was moved across our state. This number includes both imports and exports. FHWA also estimates that by the year 2040 more than 685 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

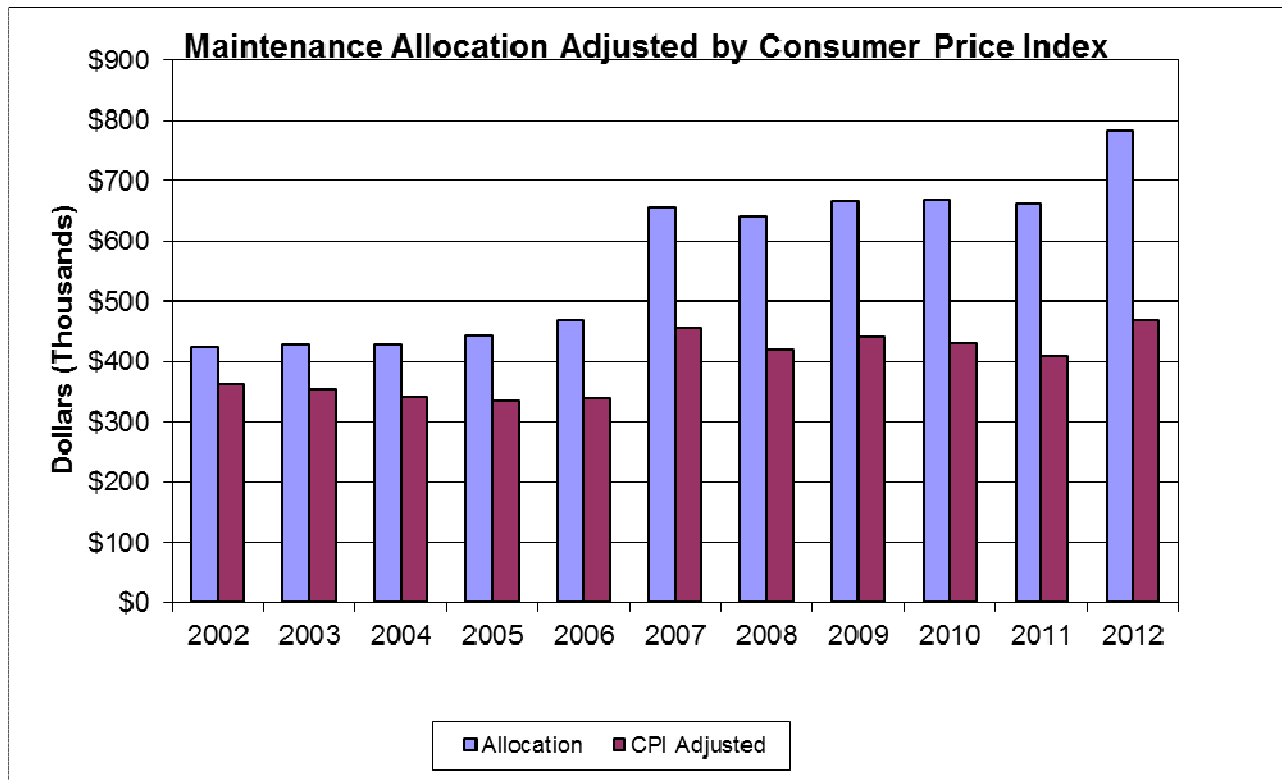


transportation modes and attention to system operation and maintenance. Trucks continue to be the single most-used mode to transport freight across our country. One loaded tractor trailer causes the same damage to pavement as a minimum of 5000 passenger vehicles.

### **History of Highway Maintenance and Contract Resurfacing 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, it is also more costly to maintain and preserve. When past maintenance funding is adjusted by the Consumer Price Index (CPI), the total dollar amount devoted to maintenance operations is only 29% higher than that of FY 2002, as indicated in Figure 1.

## 2012 Report on the Condition of the State Highway System

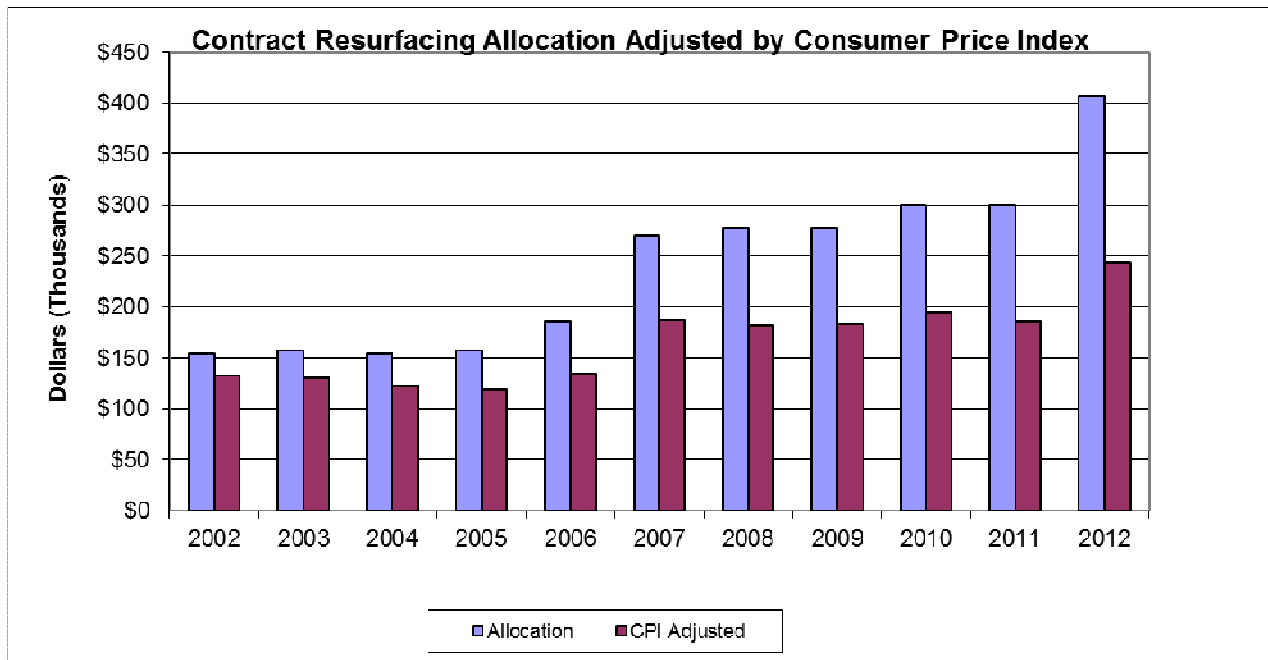


**Figure 1 – Maintenance Allocation, Adjusted by the Consumer Price Index Shows the Buying Power of the Dollar Has Not Increased at the Same Rate as the Maintenance Allocation.**

While the amount of Contract Resurfacing funds has more than doubled since 2002, when adjusted by the NC Highway Construction Cost Index table of the Consumer Price Index, the total dollar amount allocated for Contract Resurfacing is only 46% higher as indicated in Figure 2.

