

Under the guidance of the North Carolina Section of ASCE and its Board of Directors, this document was prepared by a group of volunteer professional engineers, with assistance from many public agencies and organizations providing invaluable data for this evaluation. In conjunction with ASCE staff, and a Blue Ribbon Panel of Experts, the North Carolina Infrastructure Report Card findings and evaluation was reviewed for objectivity, and consistency. This document would not have been possible without these volunteer's effort in finding, analyzing, reducing and presenting this information in a simplified manner.

## REPORT CARD AUTHORS

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### *Aviation and Roads*

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## BLUE RIBBON PANEL OF EXPERTS

Leaders in the Engineering Industry were called upon to assist in the review of the Report Card “White Papers” that summarized the data evaluation and assessment efforts and the the development of the grade and recommendations. This independent review aided in preparing an objective and consistent assessment of each infrastructure category.

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# GRADING METHODOLOGY

## 2006 NORTH CAROLINA INFRASTRUCTURE REPORT CARD

This first North Carolina's Infrastructure Report Card was published by the North Carolina Section of the American Society of Civil Engineers (ASCE) to raise public awareness of the impact crumbling infrastructure is having on our daily lives, and the many issues and decisions that face our state as we strive to maintain and improve our infrastructure. We believe discussion of the issues detailed in this report will lead to a greater understanding of the current and future needs of our state, prompting decision makers in our communities and in the legislature to formulate policies and provide the necessary funding to address North Carolina's infrastructure needs.

The Report Card evaluates North Carolina's infrastructure in nine critical areas—Airports, Bridges, Dams, Drinking Water, Rail, Roads, Schools, Storm Water and Wastewater. Overall grades were given to each category, and supporting information on existing conditions, trends and concerns, and policy options were provided, as well as recommendations for future action. The Report Card, prepared by the North Carolina Section, was modeled after the Report Card for America's Infrastructure released by ASCE National in 2005 ([www.infrastructurereportcard.org](http://www.infrastructurereportcard.org)).

A committee of 25 volunteer professional engineers from across the state were assembled to collect data, review and evaluate the information obtained and to develop the grades and recommendations. Also, in an effort to maintain an objective and consistent perspective on the findings and grading, the committee called upon a Blue Ribbon Panel of recognized public and private engineering professionals to evaluate their findings.

Grades were assigned on the basis of condition and capacity, and funding verses need—generally following a traditional grading scale (e.g., if only 77 percent of roads were found to be in good condition or better, a grade of C assigned). The following grading scale was used for the overall category assessments: A = Exceptional; B = Good; C = Fair; D = Poor; and F = Inadequate.

In some cases, category grades were adjusted if the expectations for a particular performance criterion did not meet the traditional grading scale, or if the data was incomplete. Due to the many factors that can impact infrastructure's overall performance, some categories were given individual grades in multiple areas of assessment, which were then averaged to create the overall category grade.

In addition to numeric data, qualitative information was also used to make modifications to the grades. Also, for several infrastructure categories, hard data was not readily available in all areas, which required more subjective assessments to be made. All grades were critiqued by the Review Panel for objectivity and consistency before being finalized.

	Airports	Bridges	Dams	Drinking Water	Rail	Roads	Schools	Storm Water	Wastewater
National	D+	C	D	D-	C-	D	D	N/A	D-
<b>State</b>	<b>D+</b>	<b>C-</b>	<b>D</b>	<b>C+</b>	<b>B-</b>	<b>D</b>	<b>D+</b>	<b>C-</b>	<b>C-</b>

Aviation remains a crucial industry in the state of North Carolina adding an estimated \$ 9.5 B to the state economy per year. While the NC DOT - Division of Aviation has developed a very comprehensive plan for General Aviation Airports, the state has failed to secure sufficient funding to implement the plan. The significant funding shortfall is resulting in the deterioration of the existing system of airports in the state. More funding is needed to insure that the system is maintained and necessary improvements are made to accommodate increasing demand and maintain safety and security.

An overall assessment of the condition of the North Carolina aviation infrastructure was conducted taking into account pavement conditions, funding, safety, and passenger cost/satisfaction. **A rating of D+ was assessed.**

## BACKGROUND

North Carolina is the birthplace of the aviation industry and infrastructure as it is the place where Orville and Wilbur Wright made their first flight in 1903. Since then, aviation has become a very vital part of the infrastructure opening up the state to both national and international access and adding an estimated \$ 9.5 B per year to the North Carolina economy.

