

**2006
Maintenance Condition And
Funding Needs
For The
North Carolina State Highway System**

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December 2006

Acknowledgements

The Division of Highways wishes to acknowledge the contributions of those individuals within the State Road Maintenance Unit, the Pavement Management Unit, the Bridge Maintenance Unit, the Roadside Environmental Unit, the GIS Unit, and the 14 Highway Divisions for their assistance in providing the survey data and contents of this report.

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2006 Report on the Condition of the State Highway System

2006 REPORT ON THE CONDITION OF THE STATE HIGHWAY SYSTEM

EXECUTIVE SUMMARY

Introduction

The North Carolina Department of Transportation has surveyed and evaluated the condition of the state's structures and paved roads in order to estimate the needs for routine maintenance and resurfacing. The purpose of this report is to provide the results of the survey. This report assesses the current condition of the highway infrastructure and estimates the funding needed to reach an acceptable level of service.

North Carolina's highway system consists of 79,009 miles of roadway and 17,848 structures. The Division of Highways within the Department of Transportation is responsible for maintaining this system. Over the past 10 years, the number of lane miles of North Carolina's paved highway system has increased by 12.3% and bridge deck area has grown by 20.5%. While the system continues growing, traditional highway maintenance funds necessary to maintain the country's second largest highway system have not changed significantly when adjusted for inflation.

Recognizing the gap between available funding and the maintenance needs, Governor Easley, the North Carolina General Assembly and the Department have worked together to find non-traditional funding sources. In 2001, Senate Bill 1005 allowed for up to \$ 515 million to be spent on primary route pavement preservation and traffic management systems. Most recently, in 2003, *NC Moving Ahead!* allowed \$ 630 million to be spent to improve the safety and maintenance condition on designated primary and high volume secondary routes. The utilization of these funds has permitted the improvement of pavement conditions while freeing up traditional maintenance funds for other routine maintenance activities.

The Department has also taken advantage of the flexibility in the Federal-Aid funding allotments to address highway maintenance and operational programs. In addition, recent general statute changes allow the Department to use Secondary Road Construction Funds

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for system improvements. These new non-traditional funding sources (approximately \$93.5 million) have been included in this report and the maintenance needs identified take into consideration the availability of these dollars.

Background

North Carolina General Statute 136-44.3 requires that on each even-numbered year, the NCDOT shall survey and report the condition of the state highway system. This report shall provide estimates of:

- (1) the annual cost of routine maintenance,
- (2) the cost of eliminating any maintenance backlog,
- (3) the annual cost of resurfacing based on:
 - (a) a 12-year paving cycle for the primary system, and
 - (b) a 15-year paving cycle for other highways
- (4) the cost of eliminating any resurfacing backlog.

On the basis of this report, NCDOT shall develop a statewide annual maintenance program for the state highway system.

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 confirmed that many of the highway features, such as pavements, drainage structures, timber bridges, signs, etc., are not in an acceptable maintenance condition. In accordance with the legislative requirements, the Department has estimated the cost to achieve a minimum acceptable maintenance condition and estimated the backlog cost. These costs are itemized as follows:

Annual Cost of Routine Maintenance

The annual cost of routine maintenance in order to provide a minimum acceptable level of service is \$743.35 million.

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Cost of Eliminating Maintenance Backlog

The cost of eliminating the maintenance backlog in order to raise the existing condition to an acceptable level is \$ 437.21 million. Prorated over several years, the first year's cost would be \$48.14 million.

Annual Cost of Resurfacing

The annual cost of resurfacing the Primary system on a 12-year cycle and the Secondary system on a 15-year cycle is \$284.30 million.

Cost of Eliminating Resurfacing Backlog

The cost of eliminating the resurfacing backlog in order to raise existing conditions of the pavements to an acceptable level is \$687.50 million. Prorated over 10 years, the first year's cost would be \$68.75 million.

Disasters and Emergencies

Recent years have brought fewer hurricanes and milder winter weather to North Carolina, and this has allowed the Department to reduce the debt incurred in handling disasters to approximately \$15.0 million. It is anticipated that this debt would be eliminated in Fiscal Year 2007-08. Additionally the annual anticipated need for disasters and emergencies is \$15 million bringing the total disaster and emergency obligation to be \$30 million for FY 2007-2008.

Total Maintenance Funding Need

The total maintenance funding need for FY 2007-08 is \$ 1,174.54 million.

Adjustment for Alternate Funding

Non-traditional funding sources such as the Transportation Improvement Program have helped to reduce the strain on traditional maintenance dollars. Additionally, beginning with the July 2007 Budget Year, House Bill 1825 will allow the Department to use Secondary Road Construction Funds to address highway needs on the Paved Secondary Road System. These projects will reduce the total maintenance funding need next fiscal year by \$93.5 million, leaving the estimated funding need at \$1,081.04 million.

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Long Range Plans for Transportation Needs

In 2004, the Board of Transportation adopted a Statewide Long Range Transportation Plan. This plan provides a blue print for the next 25 years for greater investment in maintenance, preservation and modernization of the state's existing highway system. The plan's Recommended Investment Scenario would enable the Department to meet an additional 10% of its maintenance and preservation needs and nearly 25% more of its infrastructure modernization needs. The plan identifies three levels of transportation facilities: Statewide facilities such as interstates and major primary routes, Regional facilities such as NC and US routes, and Sub-regional facilities such as secondary roads. By separating its system into three main categories, the Department can adjust its funding strategy to provide funding priority to those roads that carry the largest volumes of traffic.

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A - INTRODUCTION

Background

Since 1998, the North Carolina Department of Transportation has submitted a report to the Joint Legislative Transportation Oversight Committee on the condition of the state system's roads and bridges and the funding level needed to maintain this system at a reasonable level of service. These reports have also estimated the cost to resurface the state primary system on a 12-year paving cycle and the cost to resurface all other state highways on a 15-year cycle. As required by G.S. 136-44.3, these reports also estimate the cost to eliminate the maintenance and resurfacing backlogs.

This document, the "2006 Maintenance Condition and Funding Needs For The North Carolina State Highway System", is an update of the most recent report which was presented in December 2004. The intent of this report is to satisfy the legislative requirements, as well as provide a clear link between maintenance objectives, maintenance activities, maintenance service levels, budget and actual performance.

Highway System Growth

North Carolina's highway system consists of 79,009 miles of roadway and 17,848 structures. Over the past 10 years, the number of paved lane miles has increased by more than 12.3% and the square footage of bridge deck area has grown by 20.5%. As illustrated in Figures 1 and 2 on the next page, the system continues to increase as roads are widened and new roads and bridges are constructed. Appendix A lists the mileage and bridge deck area totals for the past 10 years.

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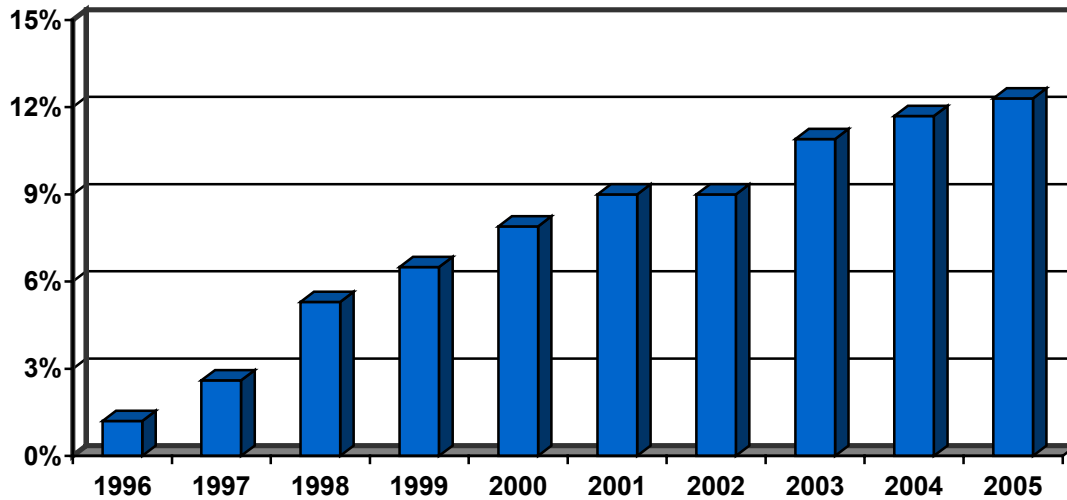


Figure 1 - Paved Lane Mileage Growth

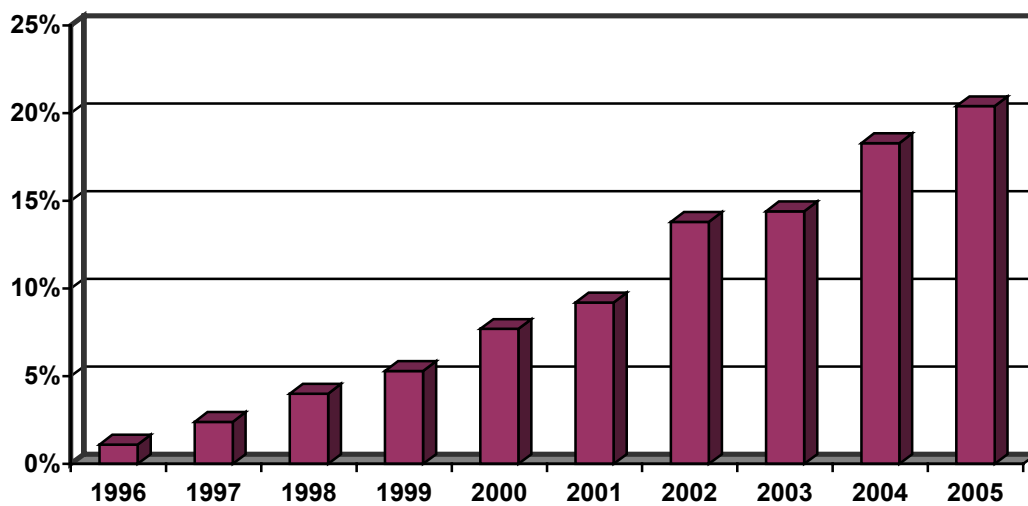


Figure 2 - Bridge Deck Surface Area Growth

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In addition to the steady increase in the paved system, vehicular travel has also risen. During this same 10-year period, vehicle miles traveled increased by 32.6% while the paved lane miles have only increased by 12.3% as indicated in Figure 3. In other words, traffic volumes have increased by almost three times as much as the travel lanes needed to carry them. This increase places a heavier burden on the existing infrastructure and accentuates the need for additional maintenance funding to address the added deterioration created by the increase in traffic.