The result to both of these funding sources is a marked decline in purchasing power.

## 2012 Report on the Condition of the State Highway System



**Figure 2 – Contract Resurfacing Allocation, Adjusted by the Consumer Price Index Shows the Buying Power of the Dollar has not Increased at the Same Rate as the Contract Resurfacing Allocation**

### **Current State Funding**

The following table summarizes and describes the funding sources utilized for maintenance and preservation activities. Highway Maintenance, Contract Resurfacing, System Preservation and General Maintenance Reserves listed in Table 3 are funding sources that address various infrastructure needs and are detailed in Sections C, D, E and F of this report.

## 2012 Report on the Condition of the State Highway System

Funding Program	Description	FY 2012-2013 Allocation
Highway Maintenance (State Funds)	Funds are used for planned and reactive work to correct problems on roads. Maintenance funds address needs on pavements, bridges and roadside features. See Sections C “Highway Routine Maintenance”, D “Bridge Maintenance”, E “Highway System Operations” and F “Pavements” for more details	\$ 385 M
Contract Resurfacing (State Funds)	Funds are typically used to resurface roads on the Primary and Secondary Paved system. Activity consists of applying 1-2 layers of hot-mixed asphalt. See Section F “Pavements” for more details.	\$ 427 M
System Preservation (State Funds)	Funds are currently allocated to address bridge preservation and replacement needs. Historically, funds were utilized for pavements, bridges and roadside features; however in the last two years, \$450 Million is allocated exclusively for bridge needs. See Section D “Bridge Maintenance” for more details.	\$ 235 M
General Maintenance Reserves (State Funds)	Funds are used to make improvements on any system to address maintenance needs identified by the Maintenance Condition Assessment Program. Reserves allow Divisions to apply funding to their greatest individual need. See Sections C “Highway Routine Maintenance”, D “Bridge Maintenance”, E “Highway System Operations” and F “Pavements” for more details	\$ 140 M
HB 1825 Secondary Road Improvement Program (State Funds)	Funds are used to make improvements to the paved and unpaved secondary road system. Prior to 2006 these funds were exclusively used for paving unpaved secondary roads, but now can be used on paved and unpaved roads. See paragraph below and Sections C “Highway Routine Maintenance”, E “Highway System Operations” and F “Pavements” for more details	\$ 66 M (Paved) \$ 12 M (Unpaved)
<b>Total State Maintenance &amp; Preservation Funds</b>		<b>\$ 1,265 M</b>

**Table 3– State Maintenance and Preservation Funding Sources with Descriptions and Fiscal Year 2013 Allocation**

### HB 1825 Secondary Road Improvement Program Details:

Since creation of the State Highway Trust Fund in 1989, the Department paved over 13,000 miles of unpaved secondary roads in North Carolina. There are only 4,357 miles that remain 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 unpaved 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



## ***2012 Report on the Condition of the State Highway System***

more of the paved secondary road needs in addition to the traditional unpaved secondary road paving program. Currently about 15% of the \$78 million (\$12 million) funds are programmed for traditional unpaved secondary road paving projects, and 85% is programmed for paved secondary road improvements. Therefore, it is estimated that about \$66 million of these funds will have a positive effect on the maintenance condition of the paved secondary road system.

### **Current Federal Funding**

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 has taken advantage of the Federal-Aid funding allotments to help offset infrastructure costs. This allows North Carolina the flexibility to expand from a strictly "construction" program to include preservation and modernization programs as well. The following table summarizes and describes funding sources that help address or supplement current operational programs. ITS Traffic Operations, Positive Guidance Program, Traffic Systems Operations Program, Bridge Preventative Maintenance Program and Low Impact Bridge Replacement funding sources listed in the table below supplement various infrastructure needs and are detailed in Sections D and E of this report. The funds shown in Table 4 have been taken into consideration in estimating funding needs and are reflected in Appendix 4.

## 2012 Report on the Condition of the State Highway System

Funding Program	Description	FY 2012-2013 Allocation
ITS Traffic Operations (Federal TIP Funds)	Funds are used for operation and maintenance of Incident Management and Intelligent Transportation System Programs. Items include electronic message boards, video camera systems, traffic speed sensors and the Incident Management Assistance Patrol (IMAP). See Section E "Highway System Operations" for further details.	\$ 13 M
Positive Guidance Program (Federal TIP Funds)	Funds are used to improve pavement marking lane lines and symbols to provide better traffic guidance and visibility on the primary roadway system. See Section E "Highway System Operations" for further details.	\$ 4 M
Traffic System Operations Program (Federal TIP Funds)	Funds are used for operation and maintenance of traffic signal systems to provide more efficient signal lengths and reduce motorist delays. See Section E "Highway System Operations" for further details.	\$ 26 M
Bridge Preventative Maintenance Program (Federal TIP Funds)	Funds are used to address bridge preservation needs such as joint repair, deck overlays and bridge painting. See Section D "Bridge Maintenance" for further details.	\$ 5 M
Low Impact Bridge Replacement (Federal TIP Funds)	Funds are used to replace small bridges, typically on the paved secondary system, that have low impact on the environment, right of way, utilities and the public. See Section D "Bridge Maintenance" for further details.	\$ 28 M
Interstate Maintenance Preservation Program (Federal TIP Funds)	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. See paragraph below for further details.	\$ 10 M
<b>Total Federal TIP Maintenance &amp; Preservation Funds</b>		<b>\$ 86 M</b>

**Table 4 – Federal Transportation Improvement Program (TIP) Funding Sources with Descriptions and Fiscal Year 2013 Allocation**

### 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 operational activities.

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

## ***2012 Report on the Condition of the State Highway System***

system repairs and pavement marking or sign replacement. Since the inception of this program three years ago, half of the \$30 million allocated has been expended.

### **Alternate Funding Source: American Recovery and Reinvestment Act (ARRA)**

In February 2009, the Department received \$838 million in federal funding - \$735 million for highway and bridge improvements and \$103 million for transit. As this program is winding down, the Department developed 402 projects, let 371 contracts with 345 completed, and approximately \$723 million of the \$735 million has been expended. As of September 20 of this year, 242 projects received their final voucher from FHWA, meaning no additional reporting is necessary for these projects.

**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, bridges and roadway features.

## ***2012 Report on the Condition of the State Highway System***

### **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 Based Management**

The Performance Based Management approach, developed in 2005 by Division of Highways, 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 allowed local managers to focus more on a network approach to the highway system. Using concepts of asset management, they are able to improve system condition over the long term while being more efficient with the resources available to them.