There are 91 publicly owned airports and heliports in the state, of which 11 are classified as Air Carrier (AC) Airports and receive their federal funds directly from FAA and state funds from the Division of Aviation. 63 airports are classified as General Aviation (GA) airports and receive federal and state funds that are administered by the Division of Aviation. The remaining 16 airports are GA airports listed as Private Use and do not receive government funding. These airports handle approximately 35 million passengers per year. Two of the airports, Charlotte Douglas International and Raleigh-Durham International, are in the top 50 airports in the nation by passengers enplaned, and a third one, Piedmont Triad International handles more than 1 million passenger enplanements per year. Number of passengers using the Charlotte Douglas Airport in 2005 was 28 M, a 12% year-to-year growth. The 63 GA airports accommodate 5,620 based active aircraft that collectively log 770,000 hours per year flight time.

In general, the aviation industry, including the one in North Carolina, was profoundly impacted by September 11, 2001. A net result is that FAA and local funds and attention had to be diverted from infrastructure issues to security as a wide range

of security investments had to be made in order to bring airports up to new Homeland Security standards. The recent period has also seen tremendous economic pressure on the commercial airline industry driven by significant increases in costs, drop in passenger traffic, and more recently a large increase in fuel costs. The Charlotte Douglas International Airport, the largest airport in the state, was particularly affected because of its high dependency on US Airways as one of its major hubs and headquarters. US Airways had to go through significant cost cutting measures under Chapter 11 protection and restructure the way it does business in order to survive. More recently it emerged from Chapter 11 and merged with America West and reported significant profit in their Q2, 2006 results indicating that it is now healthy and will continue to use Charlotte as a major hub.

In the past few years, consumer confidence has been restored and demand for air travel is on the rebound. Projections for the future are for continued growth. The NC Aviation industry must be ready to accommodate this growth to avoid costly delays in the future.

At current funding levels, it will not be possible for the GA airports, and to a lesser extent for the Air Carrier airports, to fund capacity improvements to keep pace with demand.

In order to assess the condition of the North Carolina aviation infrastructure, pavement conditions, funding vs. needs, safety, and passenger costs and satisfaction were considered as detailed in the next section.

# CONDITIONS

## Pavement Condition Index (PCI)

Public Law 103-305, section 107, amended Title 49, Section 47105, of the United States Code mandates sponsors provide assurances on preventative maintenance for project applications involving airfield pavements. For any pavement rehabilitation reconstruction project, each airport sponsor must provide assurances to the FAA that they have implemented an effective pavement maintenance management program. The amendment also provides for the submittal of reports addressing the pavement condition and the management program.

The requirement to establish a pavement maintenance management program applies to any pavement at the airport which has been constructed, reconstructed, or repaired, with federal assistance. All grants involving pavement rehabilitation or reconstruction contain a grant assurance that addresses the pavement maintenance obligation. FAA Advisory Circular 150/5380-6, Guidelines and Procedures for Maintenance of Airport Pavements, is used for specific guidelines and procedures for maintaining airport pavements and establishing

an effective maintenance program. Specific types of distress, their probable causes, inspection guidelines, and recommended methods of repair are presented.

The NCDOT Division of Aviation undertook a comprehensive initiative in 2004, referred to as the “North Carolina General Aviation Airport Development Plan” which focused on the airports under its jurisdiction. This plan evaluated the needs at the general aviation airports and set minimum state standards for their development. In this plan the airport needs in the system were identified and prioritized.

One of the requirements for capital improvements and maintenance established was to institute the FAA mandated maintenance management program. As part of this program a Pavement Condition Index (PCI index) of all pavements was established to monitor and assess the aging of pavement over time. The initial PCI survey was conducted in 2002 and updated in 2004.

Findings of the PCI survey were as follows:

### 2004 NC Pavement Management System Database (2002 data in red)

#### 59 Publicly Owned/Operated General Aviation Airports

##### Primary Pavement Only

Section	Number	% Area	Wt. Avg. PCI	PCI Rating	Pavement Area (sf)
Runway	112	54	75 (74)	Fair	26,693,376
Taxiway	174	24	75 (79)	Fair	11,705,127
Apron	<u>153</u>	23	76 (76)	Good	<u>11,305,229</u>
	439				49,703,732
					48,341,646

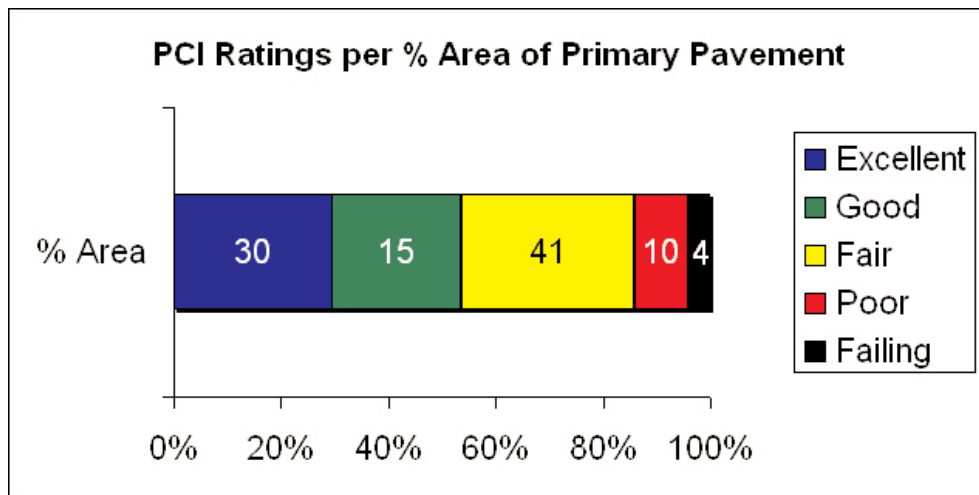
2,070,989 ft @ 24' wide  
392 miles @ 24' wide