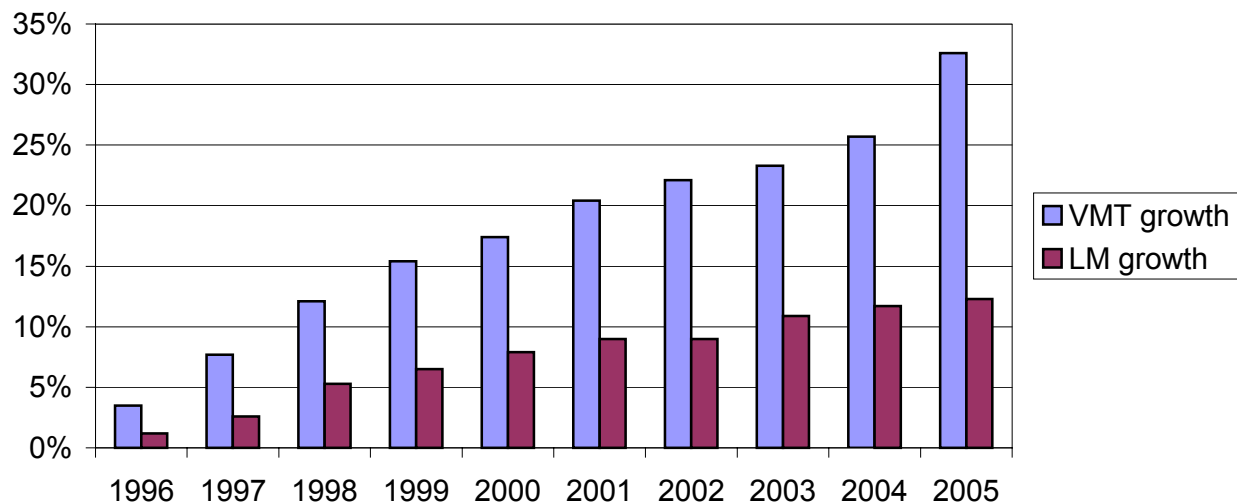


Figure 3 – Percentage Trends of System Inventory and Traffic Volumes

History of Maintenance Funding

Although the size of the highway system has shown a steady increase in the last decade, the increase in total funds for maintenance has not kept pace with inflation. In fact, when adjusted by the Consumer Price Index, the total dollar amount devoted to maintenance and resurfacing in FY 2006 is only \$54.4 million (19%) higher than that of FY 1996 as indicated in Figures 4 and 5 respectively.

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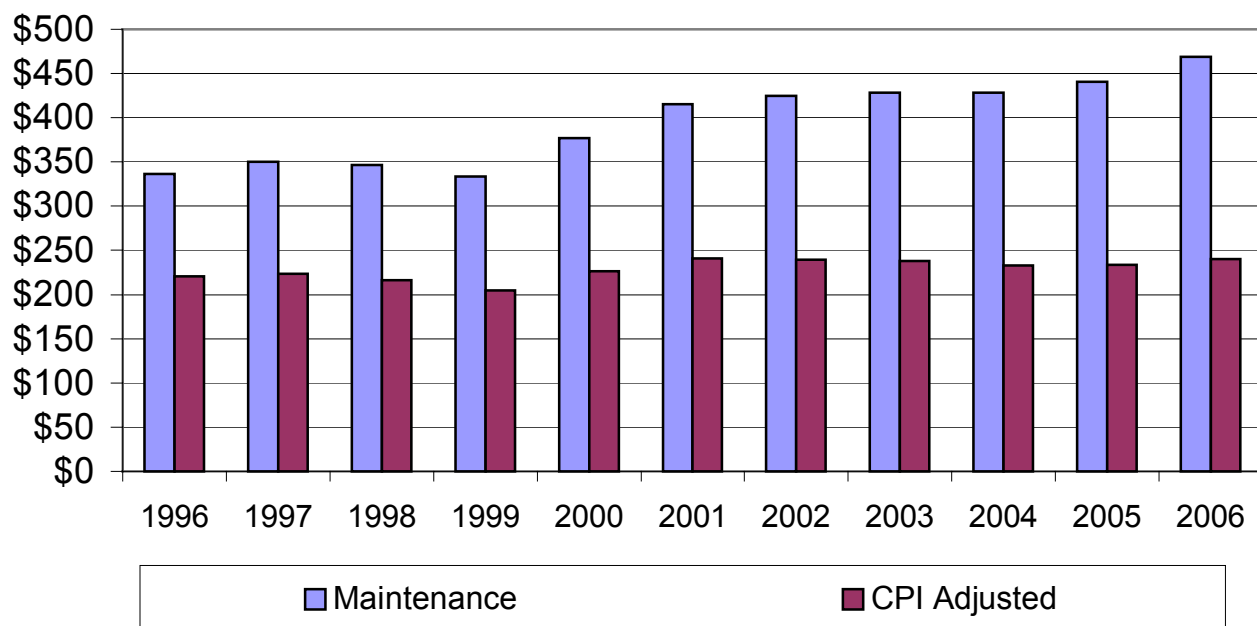


Figure 4 – Maintenance Funding, Adjusted by Consumer Price Index

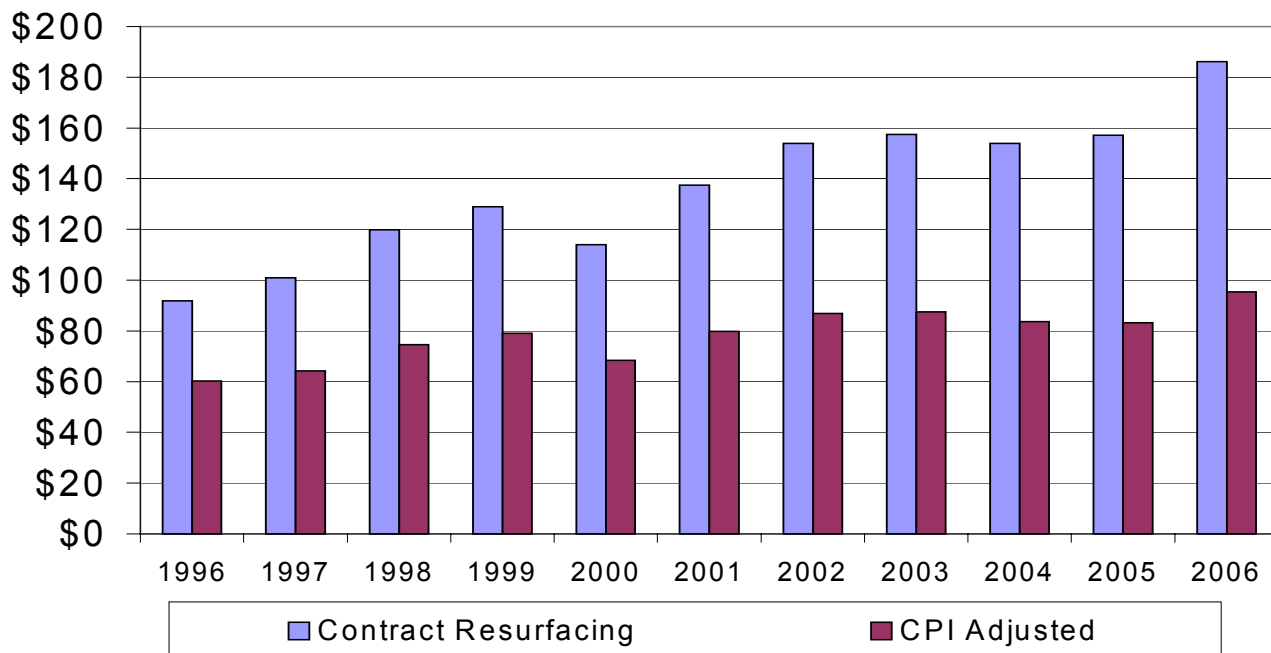


Figure 5 – Contract Resurfacing, Adjusted by Consumer Price Index

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Non-Traditional Funding Sources

In August 2005, the United States Congress passed the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU). SAFETEA-LU addresses the many challenges facing our transportation system today – challenges such as improving safety, reducing traffic congestion, improving efficiency in freight movement, increasing intermodal connectivity, and protecting the environment – as well as laying the groundwork for addressing future challenges. SAFETEA-LU promotes more efficient and effective Federal surface transportation programs by focusing on transportation issues of national significance, while giving State and local transportation decision makers more flexibility for solving transportation problems in their communities.

The passage of SAFETEA-LU, like its predecessor ISTEA, allows North Carolina the flexibility to expand from a strictly “construction” program to include “maintenance and preservation” programs as well. It has been estimated that the Nation’s investment in its transportation system is about \$1 trillion in replacement value. It only makes good business sense to maintain and preserve this tremendous asset.

Since passage of the Highway Trust Fund in 1989, the Department has paved over 10,000 miles of unpaved secondary roads in North Carolina. With only 3,400 miles of unpaved roads remain to be paved. In view of the fact that the Paved Secondary Road System has not kept up with the demands being placed on it by increased urbanization and traffic, the 2006 Session of the General Assembly approved changes in the General Statutes that govern the use of Secondary Road Construction Funds. House Bill 1825 allows the use of these funds on the Paved Secondary Road System to improve their functionality through safety, modernization and condition improvements. It is estimated that approximately \$50 million of these funds will have a positive effect on the maintenance condition of the Paved Secondary Road System.