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 Measures**

Since the 2010 Condition of the Highway System Report, the Department conducted a Roadway Review in an effort to evaluate its performance measures and gain perspective into the public's view on how well the Department meets performance expectations. During October 2011 over 300 people from 61 different communities participated. The Roadway

## ***2012 Report on the Condition of the State Highway System***

Review brought together local residents and community leaders to ride parts of the road system in their area including Asheville, Burlington, Charlotte, Jonesville, Rocky Mount, and Wilmington. Participants reviewed Interstates, Primary roads (US and NC), and Paved Secondary Roads. Participants were asked to evaluate features of the roadway by condition and importance. In general, the public's assessment of performance appears to be slightly higher than NCDOT's internal performance assessment. Summary findings from the public are:

- NCDOT is meeting expectations maintaining the Interstate system and did not have any areas of concern.
- NCDOT is meeting expectations on the Primary (US and NC) system and identified width of shoulders as a concern.
- NCDOT has opportunity to improve the Paved Secondary system. Focus areas are pavement condition and smoothness of the road, width of travel lanes, roadway striping and pavement markers.

The Department anticipates refining the performance measure targets in an effort to reflect the public's feedback.

### **Performance Results**

Current 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 (US and NC) and Paved 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 below in Tables 5 and 6. These tables show 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

## ***2012 Report on the Condition of the State Highway System***

features must be maintained at a high level of service due to safety concerns and considerations.

Tables 5 and 6 show that the Department is generally meeting performance targets; however, there are some areas for improvement such as:

### **Interstates:**

- Pavement Condition
- Unpaved Shoulders
- Drainage Systems
- Turf Condition
- Overhead Sign Structures
- Bridge Components

### **Primary (NC and US):**

- Pavement Condition
- Drainage Systems
- Pavement Markers
- Bridge Components

### **Secondary Paved:**

- Pavement Condition
- Drainage Systems
- Bridge Components

It should be noted that condition scores for the Bridge section of Table 6 **do not** reflect the recent infusion of System Preservation funds. Due to federal requirements, bridges are inspected every two years and the Department anticipates the overall bridge condition scores will increase after the completion of the next bridge inspection cycle. This increase in condition will reflect the Department's focus of addressing bridges through System Preservation funds.

## 2012 Report on the Condition of the State Highway System

Roadway		Interstate			Primary			Secondary		
	ELEMENT	2012 Target	State Average Score	2012 Target	2012 Target	State Average Score	2012 Target	2012 Target	State Average Score	2012 Target
DRAINAGE	PERFORMANCE MEASURE									
	No dropoffs greater than 3 inches and no shoulders higher than 2 inches	95	92	90		92	85		93	
	No blocked, eroded, or nonfunctioning ditches	95	99	90		97	85		96	
	Greater than 50% diameter open	95	87	90		81	85		82	
	No damage or structural deficiency effecting functionality	95	91	90		97	85		96	
	No obstruction greater than 2 inches for 2 feet	95	96	90		97	85		97	
ROADSIDE	Grates and outlet pipes of boxes are not damaged, inlets and outlets of boxes are not damaged, and grates are present and not broken.	95	84	90		90	85		92	
	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	92	85		90	80		86	
	Areas free of erosion	95	91	90		94	85		94	
	Functioning as designed	90	94	90		94	90		94	
	Achieving a score of 2 or higher on the inspection form	90	90	80		90	N/A		N/A	
	Condition Rating of 90	90	96	90		93	N/A		N/A	
TRAFFIC	Long Line Pavement Markings	90	96	85		94	80		88	
	Words and Symbols	N/A	N/A	85		87	80		85	
	Pavement Markers	90	91	85		81	N/A		N/A	
	Ground Mounted Signs	90	94	85		94	85		89	
	Overhead Signs	92	99	85		97	N/A		N/A	
	Condition Rating >= 6	85	86	80		87	75		89	
BRIDGE	Non-NBIS Culverts	80	81	70		72	60		56	
	Overhead Sign Structures	95	88	92		93	92		84	
	Condition Rating = Good									
Totals		91.27	91.43	86.16		90.27	82.16		87.43	

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

**Table 5 – Summary of Roadway Performance Condition Scores with 100 Being the Highest Score on a 0 to 100 Scale.**



## 2012 Report on the Condition of the State Highway System

Bridges	ELEMENT	PERFORMANCE MEASURE	Interstate		Primary		Secondary		Statewide
			2012 Target	State Average Score	2002 Target	State Average Score	2012 Target	State Average Score	
Bridge Deck	Concrete	% of decks rating less than or equal to 6	85	84	80	80	75	84	82
	Timber		85	N/A	80	79	75	89	89
	Steel Planks		85	N/A	80	67	75	84	83
	Open Grid Steel		85	N/A	80	58	75	0	50
Superstructure	Concrete	% of superstructure rating less than or equal to 6	90	80	85	59	80	65	61
	Steel Planks		90	88	85	82	80	79	81
	P/S Concrete		90	96	85	96	80	94	95
	Timber		90	N/A	85	49	80	70	70
Substructure	Timber	% of substructure rating less than or equal to 6	90	N/A	85	44	80	46	46
	Concrete Pile		90	78	85	75	80	87	82
	Steel Pile		90	88	85	85	80	83	84
	Concrete Piers		90	91	85	83	80	77	80

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	81.4	80	65.35	75	69.36

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

**Table 6 – Summary of Bridge and Pavement Condition Scores with 100 Being the Highest Score on a 0 to 100 Scale.**

Note: Bridge Condition scores do not include recent infusion of System Preservation funds. It is projected this effort will increase the bridges in good condition by more than 7%.

## **C – HIGHWAY ROUTINE MAINTENANCE**

Highway 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 funded, the remaining dollars are allocated by division and county to fund routine maintenance activities. Highway routine maintenance is primarily funded by state dollars through Highway Maintenance and General Maintenance Reserves (Section A, Table 3).

Highway routine 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 associated 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, and emergency repairs in non-declared events. The annual need for these programs is approximately \$ 62.58 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 and the nighttime sign survey assesses the condition of

## ***2012 Report on the Condition of the State Highway System***

these roadway features. The major categories are pavements, shoulders and ditches, drainage, roadside features, traffic control devices, and 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 Section B, Table 5.

## ***2012 Report on the Condition of the State Highway System***

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 Table 5, is used to calculate an estimated cost to achieve a predetermined target performance. The estimated annual need for these performance based activities is \$527.11 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 include; patching, crack sealing, faulting, spalling, and slab repair. The estimated annual need of these operations is \$229.94 million.

### **C.4 Survey Findings**

The survey results are summarized in Section A, Table 5. 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 MAINTENANCE**

Bridge maintenance and structure maintenance consists of work activities associated with the maintenance and upkeep of bridges, 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 Highway Routine Maintenance section of this report. Bridge routine maintenance is funded through state and federal dollars. Specifically, bridge activities are funded by state funds through Highway Maintenance and System Preservation (Section A, Table 3). Federal funds account for the Bridge Preventive Maintenance Program and the Low Impact Bridge Replacement Program (Section A, Table 4).

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. 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 need for these programs is approximately \$27.96 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

## ***2012 Report on the Condition of the State Highway System***

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 Section B, Table 6 and provides the level of service for Decks, Superstructure, Substructure, Rails and Expansion joints. The estimated annual need to maintain these features at an acceptable level is \$57.30 million.