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

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Project	Description	FY 2007-2008 Allocation
ITS Traffic Operations (R-4049)	Funds would be used for operation and maintenance of Incident Management and ITS Programs	\$18.0 M
Positive Guidance Program (R-4067)	Funds would be used to improve pavement marking lane lines and symbols to provide better traffic guidance and visibility on the primary roadway system	\$ 5.5 M
Traffic System Operations Program (R-4701)	Funds would be used for operation and maintenance of traffic signal systems	\$18.0 M
Bridge Preventative Maintenance Program (B-4700)	Funds would be used to address bridge preservation needs such as deck and joint repair, and bridge painting	\$ 2.0 M
HB 1825 Secondary Road Improvement Program	Funds would be used to make improvements to the paved secondary road system	\$50.0 M

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

B – REQUIREMENTS AND METHODOLOGIES

Requirements of G.S. 136-44.3

North Carolina General Statute 136-44.3, ratified by the 1997 General Assembly, requires NCDOT to survey the condition of the State Highway System and prepare a report of the findings. The report is to provide quantitative and qualitative descriptions of the condition of the system and provide cost estimates of the following:

- (1) the annual cost of routine maintenance of the State Highway System,
- (2) the cost of eliminating any maintenance backlog by categories of maintenance requirements,
- (3) the annual cost to resurface the State Highway System based upon
 - (a) a 12-year paving cycle for the primary system, and
 - (b) a 15-year paving cycle for other highways,
- (4) the cost of eliminating any resurfacing backlog by system.

The statute also requires that, on the basis of this report, the Department shall develop a statewide annual maintenance program for the State Highway System. The report shall be presented to the Joint Legislative Transportation Oversight Committee each even-numbered year.

In accordance with the requirements of this statute, this report describes the survey methodology and estimated costs of routine maintenance and resurfacing, as well as the costs to eliminate backlogs. To satisfy the requirements of this legislation, a detailed assessment was conducted of the state's pavements, structures and roadway features.

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 of routine maintenance and resurfacing to provide a minimum acceptable level of service.

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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.

Level of Service

In order to effectively evaluate the condition of the State Highway System, it was necessary to establish definitions for different levels of services. A five-level grading system (A, B, C, D and F) was established and is used in this report. Level A refers to the highest or best level and Level F refers to the lowest or worst level. The report also includes cost estimates for delivering each of the five service levels for the major maintenance activities. Detail definitions of each level are as follows.

Level of Service A (best)

This is a very high level of service in which the roadway, bridges and associated features are in excellent condition. Very few deficiencies are present, all systems are operational and the overall appearance is pleasing. Preventive maintenance is a high priority in all maintenance activities.

Level of Service B (good)

This is a high level of service in which the roadway, bridges, and associated features are in good condition. Very few deficiencies are present in safety and investment protection, but moderate deficiencies exist in other areas. All systems are operational. Preventive maintenance is a high priority for safety-related activities, but is deferred for other areas, resulting in additional corrective maintenance activities.

Level of Service C (fair)

This is a fair maintenance service level in which the roadway, bridges and associated features are in fair condition. Very few deficiencies are present in safety related activities, but moderate deficiencies exist for investment protection and significant aesthetic related deficiencies. Preventive maintenance is deferred for many activities except safety-related work. Corrective maintenance is routinely practiced for all activities. A backlog of deficiencies begins to build up that will have to be dealt with eventually, at a higher cost. Some roadway structural problems begin to appear due to long-term deterioration of the system.

Level of Service D (poor)

This is a low maintenance service level in which the roadway, bridges and associated features are kept in generally poor condition. Moderate deficiencies are present in safety-related activities, and significant deficiencies for all other activities. Very little preventive maintenance is accomplished; maintenance becomes very reactionary and places emphasis on correcting problems as they occur. A backlog of deficiencies will build up. Safety problems begin to appear that increase risk and liability, and significant structural deficiencies exist that accelerate the long-term deterioration of the system. The overall appearance of the system is poor.

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Level of Service F (worst)

This is a very low service level in which the roadway, bridges and associated features are kept in poor and failing condition. Significant deficiencies are present in all maintenance activities. The overall appearance is not aesthetically pleasing. Preventive maintenance is not practiced for any maintenance activities. Maintenance is completely reactive and places emphasis on correcting problems as they occur. Significant backlogs of maintenance deficiencies exist. Excessive safety problems occur.

Minimum Acceptable Levels of Service

In order to establish the five levels of service previously described and relate them to performance standards and condition ratings, the Department conducted extensive research into condition assessment methods in other State DOT's. The Department also conducted work sessions with representatives from each of the 14 Divisions to provide input based on their knowledge of the highway system and its maintenance condition. Baselineing what other State DOT's have done along with input from the professional staff, realistic levels of service were established for each maintenance feature.

Based on the definition of these five levels, it would be desirable for the entire highway system to be maintained at Level of Service "A". However, due to fiscal constraints and funding limitations, it would be impractical, if not impossible, to achieve this level of service for all highways. On the other hand, there are valid reasons for some of the features to be maintained at a high level of service; especially those features associated with safety such as median guardrails. Other features such as pavements, pavement striping, low shoulders and raised pavement markers affect safety as well. The lower the level of service of these features, the poorer the condition, and the greater the potential for vehicle damage and accidents. In order to provide the traveling public with a safe and uniformly maintained highway system, the cost estimates itemized in this report reflect achieving at least a "C" Level of Service. However, some of the cost estimates reflect a higher level of service due to safety considerations.

C – ROUTINE MAINTENANCE

Routine maintenance may be described as those work activities that are performed on a recurring basis to provide the traveling public with a safe and reliable highway facility. However, before the first dollar can be allocated to satisfy Routine Maintenance Activities, several million maintenance dollars are set aside each year to fund specific statewide programs. Some of these programs are mandated while others are allocated by choice. 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, and emergency repairs in non-declared events. Next year's funding needs are estimated at approximately \$9.8 million. Once these program needs are satisfied, the remaining dollars are allocated to fund routine maintenance activities. For the purposes of this report, roadway maintenance and bridge maintenance are addressed separately as follows.

C.1 – ROADWAY MAINTENANCE

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

Recurring Programs

These activities consist of rest area and welcome center maintenance, roadway hazard removal, traffic signal maintenance, roadway lighting, sign lighting, municipal agreements, plant beds and unpaved roads. The overall expenditures of these programs are approximately \$122.49 million. The cost of these activities is estimated to grow at a constant rate of approximately 5% each year.

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Performance Based Activities

These activities consist of maintenance to pavements, shoulders and ditches, drainage, mowing, litter, guardrail, signs, pavement markings, vegetation, etc. A detailed survey was conducted through the Maintenance Condition Survey and the Pavement Condition Survey to assess the condition of these roadway features. They were categorized into six (6) major elements of the roadway: pavement, shoulders and ditches, drainage, roadside, traffic control devices, and environmental. The following photographs illustrate some of the features recorded during the survey.



Pavement



Shoulders and Ditches



Drainage



Roadside



Traffic Control Devices



Environmental

The pavement evaluation was based on the recently completed Pavement Condition Survey. The survey uses the complete roadway length for all asphalt surfaced roadways and a sampling of every mile of concrete pavement. This report also includes updated treatments and costs associated with pavement preservation activities. Pavement Preservation Activities are recommended earlier in the pavement life, “keeping good roads in good condition”. Treatments for pavements in poor condition now include rehabilitation methods such as milling and deeper overlays. These treatments increase the overall resurfacing cost, but they provide much needed pavement strengthening.

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For the remaining elements, an evaluation was made by gathering data as part of the Maintenance Condition Survey. For each of the three highway systems (Interstate, Primary, and Secondary), a statistical sampling was made to determine the location of sites to be surveyed. This year, for the first time, data was collected to project the highway condition to the county-level. In past years sampling data has been collected to project condition to the statewide or division level. These sites were randomly selected and survey teams assessed the condition of these 0.2-mile sections for the features shown on the next page in Table 1. The deficient conditions were recorded and summarized, and a maintenance condition rating calculated. From this assessment, the necessary maintenance activities to achieve the various levels of service were determined along with their estimated costs. For the purposes of this report, the data has been rolled up to a statewide-level and does not include individual division or county condition data. The Interstate system was sampled at a statewide level and can not be extrapolated to the division or county level.

Survey Findings

The results of the surveys have been summarized in accordance with the previously defined service level descriptions on pages 12 and 13. Figures 6, 7, and 8, illustrate the average statewide level of service by maintenance activity on the Interstate, Primary, and Secondary systems. These figures indicate that some activities are being maintained at an acceptable level of service or higher, while others are being maintained at a poor “D” or unacceptable “F” level of service due to a lack of funds. In order to bring those poor and unacceptable maintenance activities up to an acceptable condition, additional funding is needed. In addition, as was previously mentioned, some features must be maintained at a high level of service due to safety concerns and considerations. The five levels of service for each feature along with their associated cost are listed in Appendix B and C. Table 2, on page 21, is a summary of the estimated cost to achieve the acceptable level of service. As seen in this table, \$460.81 million is the estimated cost to fund routine road maintenance at the minimum acceptable level of service for the performance based activities.

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Feature	Threshold Condition
Pavement	
Cracking	Cracks \geq 1/8 inch wide
Rutting	Ruts \geq 1/4 inch deep
Raveling	Loss of aggregate, pitting, or binder wearing away
Bleeding	Bleeding \geq 10% of the section
Ride Quality	Uneven ride, tire noise, cannot maintain speed
Unpaved Shoulders and Ditches	
Low Shoulder	Low \geq 2 inches
High Shoulder	High \geq 1 inch
Lateral Ditches	Blocked \geq 50% and Not Funct. as designed or Eroded \geq 1 ft
Drainage	
Crossline Pipe Blocked	Blocked \geq 50%
Crossline Pipe Damaged	Damaged
Curb & Gutter Blocked	Blocked \geq 2 in x 2 ft
Curb & Gutter Damaged	Damaged
Inlets Blocked	Blocked \geq 50%, Damaged, or Grate Problem
Inlets Damaged	Damaged, or Grate Problem
Roadside	
Mowing	Average Grass Height
Brush and Tree Control	Within 15' above, 10' back of ditch/shoulder
Litter & Debris	Number of Pieces \geq Fist-Sized
Slope	Failures \geq 1ft wide
Barriers & Guardrail	Damaged, or Not Functioning as designed
Traffic Control Devices	
Traffic Signs	Illegible, Missing or Obliterated
Pavement Striping	Worn, Missing or Obliterated
Words and Symbols	Worn, Missing or Obliterated
Pavement Markers	Damaged or Missing
Environmental	
Turf Condition	Bare, Dead, Diseased, Distressed or Weedy
Misc. Vegetation Management	Uncontrolled Growth at Signs or Guardrail

Table 1 – Maintenance Features and Threshold Conditions

Statewide Average - Interstate System

Maintenance Activity	Level of Service									
	+ A -		+ B -		+ C -		+ D -		+ F -	
Pavement										
Pavement							■			
Unpaved Shoulders and Ditches										
Low Shoulder					■					
High Shoulder						■				
Lateral Ditches								■		
Drainage										
Crossline Pipe - Blocked										■
Crossline Pipe - Damaged				■						
Curb & Gutter - Blocked				■						
Curb & Gutter - Damaged	■									
Catch Basin & Drop Inlet - Blocked										■
Catch Basin & Drop Inlet - Damaged				■						
Roadside										
Mowing								■		
Brush & Tree Control									■	
Litter & Debris								■		
Slope		■								
Guardrail		■								
Traffic Control Devices										
Traffic Signs				■						
Pavement Striping									■	
Words & Symbols										■
Pavement Markers										■
Environmental										
Turf Condition									■	
Misc. Vegetation Management										■

■ Average Feature Service Level

Figure 6

Statewide Average - Primary System

Maintenance Activity	Level of Service									
	+ A -		+ B -		+ C -		+ D -		+ F -	
Pavement										
Pavement						■				
Unpaved Shoulders and Ditches										
Low Shoulder										■
High Shoulder								■		
Lateral Ditches				■						
Drainage										
Crossline Pipe - Blocked								■		
Crossline Pipe - Damaged				■						
Curb & Gutter - Blocked				■						
Curb & Gutter - Damaged		■								
Catch Basin & Drop Inlet - Blocked								■		
Catch Basin & Drop Inlet - Damaged				■						
Roadside										
Mowing				■						
Brush & Tree Control						■				
Litter & Debris						■				
Slope				■						
Guardrail				■						
Traffic Control Devices										
Traffic Signs						■				
Pavement Striping						■				
Words & Symbols										■
Pavement Markers										■
Environmental										
Turf Condition								■		
Misc. Vegetation Management										■

■ Average Feature Service Level

Figure 7

Statewide Average - Secondary System

Maintenance Activity	Level of Service									
	+ A -		+ B -		+ C -		+ D -		+ F -	
Pavement										
Pavement								■		
Unpaved Shoulders and Ditches										
Low Shoulder		■								
High Shoulder		■								
Lateral Ditches				■						
Drainage										
Crossline Pipe - Blocked									■	
Crossline Pipe - Damaged				■						
Curb & Gutter - Blocked										
Curb & Gutter - Damaged		■								
Catch Basin & Drop Inlet - Blocked						■				
Catch Basin & Drop Inlet - Damaged				■						
Roadside										
Mowing				■						
Brush & Tree Control						■				
Litter & Debris				■						
Slope										
Guardrail										
Traffic Control Devices										
Traffic Signs								■		
Pavement Striping									■	
Words & Symbols				■						
Pavement Markers										■
Environmental										
Turf Condition						■				
Misc. Vegetation Management				■						

■ Average Feature Service Level

Figure 8

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Road Maintenance Funding Needs for Acceptable Level of Service - Performance Based Activities (all figures in million dollars)				
Maintenance Activity	Interstate	Primary	Secondary	Total
Pavement Maintenance				
Pvmt	\$ 3.11	\$ 94.96	\$ 124.48	\$ 222.55
Subtotal	\$ 3.11	\$ 94.96	\$ 124.48	\$ 222.55
Shoulders & Ditches				
Low Shoulder	\$ 0.39	\$ 8.68	\$ 17.10	\$ 26.17
High Shoulder	\$ 0.44	\$ 4.71	\$ 12.85	\$ 18.01
Blocked Lateral Ditches	\$ 0.43	\$ 2.08	\$ 10.70	\$ 13.21
Subtotal	\$ 1.26	\$ 15.48	\$ 40.65	\$ 57.39
Drainage				
Cross Line Blocked	\$ 0.91	\$ 2.15	\$ 6.65	\$ 9.71
Cross Line Damaged	\$ 0.18	\$ 0.63	\$ 3.68	\$ 4.49
Curb and Gutter Blocked	\$ 0.29	\$ 0.94	\$ 0.64	\$ 1.88
Curb and Gutter Damaged	\$ 0.02	\$ 0.14	\$ 0.27	\$ 0.43
Basin Blocked (Inlet)	\$ 1.71	\$ 2.54	\$ 3.15	\$ 7.40
Basin Damaged (Inlet)	\$ 0.18	\$ 1.04	\$ 1.86	\$ 3.08
Subtotal	\$ 3.30	\$ 7.45	\$ 16.25	\$ 26.99
Roadside				
Grass	\$ 1.26	\$ 5.91	\$ 17.84	\$ 25.01
Brush and Tree	\$ 3.85	\$ 6.59	\$ 13.96	\$ 24.39
Litter	\$ 4.36	\$ 14.87	\$ 6.49	\$ 25.72
Slope	\$ 0.07	\$ 0.49	\$ 0.67	\$ 1.23
Guard Rail (Barrier)	\$ 1.28	\$ 4.36	\$ 1.18	\$ 6.82
Subtotal	\$ 10.82	\$ 32.21	\$ 40.14	\$ 83.16
Traffic Control Devices				
Damaged Signs	\$ 0.85	\$ 5.68	\$ 15.41	\$ 21.93
Damaged Striping	\$ 0.44	\$ 1.80	\$ 14.59	\$ 16.83
Damaged Symbols	\$ 1.01	\$ 2.90	\$ 1.70	\$ 5.61
Damaged Markers	\$ 0.50	\$ 4.74	\$ 4.26	\$ 9.50
Subtotal	\$ 2.80	\$ 15.11	\$ 35.96	\$ 53.86
Environmental				
Turf	\$ 1.35	\$ 3.16	\$ 3.53	\$ 8.04
Uncontrolled Vegetation	\$ 2.82	\$ 4.51	\$ 1.48	\$ 8.81
Subtotal	\$ 4.17	\$ 7.67	\$ 5.01	\$ 16.85
TOTAL	\$ 25.46	\$ 172.88	\$ 262.48	\$ 460.81

Table 2

C.2 – BRIDGE MAINTENANCE

Bridge maintenance consists of those work activities associated with the maintenance and upkeep of bridges, structures, and large culverts. Like road maintenance work activities, these can be subdivided into two categories: (1) Recurring Programs, and (2) Performance Based Activities.

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 is approximately \$37.81 million.

Performance Based Activities

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

Every bridge in the state is inspected in detail once every two years. Survey teams assess the condition of the elements for each bridge. Element conditions are then determined for each bridge and summarized into a statewide Bridge Condition rating. In addition, the survey teams determine the quantity and type of repair needed. This information is used to calculate the statewide bridge maintenance needs.

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Railings



Decks



Expansion Joints



Superstructures



Substructures

Survey Findings

The Bridge Condition Survey identifies levels of service for each element which can be summarized into five levels of service, LOS A through LOS F. Figure 9, shown on the next page, illustrates the average statewide condition of North Carolina structures. In addition to the level of service for each feature or characteristic, the average for each element is also shown.

Figure 9 indicates that some activities are being maintained at an acceptable level (LOS B). However, many activities are being maintained at an unacceptable level. In order to bring those poor activities up to an acceptable condition, additional funding is needed. The five levels of service for each feature along with their associated costs are listed in Appendix D and E. Table 3, on page 26, is a summary of the estimated cost to achieve an acceptable level of service. As seen in the table, \$25.19 million is the estimated cost to fund routine bridge maintenance at an acceptable level of service for the performance based activities.

Statewide Average - Bridges

Maintenance Activity	Level of Service					
	+ A -	+ B -	+ C -	+ D -	+ F -	
Railing						
Concrete		■				
Timber		■				
Aluminum		■				
Steel		■				
Deck						
Concrete			■			
Timber			■			
Steel Planks			■			
Open Grid Steel				■		
Expansion Joints						
Steel Plate				■		
Prefabricated			■			
Compression Seal		■				
Standard Deck			■			
Open		■				
Superstructure						
Concrete				■		
Steel			■			
P/S Concrete		■				
Timber			■			
Substructure						
Timber				■		
Concrete Pile			■			
Steel Pile		■				
Concrete Piers			■			

■ Average Feature Service Level

Figure 9

Federal-Aid Preventative Maintenance Program

Included in the Transportation Improvement Program is a project to address Preventative Maintenance and Safety Issues at selected bridge sites statewide on the Federal-Aid Primary Highway System. This program earmarks approximately \$2 million each year to address some of the bridge needs identified in this report. These needs include items such as deck and joint repair, joint sealing, bridge painting and bridge bearing preventative maintenance. This work has been reflected in the total estimated Highway Maintenance needs listed in Appendix G.

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Bridge Maintenance Funding Needs for Acceptable Level of Service - Performance Based Activities (all figures in million dollars)	
Maintenance Activity	Total Funds Needed
Deck	
Concrete	\$ 5.42
Timber	\$ 1.69
Steel Plank Floor	\$ 0.27
Open Grid Steel	\$ 0.02
Subtotal	\$ 7.40
Railing	
Concrete	\$ 0.84
Timber	\$ 0.03
Aluminum	\$ 0.01
Steel	\$ 0.03
Subtotal	\$ 0.91
Expansion Joints	
Steel Plate	\$ 0.04
Prefabricated	\$ 0.42
Compression Seal	\$ 0.16
Standard Deck	\$ 4.08
Subtotal	\$ 4.71
Superstructure	
Concrete	\$ 0.88
Steel	\$ 5.86
Prestressed Concrete	\$ 0.26
Timber	\$ 0.38
Subtotal	\$ 7.38
Substructure	
Timber	\$ 1.81
Concrete Pile	\$ 0.37
Steel Pile	\$ 0.20
Concrete Pier	\$ 2.42
Subtotal	\$ 4.80
TOTAL	\$ 25.19

Table 3

D – CONTRACT RESURFACING

The Contract Resurfacing Program provides funding for the resurfacing of the paved road system with hot mixed asphalt. In order to preserve the integrity of the pavement structure and to provide a smooth riding surface, it is necessary to resurface paved roads on a regular frequency. Many national studies of pavements and their performance lives indicate that pavements generally deteriorate at a slow rate in the very first years of their life. However, when pavements reach a certain age, they deteriorate at an accelerated pace. Failure to resurface a pavement before it begins a sharp downward trend will result in higher repair costs in maintenance, patching and eventually, if deferred too long, in reconstruction. Furthermore, the rapid growth this state has experienced has placed an additional strain on our highway pavements. Not only are there more cars and trucks traveling our highways, the trucks tend to have heavier payloads, which accelerates the deterioration of the pavements.