Railings



Decks



Expansion Joints



Superstructures



Substructures

## ***2012 Report on the Condition of the State Highway System***

### **D.3 Large Pipes & Culverts**

There are approximately 25,000 state owned pipes, culverts and drainage structures which are 54" or greater in diameter and does not exceed 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 need of this item is estimated at \$9.34 million.

### **D.4 Bridge Preservation**

Bridge Preservation activities are minor, low-cost treatments performed on bridges in relatively good condition to extend the service life of components within a bridge. In general, preservation activities do not significantly improve the condition of the bridge unless the deficiency is related to deck condition. The benefit of bridge preservation activities is they slow down deterioration or prevent problems before they occur.

#### **Bridge Preservation Activities Include:**

- **Joint Repair/Replacement** – seals joints in bridges to keep water from rusting steel components
- **Overlays** – consists of applying a new riding surface to a bridge
- **Painting** – corrects and prevents areas susceptible to rusting (typically steel)

It is important to make minor improvements to good bridges regularly to delay or eliminate the need for more expensive and time-consuming major repairs and delay replacement of the structure. The estimated annual need of bridge preservation is \$29.77 million.



Replacing Expansion Joint



Freshly Painted Steel Bridge Girders

### **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. Rehabilitation activities can include the preservation activities mentioned above but generally include much more work and should improve the overall condition of the bridge. These projects are typically for larger bridges whose replacement costs exceed \$4 million.

#### **Bridge Rehabilitation Activities Include:**

- Preservation activities listed above and
- Substantial corrective work on a bridge such as replacing the deck or performing major work to steel components.
- Bridge “jacking” (the raising of bridges) to alleviate deficient vertical clearances.

The estimated annual need for bridge rehabilitation is \$127.09 million.





Bridge "Jacking" and  
Replacing Steel Girder



Replacing Concrete Deck

## **D.6 Recent Funding Initiatives**

### **Low Impact Bridge Replacement (LIBR) Program:**

In 2009, NCDOT had approximately 2,770 structurally deficient bridges. About 30% of these bridges were funded for replacement in the State Transportation Improvement Program (STIP). NCDOT estimates that 300 bridge replacements per year is needed to address the growing population of deficient bridges. In order to begin addressing this concern, the Department established a new process to replace bridges at a lower cost and reduce the time it requires to design and construct a project. The Low Impact Bridge Replacement (LIBR) Program began in 2010 and addresses bridges for paved secondary roads that have a low impact on the environment, public and minimal right of way and utility conflicts. An agreement was reached with regulatory agencies to streamline permitting process for this program. Standard plans and drawings were developed to reduce engineering costs associated with design. The 2013 allocation for this program is \$28 million.

## ***2012 Report on the Condition of the State Highway System***

### **System Preservation:**

In July 2011, the General Assembly authorized \$450 million over a two year period to be transferred from system preservation funds to bridge funding only. All funds require commitments by June 30, 2013. The Department has two goals with this initiative:

- 1) Improve the overall health of the state's bridges by utilizing preservation, rehabilitation and total bridge replacement activities;
- 2) Commit money to projects in order to meet the 2-year deadline.

The first year of the program focused on preservation and rehabilitation activities while the second year of the program focuses on replacements using the Low Impact Bridge Replacement Procedures.

While this program is on-going and inspections have not completed a cycle, it is projected that through this program:

- Over 500 Bridges will be replaced
- Over 450 Bridges will receive preservation work
- Approximately 40 Bridges will be rehabilitated and
- 23 Bridges will be “jacked” or raised

Once this program is completed it is estimated that 470 bridges will no longer be structurally deficient and 736 bridges will have their ratings changed from poor to good. It is anticipated this program will increase the bridges in good condition by more than 7%.

## **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, ITS devices such as electronic dynamic message boards, video camera systems, traffic speed sensors, and the Incident Management Assistance Patrol (IMAP). Highway System Operations is funded by state and federal sources. State funds come from Highway Maintenance (Section A, Table 3) and Federal funds for ITS Operations, Positive Guidance Program, and Traffic System Operations Program (Section A, Table 4).



### **E.1 Traffic Signals Maintenance and Signal System Timing**

Traffic signal maintenance consists of work activities associated with the maintenance and operation of approximately 9,000 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) “Closed loop” signal systems where multiple signals in a corridor are “connected” with each other through communication media issuing different timing plan parameters to all the signals in the system, 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,

## ***2012 Report on the Condition of the State Highway System***

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 damaged signals and supports.

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 70% 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, NCDOT evaluates timing plans on 43% 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, reduces secondary crashes 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 \$49.31 million. The Department adds approximately 200 signals annually to its maintenance inventory, and meeting the

## ***2012 Report on the Condition of the State Highway System***

established performance measures for these additional signals would require an annual increase of approximately \$1.46 million for these signal additions.

### **E.2 TRAFFIC OPERATIONS**

Planned activities including maintenance, construction and special events and unplanned activities including crashes, disabled vehicles, inclement weather and debris in the roadway adversely affect North Carolina's roadways. Incidents cause congestion and secondary crashes as well as waste time, fuel and money. Secondary accidents due to backups account for approximately 30% of all accidents and 18% of the fatalities on our roadways.

The Department has a robust network of intelligent transportation system devices, including 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,

## ***2012 Report on the Condition of the State Highway System***

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 covers 730 miles of the most congested roadways in the Triangle, Triad, Metrolina and Asheville regions, as well as I-40 near the Tennessee state line. 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. Annually, IMAP responds to over 68,000 incidents. 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, 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. The total estimated annual need for Highway Operations is \$66.31 million.

## ***2012 Report on the Condition of the State Highway System***

### **F – PAVEMENTS**

Pavement is one of the most valuable assets in the state's transportation network. The most cost-effective method for maintaining pavements is through a combination of treatments including maintenance, preservation, resurfacing and rehabilitation. Pavements are primarily state funded through Highway Maintenance, Contract Resurfacing, General Maintenance Reserves and the Paved Secondary Road Improvement Program (Section A, Table 3). The most recent Pavement Condition Survey, completed in 2012, is used to determine the condition of this asset and to generate broad program needs as defined in Table 7 below:

<b>Pavement Condition Rating (PCR)</b>	<b>Treatment Category</b>	<b>Flexible Pavement Treatment Activities (Asphalt)</b>	<b>Rigid Pavement Treatment Activities (Concrete)</b>
PCR 75-90	Preservation	<ul style="list-style-type: none"><li>• Crack Seal</li><li>• Chip Seal</li></ul>	<ul style="list-style-type: none"><li>• Clean and Reseal Joints</li><li>• Diamond Grind</li></ul>
PCR 60-75	Resurfacing	Resurface with 1.25 to 2" single lift of asphalt surface course	Spall repairs, minor patching, overlay with ultra thin bonded wearing course
PCR 45-60	Rehabilitation	Mill 2.5", Replace with Intermediate Course and then Overlay with 2 lifts of asphalt 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 and 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.