In accordance with North Carolina General Statute 136-44.3, the Department has estimated the annual cost of resurfacing based upon cycle lengths of 12 years for the Primary system and 15 years for the Secondary system. However, past experience in North Carolina as well as in other states, has shown that it is more cost effective to utilize a combination of asphalt overlays and other preventive maintenance treatments such as chip seals and slurry seals to extend pavement life and performance. The timing and selection of treatments are largely dependant on traffic and environmental influences and are best determined through the analysis of data collected from routine pavement condition surveys as compared to a purely cyclical approach.

In accordance with the previous discussion on Level of Service from pages 12 and 13 of this report, five different levels of service have been determined based on resurfacing frequency. Table 4 as shown on the next page indicates these five levels along with estimated costs for each resurfacing frequency. Asphalt resurfacing deals with the functional aspects of the road; it improves ride quality and provides a new wearing surface for an aged or environmentally cracked surface. The treatments in Table 4 consist of resurfacing with either 1.5" for primary routes or 1.0" for secondary routes. Table 4 shows that the funding required to maintain both

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systems at the “C” level is \$284.3 million per year. Funding below this level will result in a backlog of pavement needs in one or more systems.

It should be noted that the funding identified in this section does not include any contract resurfacing or rehabilitation needs for the Interstate System. It is anticipated the Transportation Improvement Program will address these needs.

System	Level of Service					
		A	B	C	D	F
Primary	Years	10	11	12	14	>14
	Millions	\$150.43	\$136.75	\$125.40	\$107.45	< \$107.45
Secondary	Years	12	13	15	17	>17
	Millions	\$216.10	\$194.10	\$158.90	\$132.00	< \$132.0
Total	Millions	\$366.53	\$330.85	\$284.30	\$239.45	<\$239.45

Table 4 – Resurfacing Level of Service

Pavement Preservation

In conjunction with the Contract Resurfacing Program, the Department has expanded its preventive maintenance treatment program by using chip seals, slurry seals and micro-surfacing. When applied at the right time, these low-cost treatments help keep good roads in good condition and retard the deterioration caused by weather, traffic and the environmental factors. These treatments typically have a life span of about 6-9 years and cost approximately one-third of what a hot mixed asphalt surface would cost. These treatments can be utilized effectively on most state system highways to extend the service life and get the maximum performance out of our asphalt pavements. While not especially suited for high volume roadways, more than 72,000 miles of the system would benefit from these types of preventive maintenance treatments at an annual cost of about \$87.3 million at a Level of Service B as shown in Table 5. By definition, Level of Service B provides for an emphasis on preventive maintenance.

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Level of Service					
	A	B	C	D	F
System	6 Years	7 Years	8 Years	9 Years	> 9 Years
Primary	\$ 10.4	\$ 9.6	\$ 9.0	\$ 8.5	< \$8.5
Secondary	\$ 84.5	\$ 77.7	\$ 71.8	\$ 66.8	< \$66.8
Total	\$ 94.9	\$ 87.3	\$ 80.8	\$ 75.3	< \$75.3

Table 5 – Retreatment Level of Service

While the cyclical approach of resurfacing on a 12 and 15 year frequency provides a simplistic method to calculate funding needs, it is not a realistic view of how roads are actually treated. Nationally, pavement experts recommend that pavement should be treated with a blend of plant mix resurfacing and surface treatments. (Treatments may also include patching and milling.) A more strategic approach would be to incorporate surface treatments in conjunction with the plant mix resurfacing cycles.

Through the legislative initiatives of Senate Bill 1005 and NC Moving Ahead!, the Department has focused on rehabilitating and modernizing both primary and secondary routes throughout North Carolina. These two programs invested over \$1 billion to improve and preserve our State's roads and bridges. It is anticipated that these initiatives, combined with contract resurfacing and system preservation funding, will allow the treated routes to remain in good condition. Recurring funds provided at the levels indicated in previous Tables 4 and 5, will mean the Department will be in a position to sustain these good pavement conditions through the implementation of a pavement preservation strategy. This strategy will reduce maintenance costs for patching and pavement repairs as well as road user costs, resulting in a long-term savings ratio of at least 4:1 when compared to allowing pavements to deteriorate to poor condition where significant repairs or rehabilitation is required.

E – TRAFFIC SYSTEMS MAINTENANCE

In July 2000, the Department began a comprehensive study of its operation and maintenance of the more than 8,800 traffic signals across North Carolina. As a part of this initiative, a course of action was prepared similar to the other Performance Based activities in this report with the expected outcome to determine the cost to operate and maintain the various traffic signal systems at a “Good” level of service.

The Department has a variety of different types of traffic signal systems to maintain. These systems include: 1) timed-based signals systems, 2) traffic responsive “closed loop” systems where several signals “talk” to each other, and 3) large municipal integrated coordinated traffic systems throughout a city’s core area.

The benefits of maintaining traffic signal systems at a good level of service are increased safety, reduction in the amount of time waiting for the light to change, reduction in fuel consumption, improvement in air quality, and lastly, it makes good business sense to keep signals operating efficiently.

Since 1999, the Department has aggressively replaced many of its outdated incandescent signal bulbs with modern “LED” (Light Emitting Diodes). The benefits of this effort are multifold: (1) These devices last longer than bulbs, reducing trouble calls, and causing less disruption to traffic (2) LEDs use only a fraction of the energy of an incandescent bulb, thereby reducing electricity cost.

The funding for the needs identified in this study have been shared between highway maintenance funds and Federal dollars. The highway maintenance funding level has been fixed at \$ 5.5 million each year for the next several years. The Federal Aid funding for this is \$18 million per year. This funding amount will help to achieve a “C” Level of Service for traffic signal systems.

F – BACKLOG

Most people will agree that backlog is the accumulation of unfinished work. For the State Highway System, the existence of a backlog may be attributed to the continual underfunding of maintenance programs over time. Adequate funding of a maintenance program where a backlog already exists will not reduce the backlog; it will only stop its growth. Conversely, eliminating the backlog along with adequately funding maintenance will prevent the growth of any backlog. Over the last several years, maintenance funding has not kept up with the need; therefore, the maintenance condition of our highways has suffered and a backlog of work has developed. The extent and effect of this “backlog” figure is real and continues to eat away at maintenance dollars. Previous reports have attempted to address backlog; however, adequate funding was not provided. While the Department was addressing backlog reduction in one area, it was growing in another. Based on lessons learned from the past and on the information from our surveys, the first step should be the adequate funding of maintenance at the level previously identified in the report in order to stop the growth of backlog. Once backlog growth has been stopped, then and only then can it be reduced. Based on our surveys, it is estimated that the value of the highway maintenance backlog is \$437.21 million and that of contract resurfacing is \$ 687.50 million. Obviously, these costs are too large to be funded or effectively expended in any one year; therefore one strategy might be to amortize these costs over a period of time. A strategy of spreading the cost of the maintenance backlog and the contract resurfacing backlog over a 10-year period is shown in Appendix F.

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G – SUMMARY AND CONCLUSIONS

Throughout this report, the annual maintenance and resurfacing needs have been identified and described. These activities make up the Department's road and bridge maintenance operations. As required by G.S. 136-44.3, this report documents the efforts of the Department of Transportation to provide the Joint Legislative Transportation Oversight Committee with an accurate analysis of the condition of the State Highway System and the funding levels needed to provide a minimum acceptable level of service. The completion of new and wider freeways along with the paving of approximately 500-600 miles of Secondary Roads a year places an additional burden on the maintenance budget. Each year, the funding of some popular programs and maintenance activities are in danger of being scaled back or eliminated due to funding constraints. Activities such as the Raised Pavement Marker Program, Vegetation Management Program, Litter and Debris removal, etc. are the first to be reduced when faced with a funding shortfall. In times of tight fiscal constraints, any program or activity that can be reduced or eliminated without seriously jeopardizing safety will be considered.

In order to provide for the continual maintenance of the highway system in an acceptable condition and catch-up on the maintenance and resurfacing backlogs, adequate funding levels must be provided. The chart below summarizes the funding levels needed to provide a minimum acceptable level of service as required by G.S. 136-44.3.

Category	Funding Needs
Annual Routine Maintenance	\$ 743.35 million
Annual Resurfacing	\$ 284.30 million
Backlog of Routine Maintenance (10%/yr)	\$ 48.14 million
Backlog of Resurfacing (10%/yr)	\$ 68.75 million
Disasters & Emergencies	\$ 30.00 million
TOTAL NEEDS	\$1,174.54 million

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Based on this funding level, the Department would propose to develop a statewide annual maintenance funding plan similar to that shown in Appendix G. This plan would not only allow the establishment of a sound maintenance program that would provide an acceptable level of service, but would also address the backlog which continues to reduce the condition of the highway system.