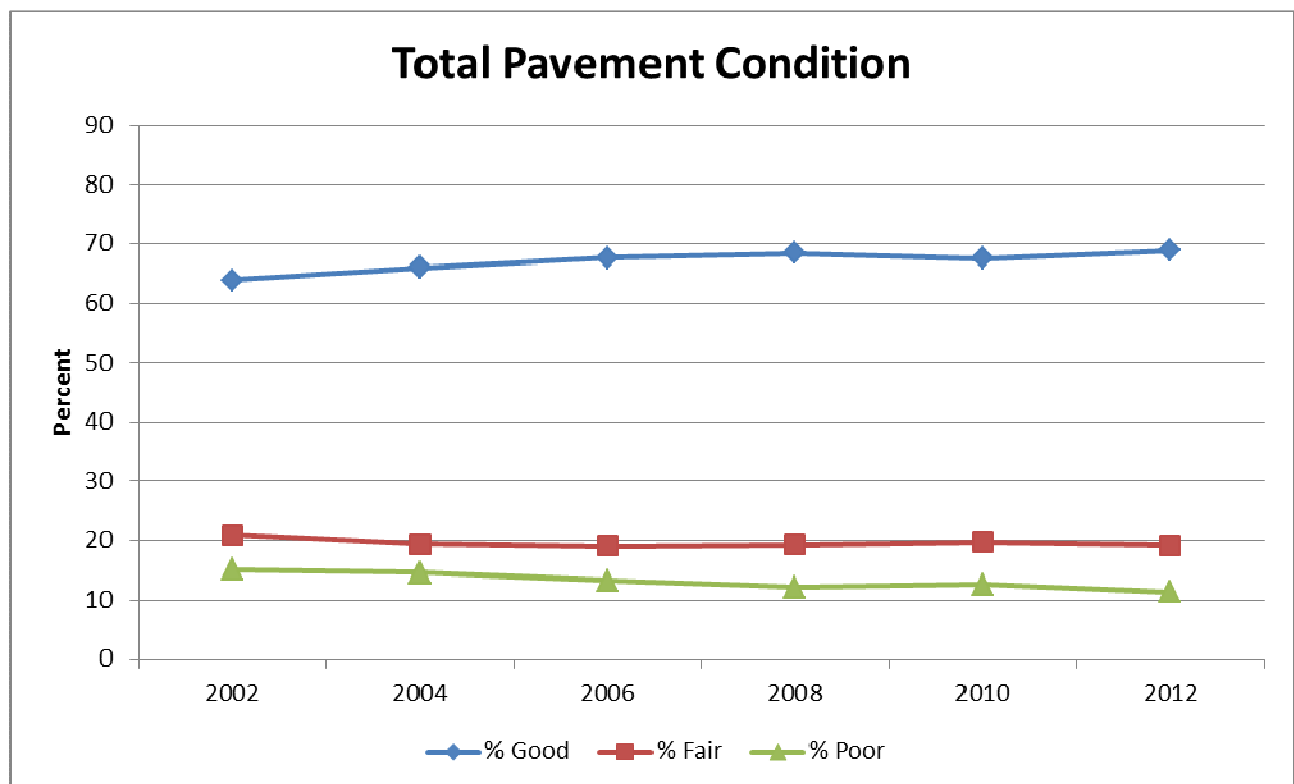
**Table 7– Summary of Pavement Treatment Activities Based on Pavement Condition Rating with 100 Being the Highest Score on a 0-100 Scale**

Table 7 shows “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

## **2012 Report on the Condition of the State Highway System**

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 the various funding sources, pavement conditions in North Carolina have improved over time as shown in Figure 3. For the period from 2002 through 2012, the percentage of pavements in good condition increased while the percentage in poor condition declined. The challenge in the future is sustaining these gains as the buying power of the dollar declines.



**Figure 3 Shows the Overall Condition Rating By Year of Pavements in Good, Fair and Poor Condition Over a 10-Year Period.**



## ***2012 Report on the Condition of the State Highway System***

### **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** – seals pavements and prevents water from penetrating into the pavement which can result in deterioration
- **Retreating** – consists of applying a seal to protect the pavement from water intrusion. Most often the Department uses chip seals for retreatment
- **Resurfacing** – consists of applying a thin layer of hot mix asphalt to a pavement that is in better condition

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 pavement condition survey ratings shown in Table 7.

Retreatments are a relatively low-cost application that seals the pavement surface, reconditions the underlying asphalt, and provides a new driving surface for about one-third the cost of a resurfacing application. The average life of these treatments is about 6 to 9 years; however, some are performing adequately for over 12 years.

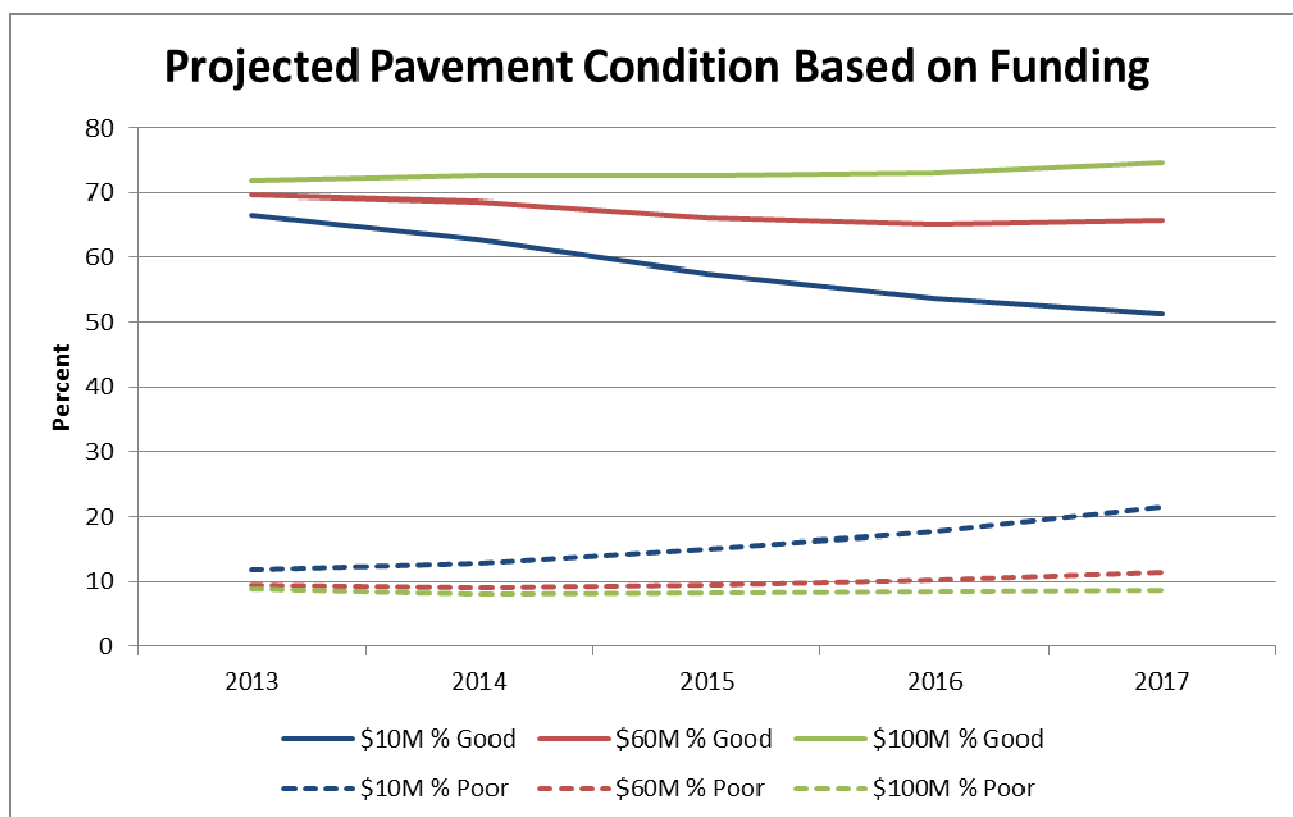
Last year, the preservation funding was set aside for bridge preservation. In order to continue the Department's preservation initiatives, pavement preservation was funded out of Highway Maintenance.

#### **Projected Condition Due to Decreased Preservation Funds:**

The Pavement Management System was used to evaluate three funding scenarios for the retreatment program. Figure 4 graphically depicts pavement condition for 3 different funding scenarios. If funding for retreatments is minimal over 5 consecutive years at \$10 million per year, the percentage of lane miles in good condition drops by over 15%, while the percentage in poor condition increases by 9% (Blue Lines in Figure 4). If funding for the program is maintained at \$60 million per year, the percentage of roads in good

## 2012 Report on the Condition of the State Highway System

condition drops by close to 4%. The percentage in poor condition increases by close to 2% (Red Lines in Figure 4). Finally, if pavement preservation funding is \$100 million per year, the percentage of roads in good condition begins to increase. Over a 5 year period, the percent of good roads increases by close to 3% and the percent of roads in poor condition minimally increases (Green Lines in Figure 4).



**Figure 4 – Projected Pavement Condition for 5 Years Based on 3 Funding Scenarios. Blue Lines Represent Funding Pavement Preservation for \$10 Million/Year. Red Lines Represent Funding Pavement Preservation for \$60 Million/Year. Green Lines Represent Funding Pavement Preservation for \$100 Million/Year.**

It is important to note that pavement preservation requires action on roads that are in the upper range of fair to good condition. Historically the prevailing approach to pavement maintenance was to “fix” roads in poor condition. Pavement preservation aims to prevent problems before they occur which is cost effective and keeps roads in good condition.

Having a preservation program is most effective with consistent funding levels. It must be sustained over a long period of time to improve the system. One field division has

## ***2012 Report on the Condition of the State Highway System***

achieved substantial results from a focused preservation program. From 2000 to 2010, the percent of roads in good condition increased by 5% while the percent of roads in poor condition dropped 3%. Once an area has improved road conditions into the good range, it becomes possible to address roads in poor condition. Because the cost to address roads in poor condition is significantly higher, only a small percentage of the road system can be touched in a “worst first” mode.



Pavement Preservation  
Crack Sealing



Pavement Preservation  
Bituminous Surface Treatment

The Department proactively seeks ways to improve its pavement preservation techniques. For example, the Department has funded numerous research projects to evaluate and make recommendations on its chip sealing operation. Also, the Department consistently works with industry to identify and use new products and materials. The estimated annual cost for preservation activities to reach target condition levels is \$106.47 million.

The Department is also developing 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 and surface issues on flexible pavements. A recent example is the surface grinding and rejuvenating on I-40 in Division 3, which reduced oxidation while improving surface friction. The estimated annual need of these interstate preservation activities is \$59.35 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 to meet target goals is \$427.16 million for all systems combined.



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. Some reconstruction is caused by material related defects in the paving materials. Understanding material defects results in modifying specifications and construction practices to prevent them in the future.



Rehabilitation



Reconstruction

Moving through the series of treatment classes depicted in Table 7, increases cost 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.

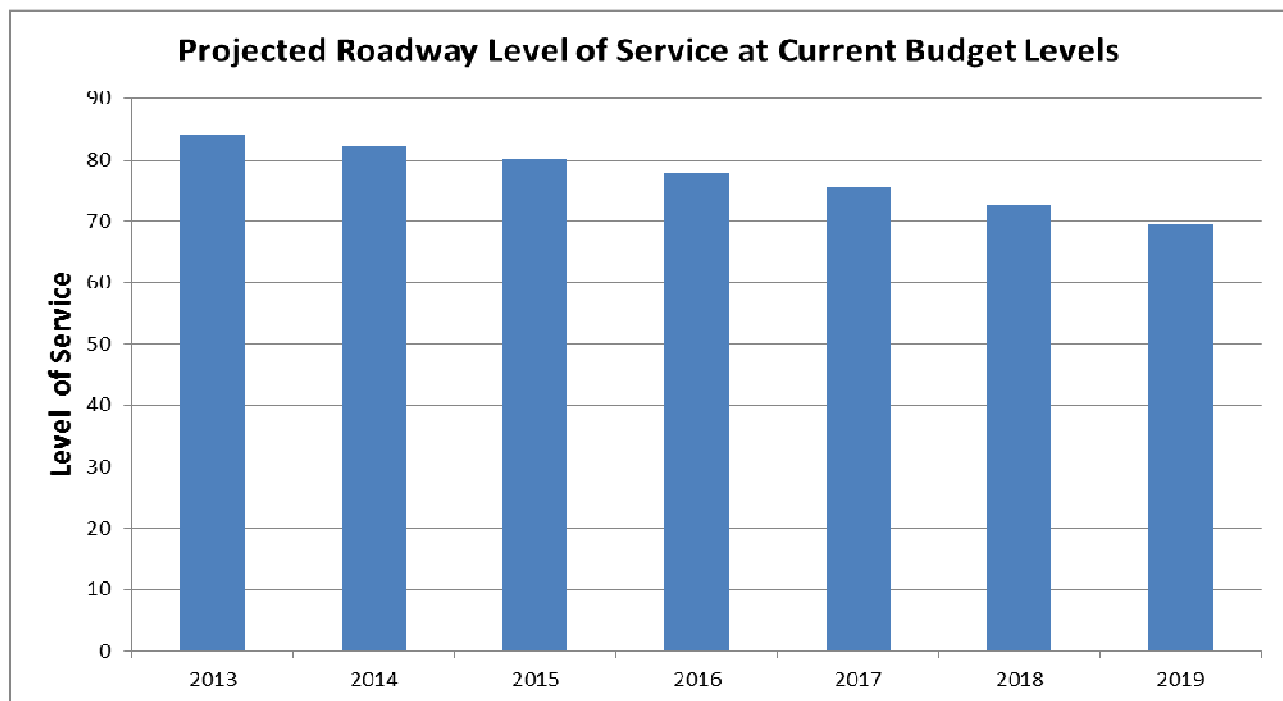
## ***2012 Report on the Condition of the State Highway System***

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 and the Interstate Maintenance Preservation Program will address these needs. The funding needed to maintain, preserve, resurface and rehabilitate pavements does not include any funds for capacity expansion (widening).