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APPENDIX INDEX

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BACKLOG REDUCTION STRATEGY	APPENDIX F
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Paved Lane Miles

Year	Lane Miles			Cumulative Total	
	Primary	Secondary	Total	Mileage	Percent
1995	35,965	107,057	143,022		
1996	36,279	108,424	144,703	1,681	1.2%
1997	36,547	110,221	146,768	3,746	2.6%
1998	36,900	113,706	150,606	7,584	5.3%
1999	36,978	115,279	152,257	9,235	6.5%
2000	37,483	116,877	154,360	11,338	7.9%
2001	37,791	118,169	155,960	12,938	9.0%
2002	37,791	118,169	155,960	12,938	9.0%
2003	38,093	120,499	158,592	15,570	10.9%
2004	38,444	121,339	159,783	16,761	11.7%
2005	38,698	121,911	160,609	17,587	12.3%

Bridge Deck Area

Year	Total	Bridge Deck Area	Cumulative Change	
	Bridges	(Square Feet)	Square Feet	Percent
1995	17,089	66,179,519		
1996	17,088	66,892,675	713,156	1.1%
1997	17,077	67,794,862	1,615,343	2.4%
1998	17,145	68,829,594	2,650,075	4.0%
1999	17,263	69,679,605	3,500,086	5.3%
2000	17,410	71,298,167	5,118,648	7.7%
2001	17,463	72,290,160	6,110,641	9.2%
2002	17,526	75,342,236	9,162,717	13.8%
2003	17,635	76,391,052	10,211,533	15.4%
2004	17,775	78,399,401	12,219,882	18.5%
2005	17,848	79,750,414	13,570,895	20.5%

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ROAD MAINTENANCE PERFORMANCE MEASURES - Interstate

ELEMENT 1			Service Level					Acceptable Level of Service
Roadway Pavement			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Pavement Maintenance	Pavement Condition Rating	PCR	98	93	86	70	< 70	B

ELEMENT 2			Service Level					Acceptable Level of Service
Unpaved Shoulders and Ditches			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Low Shoulder	Low \geq 2 inches	FT	2%	4%	7%	10%	> 10%	B
High Shoulder	High \geq 1 inch	FT	2%	4%	7%	10%	> 10%	B
Blocked Lateral Ditches	Blocked \geq 50% & not funct. as designed	FT	2%	6%	9%	12%	> 12%	B

ELEMENT 3			Service Level					Acceptable Level of Service
Drainage			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Crossline Pipe Blocked	Blocked \geq 50%	EA	1%	3%	4%	6%	> 6%	B
Crossline Pipe Damaged	Damaged or Deteriorated	EA	1%	3%	4%	6%	> 6%	B
Curb & Gutter Blocked	Blocked \geq 2 in x 2 ft	FT	2%	5%	7%	10%	> 10%	B
Curb & Gutter Damaged	Damaged or Deteriorated	FT	2%	5%	7%	10%	> 10%	B
Catch Basin & Drop Inlet Blocked	Blocked \geq 25%	EA	2%	5%	8%	11%	> 11%	B
Catch Basin & Drop Inlet Damaged	Damaged, or Grate Problem	EA	2%	5%	8%	11%	> 11%	B

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ROAD MAINTENANCE PERFORMANCE MEASURES - Interstate

ELEMENT 4			Service Level					Acceptable Level of Service
Roadside			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Mowing	Average Grass Height	IN	6	8	10	14	> 14	C
Brush & Tree Control	Within 15' above, 10' back of ditch/shoulder	FT	2%	7%	12%	17%	> 17%	C
Litter & Debris	Number of Pieces \geq Fist-Sized	PCS	25	56	100	190	> 190	C
Slope	Failures \geq 1 ft wide	FT	1%	2%	4%	6%	> 6%	B
Guardrail	Damaged, or Not Functioning as designed	FT	1%	2%	4%	6%	> 6%	A

ELEMENT 5			Service Level					Acceptable Level of Service
Traffic Control Devices			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Traffic Signs	Illegible, Missing, or Obliterated	EA	1%	3%	5%	7%	> 7%	B
Pavement Striping	Worn, Missing, or Obliterated	FT	2%	4%	7%	10%	> 10%	B
Words & Symbols	Worn, Missing, or Obliterated	EA	1%	2%	3%	4%	> 4%	B
Pavement Markers	Damaged or Missing	EA	2%	5%	8%	13%	> 13%	B

ELEMENT 6			Service Level					Acceptable Level of Service
Environmental			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Turf Condition	Bare, Dead, Diseased, Distressed, or Weedy	FT	2%	6%	10%	14%	> 14%	C
Misc. Vegetation Mgmt.	Uncontrolled Growth at Signs or Guardrail	FT	5%	10%	15%	20%	> 20%	C

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ROAD MAINTENANCE PERFORMANCE MEASURES - Primary

ELEMENT 1			Service Level					Acceptable Level of Service
Roadway Pavement			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Pavement Maintenance	Pavement Condition Rating	PCR	98	93	86	70	< 70	C

ELEMENT 2			Service Level					Acceptable Level of Service
Unpaved Shoulders and Ditches			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Low Shoulder	Low ≥ 2 inches	FT	1%	5%	8%	11%	> 11%	C
High Shoulder	High ≥ 1 inch	FT	1%	4%	6%	10%	> 10%	C
Lateral Ditches	Blocked $\geq 50\%$ & not funct. as designed	FT	2%	6%	9%	12%	> 12%	C

ELEMENT 3			Service Level					Acceptable Level of Service
Drainage			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Crossline Pipe Blocked	Blocked $\geq 50\%$	EA	2%	7%	11%	15%	> 15%	C
Crossline Pipe Damaged	Damaged or Deteriorated	EA	2%	7%	11%	15%	> 15%	C
Curb & Gutter Blocked	Blocked ≥ 2 in x 2 ft	FT	2%	5%	7%	11%	> 11%	C
Curb & Gutter Damaged	Damaged or Deteriorated	FT	2%	5%	7%	11%	> 11%	C
Catch Basin & Drop Inlet Blocked	Blocked $\geq 25\%$	EA	2%	5%	8%	12%	> 12%	C
Catch Basin & Drop Inlet Damaged	Damaged, or Grate Problem	EA	2%	5%	8%	12%	> 12%	C

ROAD MAINTENANCE PERFORMANCE MEASURES - Primary

ELEMENT 4			Service Level					Acceptable Level of Service
Roadside			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Mowing	Average Grass Height	IN	6	8	10	14	> 14	C
Brush & Tree Control	Within 15' above, 10' back of ditch/shoulder	FT	5%	10%	15%	25%	> 25%	C
Litter & Debris	Number of Pieces \geq Fist-Sized	PCS	30	60	120	200	> 200	C
Slope	Failures \geq 1 ft wide	FT	1%	3%	5%	7%	> 7%	B
Guardrail	Damaged, or Not Functioning as designed	FT	1%	3%	5%	7%	> 7%	A

ELEMENT 5			Service Level					Acceptable Level of Service
Traffic Control Devices			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Traffic Signs	Illegible, Missing, or Obliterated	EA	1%	3%	6%	8%	> 8%	C
Pavement Striping	Worn, Missing, or Obliterated	FT	2%	5%	8%	11%	> 11%	C
Words & Symbols	Worn, Missing, or Obliterated	EA	1%	4%	8%	11%	> 11%	C
Pavement Markers	Damaged or Missing	EA	5%	10%	15%	20%	> 20%	B

ELEMENT 6			Service Level					Acceptable Level of Service
Environmental			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Turf Condition	Bare, Dead, Diseased, Distressed, or Weedy	FT	3%	7%	11%	15%	> 15%	C
Misc. Vegetation Mgmt.	Uncontrolled Growth at Signs or Guardrail	FT	5%	10%	15%	25%	> 25%	C

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ROAD MAINTENANCE PERFORMANCE MEASURES - Secondary

ELEMENT 1			Service Level					Acceptable Level of Service
Roadway Pavement			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Pavement Maintenance	Pavement Condition Rating	PCR	98	93	86	70	< 70	C

ELEMENT 2			Service Level					Acceptable Level of Service
Unpaved Shoulders and Ditches			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Low Shoulder	Low ≥ 2 inches	FT	2%	5%	8%	11%	> 11%	C
High Shoulder	High ≥ 1 inch	FT	2%	5%	8%	11%	> 11%	C
Lateral Ditches	Blocked $\geq 50\%$ & not funct. as designed	FT	3%	6%	8%	11%	> 11%	C
Lateral Ditch Erosion	Eroded ≥ 1 ft	FT	1%	2%	3%	4%	> 4%	C

ELEMENT 3			Service Level					Acceptable Level of Service
Drainage			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Crossline Pipe Blocked	Blocked $\geq 50\%$	EA	5%	10%	14%	22%	> 22%	C
Crossline Pipe Damaged	Damaged or Deteriorated	EA	5%	10%	14%	22%	> 22%	C
Curb & Gutter Blocked	Blocked ≥ 2 in x 2 ft	FT	2%	5%	8%	12%	> 12%	C
Curb & Gutter Damaged	Damaged or Deteriorated	FT	2%	5%	8%	12%	> 12%	C
Catch Basin & Drop Inlet Blocked	Blocked $\geq 25\%$	EA	2%	5%	10%	13%	> 13%	C
Catch Basin & Drop Inlet Damaged	Damaged, or Grate Problem	EA	2%	5%	10%	13%	> 13%	C

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ROAD MAINTENANCE PERFORMANCE MEASURES - Secondary

ELEMENT 4			Service Level					Acceptable Level of Service
Roadside			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Mowing	Average Grass Height	IN	6	8	10	14	> 14	C
Brush & Tree Control	Within 15' above, 10' back of ditch/shoulder	FT	10%	15%	20%	30%	> 30%	C
Litter & Debris	Number of Pieces \geq Fist-Sized	PCS	30	60	120	200	> 200	C
Slope	Failures \geq 1 ft wide	FT	1%	3%	5%	7%	> 7%	C
Guardrail	Damaged, or Not Functioning as designed	FT	1%	3%	5%	7%	> 7%	A

ELEMENT 5			Service Level					Acceptable Level of Service
Traffic Control Devices			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Traffic Signs	Illegible, Missing, or Obliterated	EA	3%	4%	7%	9%	> 9%	C
Pavement Striping	Worn, Missing, or Obliterated	FT	3%	6%	10%	15%	> 15%	C
Words & Symbols	Worn, Missing, or Obliterated	EA	3%	7%	11%	15%	> 15%	C
Pavement Markers	Damaged or Missing	EA	5%	10%	15%	25%	> 25%	B

ELEMENT 6			Service Level					Acceptable Level of Service
Environmental			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Turf Condition	Bare, Dead, Diseased, Distressed, or Weedy	FT	3%	8%	12%	16%	> 16%	C
Misc. Vegetation Mgmt.	Uncontrolled Growth at Signs or Guardrail	FT	10%	15%	20%	30%	> 30%	C

Road Maintenance Funding Matrix Table

Performance Based Activities

Maintenance Activity	Interstate System			
	TOTAL COST A	TOTAL COST B	TOTAL COST C	TOTAL COST D
Pavements	\$ 3,963,032	\$ 2,963,032	\$ 2,713,032	\$ 1,963,032
Subtotal	\$ 3,963,032	\$ 2,963,032	\$ 2,713,032	\$ 1,963,032
Shoulders & Ditches				
Low Shoulder	\$ 745,507	\$ 372,753	\$ 213,002	\$ 149,101
High Shoulder	\$ 842,519	\$ 421,259	\$ 240,720	\$ 168,504
Blocked Lateral Ditches	\$ 1,232,217	\$ 410,739	\$ 273,826	\$ 205,370
Subtotal	\$ 2,820,243	\$ 1,204,752	\$ 727,548	\$ 522,975
Drainage				
Cross Line Blocked	\$ 2,600,742	\$ 866,914	\$ 650,186	\$ 433,457
Cross Line Damaged	\$ 508,704	\$ 169,568	\$ 127,176	\$ 84,784
Curb and Gutter Blocked	\$ 700,345	\$ 280,138	\$ 200,099	\$ 140,069
Curb and Gutter Damaged	\$ 44,395	\$ 17,758	\$ 12,684	\$ 8,879
Basin Blocked (Inlet)	\$ 4,081,237	\$ 1,632,495	\$ 1,020,309	\$ 742,043
Basin Damaged (Inlet)	\$ 439,999	\$ 175,999	\$ 110,000	\$ 80,000
Subtotal	\$ 8,375,422	\$ 3,142,873	\$ 2,120,453	\$ 1,489,232
Roadside				
Mowing	\$ 1,439,936	\$ 1,199,947	\$ 959,957	\$ 719,968
Brush & Tree Control	\$ 21,973,606	\$ 6,278,173	\$ 3,662,268	\$ 2,585,130
Litter & Debris	\$ 5,536,296	\$ 4,152,222	\$ 2,768,148	\$ 2,076,111
Slope Failure	\$ 134,323	\$ 67,161	\$ 33,581	\$ 22,387
Guardrail	\$ 1,223,500	\$ 611,750	\$ 305,875	\$ 203,917
Subtotal	\$ 30,307,661	\$ 12,309,253	\$ 7,729,828	\$ 5,607,513
Traffic Control Devices				
Traffic Signs	\$ 2,420,410	\$ 806,803	\$ 484,082	\$ 345,773
Pavement Striping	\$ 835,446	\$ 417,723	\$ 238,699	\$ 167,089
Words & Symbols	\$ 1,918,717	\$ 959,358	\$ 639,572	\$ 479,679
Pavement Markers	\$ 1,198,467	\$ 479,387	\$ 299,617	\$ 184,380
Subtotal	\$ 6,373,040	\$ 2,663,272	\$ 1,661,970	\$ 1,176,921
Environmental				
Turf Condition	\$ 6,438,273	\$ 2,146,091	\$ 1,287,655	\$ 919,753
Misc. Vegetation Management	\$ 8,043,646	\$ 4,021,823	\$ 2,681,215	\$ 2,010,911
Subtotal	\$ 14,481,919	\$ 6,167,914	\$ 3,968,870	\$ 2,930,665
Total	\$ 66,321,318	\$ 28,451,096	\$ 18,921,701	\$ 13,690,337

Road Maintenance Funding Matrix Table Performance Based Activities

Maintenance Activity	Primary System			
	TOTAL COST A	TOTAL COST B	TOTAL COST C	TOTAL COST D
Pavements	\$ 219,480,496	\$ 178,730,614	\$ 90,439,614	\$ 8,940,110
Subtotal	\$ 219,480,496	\$ 178,730,614	\$ 90,439,614	\$ 8,940,110
Shoulders & Ditches				
Low Shoulder	\$ 66,137,778	\$ 13,227,556	\$ 8,267,222	\$ 6,012,525
High Shoulder	\$ 26,934,277	\$ 6,733,569	\$ 4,489,046	\$ 2,693,428
Blocked Lateral Ditches	\$ 8,923,641	\$ 2,974,547	\$ 1,983,031	\$ 1,487,274
Subtotal	\$ 101,995,697	\$ 22,935,672	\$ 14,739,300	\$ 10,193,227
Drainage				
Cross Line Blocked	\$ 11,260,012	\$ 3,217,146	\$ 2,047,275	\$ 1,501,335
Cross Line Damaged	\$ 3,312,034	\$ 946,295	\$ 602,188	\$ 441,605
Curb and Gutter Blocked	\$ 3,142,619	\$ 1,257,048	\$ 897,891	\$ 571,385
Curb and Gutter Damaged	\$ 474,619	\$ 189,847	\$ 135,605	\$ 86,294
Basin Blocked (Inlet)	\$ 9,683,862	\$ 3,873,545	\$ 2,420,966	\$ 1,613,977
Basin Damaged (Inlet)	\$ 3,956,348	\$ 1,582,539	\$ 989,087	\$ 659,391
Subtotal	\$ 31,829,494	\$ 11,066,421	\$ 7,093,012	\$ 4,873,988
Roadside				
Mowing	\$ 6,751,832	\$ 5,626,526	\$ 4,501,221	\$ 3,375,916
Brush & Tree Control	\$ 18,814,506	\$ 9,407,253	\$ 6,271,502	\$ 4,703,627
Litter & Debris	\$ 28,327,509	\$ 18,885,006	\$ 14,163,754	\$ 9,442,503
Slope Failure	\$ 1,395,268	\$ 465,089	\$ 279,054	\$ 199,324
Guardrail	\$ 4,148,362	\$ 1,382,787	\$ 829,672	\$ 592,623
Subtotal	\$ 59,437,477	\$ 35,766,662	\$ 26,045,203	\$ 18,313,993
Traffic Control Devices				
Traffic Signs	\$ 32,430,810	\$ 10,810,270	\$ 5,405,135	\$ 4,053,851
Pavement Striping	\$ 6,851,355	\$ 2,740,542	\$ 1,712,839	\$ 1,245,701
Words & Symbols	\$ 22,094,338	\$ 5,523,585	\$ 2,761,792	\$ 2,008,576
Pavement Markers	\$ 9,023,119	\$ 4,511,560	\$ 3,007,706	\$ 2,255,780
Subtotal	\$ 70,399,622	\$ 23,585,956	\$ 12,887,472	\$ 9,563,908
Environmental				
Turf Condition	\$ 11,018,484	\$ 4,722,208	\$ 3,005,041	\$ 2,203,697
Misc. Vegetation Management	\$ 5,142,651	\$ 4,721,123	\$ 4,299,592	\$ 3,878,065
Subtotal	\$ 16,161,135	\$ 9,443,331	\$ 4,299,592	\$ 6,081,762
Total	\$ 499,303,921	\$ 281,528,655	\$ 155,504,193	\$ 57,966,987

Road Maintenance Funding Matrix Table

Performance Based Activities

Maintenance Activity	Secondary System			
	TOTAL COST A	TOTAL COST B	TOTAL COST C	TOTAL COST D
Pavements	\$ 236,775,212	\$ 189,486,785	\$ 118,554,143	\$ 44,074,870
Subtotal	\$ 236,775,212	\$ 189,486,785	\$ 118,554,143	\$ 44,074,870
Shoulders & Ditches				
Low Shoulder	\$ 65,141,746	\$ 26,056,698	\$ 16,285,436	\$ 11,843,954
High Shoulder	\$ 48,950,041	\$ 19,580,016	\$ 12,237,510	\$ 8,900,007
Blocked Lateral Ditches	\$ 27,170,096	\$ 13,585,048	\$ 10,188,786	\$ 7,410,026
Subtotal	\$ 141,261,883	\$ 59,221,763	\$ 38,711,733	\$ 28,153,987
Drainage				
Cross Line Blocked	\$ 17,738,216	\$ 8,869,108	\$ 6,335,077	\$ 4,031,413
Cross Line Damaged	\$ 9,819,487	\$ 4,909,744	\$ 3,506,960	\$ 2,231,702
Curb and Gutter Blocked	\$ 2,438,216	\$ 975,286	\$ 609,554	\$ 406,369
Curb and Gutter Damaged	\$ 1,021,869	\$ 408,748	\$ 255,467	\$ 170,311
Basin Blocked (Inlet)	\$ 14,992,846	\$ 5,997,138	\$ 3,748,212	\$ 2,306,592
Basin Damaged (Inlet)	\$ 8,833,728	\$ 3,533,491	\$ 2,208,432	\$ 1,359,035
Subtotal	\$ 54,844,362	\$ 24,693,515	\$ 16,663,702	\$ 10,505,422
Roadside				
Mowing	\$ 21,242,905	\$ 16,994,324	\$ 12,745,743	\$ 8,497,162
Brush & Tree Control	\$ 26,592,249	\$ 17,728,166	\$ 13,296,125	\$ 8,864,083
Litter & Debris	\$ 18,528,930	\$ 9,264,465	\$ 6,176,310	\$ 4,632,233
Slope Failure	\$ 3,179,480	\$ 1,059,827	\$ 635,896	\$ 454,211
Guardrail	\$ 1,121,372	\$ 373,791	\$ 224,274	\$ 160,196
Subtotal	\$ 70,664,936	\$ 45,420,573	\$ 33,078,348	\$ 22,607,886
Traffic Control Devices				
Traffic Signs	\$ 34,235,895	\$ 25,676,921	\$ 14,672,526	\$ 11,411,965
Pavement Striping	\$ 46,313,884	\$ 23,156,942	\$ 13,894,165	\$ 9,262,777
Words & Symbols	\$ 5,952,770	\$ 2,551,187	\$ 1,623,483	\$ 1,190,554
Pavement Markers	\$ 8,110,000	\$ 4,055,000	\$ 2,703,333	\$ 2,317,143
Subtotal	\$ 94,612,549	\$ 55,440,050	\$ 32,893,508	\$ 24,182,439
Environmental				
Turf Condition	\$ 13,444,510	\$ 5,041,691	\$ 3,361,128	\$ 2,520,846
Misc. Vegetation Management	\$ 2,817,371	\$ 1,878,247	\$ 1,408,686	\$ 939,124
Subtotal	\$ 16,261,881	\$ 6,919,939	\$ 4,769,813	\$ 3,459,969
Total	\$ 614,420,824	\$ 381,182,625	\$ 244,671,246	\$ 132,984,573