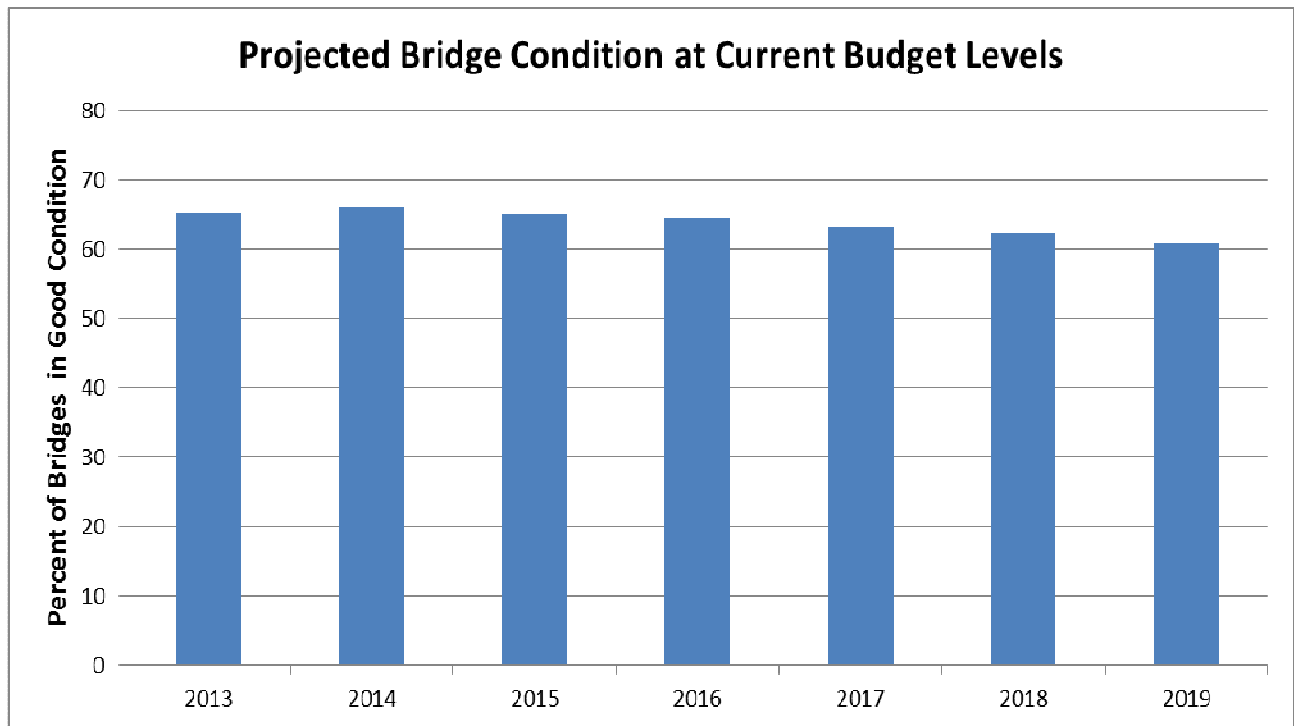
The Department utilized funds from ARRA to let shovel-ready projects, including resurfacing and rehabilitation on federal aid eligible roadways. Many of these projects provide much needed strengthening of the pavement structures to address current and future traffic volumes. The challenge is to protect this investment with timely follow-up maintenance and preservation. The estimated annual need for pavement rehabilitation activities to meet target goals is \$193.71 million.

### G – SUMMARY

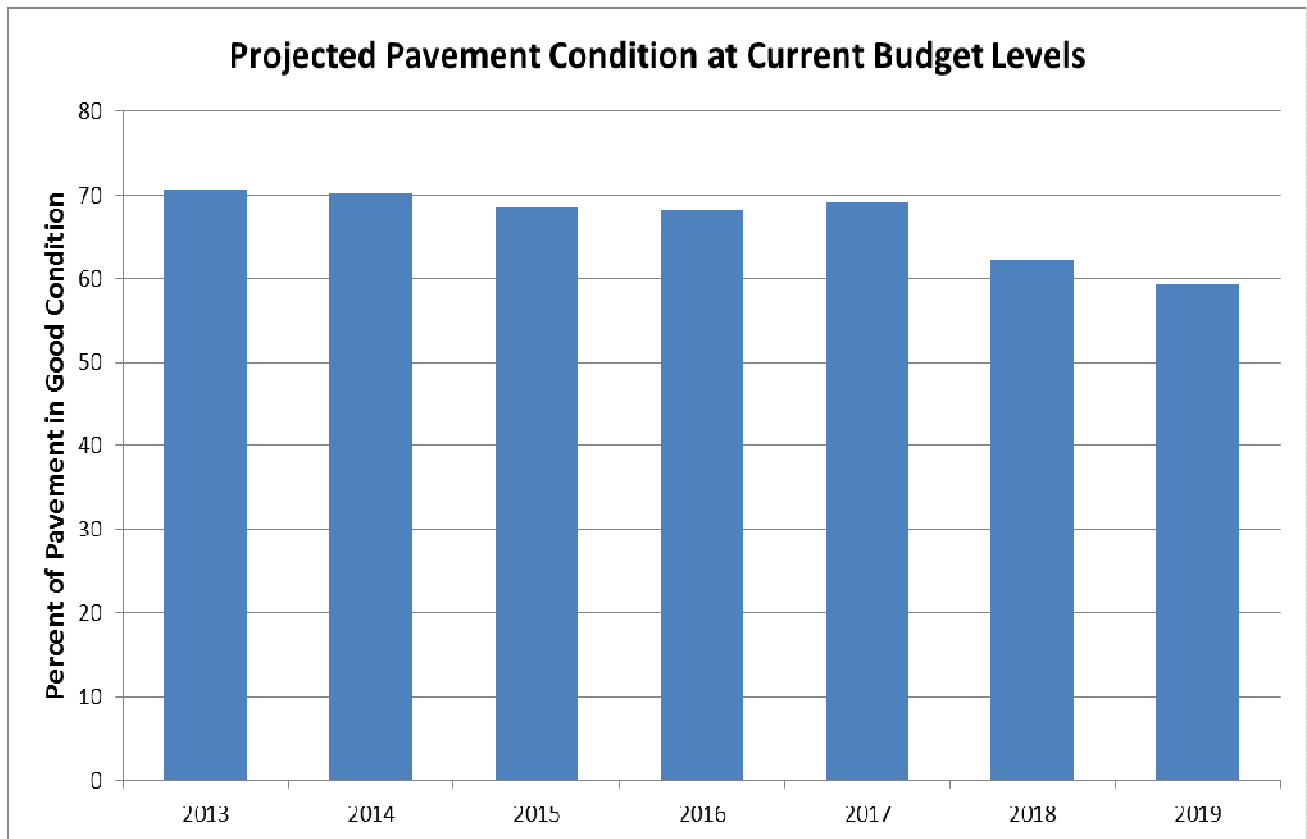
G.S. 136-44.3 requires the Department of Transportation to demonstrate the costs to meet and sustain performance targets for the primary and secondary highway systems, including routine maintenance, system preservation and rehabilitation projects. This report intends to provide the Joint Legislative 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 unpaved secondary roads, places an additional burden on the maintenance budget. With the rising cost of materials, it becomes clear that as funding remains constant, the condition of North Carolina's highways begins to deteriorate. The following figures demonstrate when funding remains stagnant, level of service and condition decreases over a seven year period.