2006 Report on the Condition of the State Highway System

BRIDGE MAINTENANCE PERFORMANCE MEASURES

			Service Level					Acceptable Level of Service
Bridge Elements			A	B	C	D	F	
Activities	Condition Indicators	Performance Measures	Threshold	Threshold	Threshold	Threshold	Threshold	
Railings	Bridge Condition Rating	BCR	8	7	6	5	> 5	B
Decks	Bridge Condition Rating	BCR	8	7	6	5	> 5	B
Expansion Joints	Bridge Condition Rating	BCR	8	7	6	5	> 5	B
Superstructure	Bridge Condition Rating	BCR	8	7	6	5	> 5	B
Substructure	Bridge Condition Rating	BCR	8	7	6	5	> 5	B

Bridge Maintenance Funding Matrix Table

Performance Based Activities

Maintenance Activity	TOT COST "A"	TOT COST "B"	TOT COST "C"	TOT COST "D"	TOT COST "F"
Deck					
Concrete	\$6,620,000	\$5,159,000	\$3,859,000	\$1,917,000	\$938,000
Timber	\$1,949,000	\$1,611,000	\$1,262,000	\$807,000	\$586,000
Steel Plank Floor	\$319,000	\$254,000	\$258,000	\$171,000	\$128,000
Open Grid Steel	\$22,000	\$21,000	\$21,000	\$18,000	\$19,000
Subtotal	\$8,910,000	\$7,045,000	\$5,400,000	\$2,913,000	\$1,671,000
Railing					
Concrete	\$1,055,000	\$797,000	\$580,000	\$200,000	\$64,000
Timber	\$40,000	\$31,000	\$23,000	\$11,000	\$5,000
Aluminum	\$10,000	\$8,000	\$6,000	\$3,000	\$2,000
Steel	\$36,000	\$28,000	\$21,000	\$9,000	\$5,000
Subtotal	\$1,141,000	\$864,000	\$630,000	\$223,000	\$76,000
Expansion Joints					
Steel Plate	\$43,000	\$36,000	\$33,000	\$26,000	\$20,000
Prefabricated	\$484,000	\$404,000	\$269,000	\$178,000	\$109,000
Compression Seal	\$192,000	\$157,000	\$126,000	\$82,000	\$57,000
Standard Deck	\$4,742,000	\$3,885,000	\$2,524,000	\$1,588,000	\$811,000
Subtotal	\$5,461,000	\$4,482,000	\$2,952,000	\$1,874,000	\$997,000
Superstructure					
Concrete	\$1,082,000	\$837,000	\$606,000	\$322,000	\$117,000
Steel	\$6,860,000	\$5,578,000	\$4,561,000	\$3,100,000	\$1,998,000
Prestressed Concrete	\$295,000	\$247,000	\$205,000	\$141,000	\$110,000
Timber	\$441,000	\$364,000	\$285,000	\$217,000	\$132,000
Subtotal	\$8,678,000	\$7,026,000	\$5,657,000	\$3,780,000	\$2,357,000
Substructure					
Timber	\$2,130,000	\$1,726,000	\$1,348,000	\$868,000	\$541,000
Concrete Pile	\$412,000	\$356,000	\$309,000	\$229,000	\$198,000
Steel Pile	\$229,000	\$192,000	\$160,000	\$109,000	\$86,000
Concrete Pier	\$2,929,000	\$2,300,000	\$1,708,000	\$971,000	\$451,000
Subtotal	\$5,700,000	\$4,574,000	\$3,525,000	\$2,177,000	\$1,276,000
Total	\$29,890,000	\$23,991,000	\$18,164,000	\$10,967,000	\$6,377,000

BACKLOG REDUCTION STRATEGY

Maintenance Programs	Total	FISCAL YEAR									
		2007-2008	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013	2013-14	2014-15	2015-16	2016-17
Road Maintenance											
Pavements	\$ 156.98	\$ 15.70	\$ 16.48	\$ 17.31	\$ 18.17	\$ 19.08	\$ 20.04	\$ 21.04	\$ 22.09	\$ 23.19	\$ 24.35
Shoulders & Ditches	\$ 13.57	\$ 1.36	\$ 1.42	\$ 1.50	\$ 1.57	\$ 1.65	\$ 1.73	\$ 1.82	\$ 1.91	\$ 2.00	\$ 2.11
Drainage	\$ 5.88	\$ 0.59	\$ 0.62	\$ 0.65	\$ 0.68	\$ 0.71	\$ 0.75	\$ 0.79	\$ 0.83	\$ 0.87	\$ 0.91
Roadside	\$ 13.79	\$ 1.38	\$ 1.45	\$ 1.52	\$ 1.60	\$ 1.68	\$ 1.76	\$ 1.85	\$ 1.94	\$ 2.04	\$ 2.14
Traffic Control Devices	\$ 15.52	\$ 1.55	\$ 1.63	\$ 1.71	\$ 1.80	\$ 1.89	\$ 1.98	\$ 2.08	\$ 2.18	\$ 2.29	\$ 2.41
Environmental	\$ 5.81	\$ 0.58	\$ 0.61	\$ 0.64	\$ 0.67	\$ 0.71	\$ 0.74	\$ 0.78	\$ 0.82	\$ 0.86	\$ 0.90
Traffic Signals (SHUP, LEDS, ETC)	\$ 5.00	\$ 1.00	\$ 1.05	\$ 1.10	\$ 1.16	\$ 1.22	\$ -	\$ -	\$ -	\$ -	\$ -
Subtotal	\$ 216.55	\$ 22.16	\$ 23.26	\$ 24.43	\$ 25.65	\$ 26.93	\$ 27.00	\$ 28.35	\$ 29.77	\$ 31.26	\$ 32.82
Bridge Maintenance											
Railings	\$ 2.47	\$ 0.25	\$ 0.26	\$ 0.27	\$ 0.29	\$ 0.30	\$ 0.32	\$ 0.33	\$ 0.35	\$ 0.36	\$ 0.38
Bridge Decks	\$ 59.21	\$ 5.92	\$ 6.22	\$ 6.53	\$ 6.85	\$ 7.20	\$ 7.56	\$ 7.93	\$ 8.33	\$ 8.75	\$ 9.19
Expansion Joints	\$ 18.26	\$ 1.83	\$ 1.92	\$ 2.01	\$ 2.11	\$ 2.22	\$ 2.33	\$ 2.45	\$ 2.57	\$ 2.70	\$ 2.83
Superstructures	\$ 67.29	\$ 6.73	\$ 7.07	\$ 7.42	\$ 7.79	\$ 8.18	\$ 8.59	\$ 9.02	\$ 9.47	\$ 9.94	\$ 10.44
Substructure	\$ 34.29	\$ 3.43	\$ 3.60	\$ 3.78	\$ 3.97	\$ 4.17	\$ 4.38	\$ 4.60	\$ 4.82	\$ 5.07	\$ 5.32
Small pipe replacement	\$ 39.14	\$ 7.83	\$ 8.22	\$ 8.63	\$ 9.06	\$ 9.51					
Subtotal	\$ 220.66	\$ 25.98	\$ 27.28	\$ 28.64	\$ 30.08	\$ 31.58	\$ 23.17	\$ 24.33	\$ 25.54	\$ 26.82	\$ 28.16
Total Maintenance Backlog	\$ 437.21	\$ 48.14	\$ 50.54	\$ 53.07	\$ 55.72	\$ 58.51	\$ 50.17	\$ 52.68	\$ 55.31	\$ 58.07	\$ 60.98
Contract Resurfacing Backlog	\$ 687.50	\$ 68.75	\$ 72.19	\$ 75.80	\$ 79.59	\$ 83.57	\$ 87.74	\$ 92.13	\$ 96.74	\$ 101.58	\$ 106.65
Grand Total	\$ 1,124.71	\$ 116.89	\$ 122.73	\$ 128.87	\$ 135.31	\$ 142.07	\$ 137.91	\$ 144.81	\$ 152.05	\$ 159.65	\$ 167.63

all figures are in million dollars

STATEWIDE ANNUAL MAINTENANCE FUNDING PLAN

Maintenance Programs	Fiscal Year Funding Need (million dollars)					
	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13
Annual Cost of Routine Maintenance	\$ 743.35	\$ 777.97	\$ 814.32	\$ 852.48	\$ 892.55	\$ 934.61
Cost of Eliminating Maint. Backlog	\$ 48.14	\$ 50.54	\$ 53.07	\$ 55.72	\$ 58.51	\$ 50.17
Annual Cost of Resurfacing	\$ 284.30	\$ 298.52	\$ 313.44	\$ 329.11	\$ 345.57	\$ 362.85
Cost of Eliminating Resurf. Backlog	\$ 68.75	\$ 72.19	\$ 75.80	\$ 79.59	\$ 83.57	\$ 87.74
Disasters & Emergencies	\$ 30.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00	\$ 15.00
Total Maintenance Funding Need	\$ 1,174.54	\$ 1,214.22	\$ 1,271.63	\$ 1,331.90	\$ 1,395.19	\$ 1,450.37
Supplemental Maintenance Funds	\$ 93.50	\$ 93.50	\$ 93.50	\$ 93.50	\$ 93.50	\$ 93.50
Adjusted Total Maintenance Funding Needed	\$ 1,081.04	\$ 1,120.72	\$ 1,178.13	\$ 1,238.40	\$ 1,301.69	\$ 1,356.87
Estimated Maintenance Fund Allocation	\$ 881.70	\$ 881.70	\$ 881.70	\$ 881.70	\$ 881.70	\$ 881.70
Estimated Maintenance Fund Shortfall	\$ 199.34	\$ 239.02	\$ 296.43	\$ 356.70	\$ 419.99	\$ 475.17