**Figure 5 – Projected Roadway Level of Service Declines from an Overall Grade of 84 to 76**



**Figure 6 – Projected Percent of Bridges in Good Condition Declines from 61% to 54%**



**Figure 7 – Projected Percent of Pavements in Good Condition Declines from 68% to 50%**



## ***2012 Report on the Condition of the State Highway System***

Providing the established performance standards indicated in this document requires adequate funding. Table 8 summarizes the annual funding need and identifies the funding programs used 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.

<b>Maintenance Program</b>	<b>2013-14 Projected Need (Millions)</b>
Highway Routine Maintenance	\$614.40
Bridge Maintenance	\$85.26
Highway Operations	\$66.31
Disasters & Emergencies	\$15.00
Contract Resurfacing	\$427.16
Pavement & Bridge Preservation	\$195.59
<b>Total Maintenance &amp; Preservation Need</b>	<b>\$1,403.72</b>
System Rehabilitation	\$320.81

**Table 8 - Maintenance and Preservation Need in Millions (includes programs addressed through federal funds)**

Based on this funding level, the Department proposes developing a statewide annual maintenance funding plan consistent with funding shown in Appendix 4. 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. In order to meet established levels of service, it would be beneficial to restore the Department's flexibility to use State System Preservation funds on pavements as well as on bridges.

## ***2012 Report on the Condition of the State Highway System***

### **APPENDIX**

Lane Mile Calculations	Appendix 1
Bridge Deck Calculations	Appendix 2
Lane Miles vs. Traffic Growth Calculations	Appendix 3
Projected Cost and Funding Need by Asset	Appendix 4

## 2012 Report on the Condition of the State Highway System

### Appendix 1

#### Paved Lane Miles

Year	Lane Miles			Cumulative	
	Primary	Paved Secondary	Total	Mileage	Percent
2002	37,791	118,169	155,960	0	0.0%
2003	38,093	120,499	158,592	2,632	1.7%
2004	38,444	121,339	159,783	3,823	2.5%
2005	38,698	121,911	160,609	4,649	3.0%
2006	40,678	120,830	161,508	5,548	3.6%
2007	40,960	121,780	162,740	6,780	4.3%
2008	40,978	122,633	163,611	7,651	4.9%
2009	39,916	120,714	169,660	13,700	8.8%
2010	40,579	130,372	170,951	14,991	9.6%
2011	40,473	130,474	170,947	14,987	9.6%

Above table contains historical data showing how North Carolina's paved road system has increased over 10 years.

### Appendix 2

#### Bridge Deck Area

			Cumulative Change		Yearly Change	
Year	Total Bridges	Bridge Deck Area	Square Feet	Percent	Square Feet	Percent
2002	17,526	75,342,236	0	0.0%	0	0.0%
2003	17,635	76,391,052	1,048,817	1.4%	1,048,817	1.4%
2004	17,775	78,399,401	3,057,166	4.1%	2,008,349	2.6%
2005	17,848	79,750,414	4,408,179	5.9%	1,351,013	1.7%
2006	17,979	82,154,308	6,812,073	9.0%	2,403,894	3.0%
2007	18,018	83,507,651	8,165,416	10.8%	1,353,343	1.6%
2008	18,159	86,693,671	11,351,435	15.1%	3,186,020	3.8%
2009	18,205	88,124,479	12,782,243	17.0%	1,430,807	1.7%
2010	18,245	89,082,335	13,740,099	18.2%	957,856	1.1%
2011	18,265	91,379,708	16,037,473	21.3%	2,297,373	2.6%

Above table contains historical data showing how North Carolina's bridges have increased over 10 years.

### Appendix 3

#### Lane Miles vs. Traffic Growth (2002 Base Year)

	Actual VMT	Actual	% Growth	% Growth
Years	(Millions)	Lane Miles	VMT	Lane Miles
2002	92893	155960	0.0%	0.0%
2003	93763	158592	0.9%	1.7%
2004	95627	159783	2.9%	2.5%
2005	100861	160609	8.6%	3.0%
2006	101648	161508	9.4%	3.6%
2007	103598	162740	11.5%	4.3%
2008	101463	163611	9.2%	4.9%
2009	102590	169660	10.4%	8.8%
2010	102385	170951	10.2%	9.6%
2011	103738	170947	11.7%	9.6%

Above table contains historical data showing how North Carolina's Vehicle Miles Traveled (VMT) and lane mile growth increased over 10 years.

# 2012 Report on the Condition of the State Highway System

## Appendix 4

Projected Cost and Funding Need (in millions)										
Maintenance Programs	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20			
Highway Routine Maintenance	\$ 614.40	\$ 635.28	\$ 656.86	\$ 679.18	\$ 702.25	\$ 726.11	\$ 750.78			
Bridge Maintenance	\$ 85.26	\$ 88.16	\$ 91.16	\$ 94.26	\$ 97.46	\$ 100.77	\$ 104.20			
Highway Operations	\$ 66.31	\$ 67.99	\$ 69.72	\$ 71.51	\$ 73.37	\$ 75.28	\$ 77.26			
Disasters & Emergencies	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00			
Contract Resurfacing	\$ 427.16	\$ 441.68	\$ 456.70	\$ 472.23	\$ 488.29	\$ 504.89	\$ 522.05			
Pavement and Bridge Preservation	\$ 195.59	\$ 202.24	\$ 209.12	\$ 216.23	\$ 223.58	\$ 231.18	\$ 239.04			
Total Maintenance and Preservation Needs	\$ 1,403.72	\$ 1,450.35	\$ 1,498.55	\$ 1,548.40	\$ 1,599.94	\$ 1,653.23	\$ 1,708.34			
Supplemental Funds	\$ 152.00	\$ 152.00	\$ 152.00	\$ 152.00	\$ 152.00	\$ 152.00	\$ 152.00			
Estimated Highway Allocations	\$ 1,188.18	\$ 1,248.90	\$ 1,309.59	\$ 1,317.58	\$ 1,413.24	\$ 1,429.21	\$ 1,434.21			
Total Projected Budget Shortfall	\$ 63.54	\$ 49.45	\$ 36.96	\$ 78.82	\$ 34.70	\$ 72.03	\$ 122.13			
System Rehabilitation	\$ 320.81	\$ 331.71	\$ 342.99	\$ 354.66	\$ 366.71	\$ 379.18	\$ 392.07			

The above table projects cost and funding needs by asset for the next seven years.