662,716 ft @ 75' wide  
133 5000' long runways @ 75' wide

5,522,637 sq yds  
\$138,065,923 pavement worth @ \$25/sq yd (not including land, drainage, markings, etc...)

5,371,294 sq yds

Color	PCI Range	PCI Rating	2004		2002	
			No. of Sections	% Area	No. of Sections	% Area
Blue	Excellent	89-100	154	30	125	29
Green	Good	76-88	50	15	89	24
Yellow	Fair	55-75	167	41	138	32
Red	Poor	40-54	48	10	40	10
Black	Failing	0-39	20	4	27	4



Data Analysis - May 16, 2005

\*Does not include Anson County or updated Shelby Municipal sections.

\*\* 2002 Data Shown in Red



This data indicates that the pavements tested have gotten worse over the test periods, as pavements considered good to excellent decreased from 53% to 45%.

No similar data was available for the Air Carrier airports, but these are considered better in light of extensive pavement management programs, and recent new construction activity.

### Funding

In 1987, the NC General Assembly revised its aviation funding approach to credit the aviation users with the general taxes paid into the state treasury. While North Carolina does not have any aviation-specific taxes like some other states (i.e. fuel tax, registration fee, etc.), each purchaser of aviation products and services is subject to payment of the statewide 4% sales tax. The Continuing Aviation Appropriations statute passed by the legislature in 1987 provides that the Department of Revenue will, each year, develop an estimate of the total amount of sales taxes paid on aviation products and services and that figure will then be used by the General Assembly in setting the biennial amount of the State Aid to

Airports Program. Although this statute was modified in recent years to reflect growth rates associated with North Carolina's General Fund, the program has grown to in excess of \$10 million and has allowed the development of a more reliable multi-year aviation funding program for use in the DOT's Transportation Improvement Program. Recent state budget cuts, however, have had a negative impact on the program. In addition, each NC county collects personal property taxes from aircraft owners annually. These taxes go into the county's general fund and are generally not earmarked for investment into the local airport. NCDOT Division of Aviation administers the State Aid to Airports Program. North Carolina participates in the FAA "Block Grant Program", meaning the state has assumed responsibility for administration and distribution of FAA grants to general aviation airports. Commercial Service airports in the state deal directly with the FAA in regard to their Airport Improvement Program (AIP) funding.

2006 Recommendations made to the Council and approved for funding is shown below:

**Fiscal Year 2006  
Recommendations to NC Aeronautics Council  
March 21, 2006**

**State Aid to Airports Program**

**General Aviation Airports**

<b>Airport</b>	<b>Description</b>	<b>State Funds</b>	<b>Local Funds</b>	<b>Total Funds</b>
Andrews - Murphy	Complete Pavement Rehabilitation and Overlay	200,000	22,222	222,222
Anson County	Parallel Taxiway and Apron Rehabilitation - Phased Project	693,000	77,000	770,000
Ashe County	Match Division of Highways Funding for Airport Road Relocation	500,000	55,556	555,556
Concord Regional	Land Reimbursement - Original Airport Construction	100,000	25,000	125,000
Gastonia Municipal	Rehabilitate Apron	199,879	22,209	222,088
Halifax - Northampton County	New Airport Construction - Next Phase - Paving Primary Surfaces	1,000,000	111,111	1,111,111
Hamett County	Extend Runway Safety Area and Glideslope Area Site Prep	180,000	20,000	200,000
Lumberton Municipal	Rehabilitate Runway - Phased Project	1,000,000	111,111	1,111,111
Michael J. Smith	Land Acquisition for Runway Protection Zone	250,000	27,778	277,778
Morganton - Lenoir	Reimbursement for Partial Parallel Taxiway Construction	455,277	50,586	505,863
Person County	Purchase and Install Approach Lighting System	495,000	55,000	550,000
	<b>Total</b>	<b>\$5,073,156</b>	<b>\$577,573</b>	<b>\$5,650,729</b>

**State Aid to Airports Total \$11,634,198**



The NC General Aviation Plan for 2007-2011 has identified a need for \$ 588 M over the period to bring all airports in the program to the state recommended standards. The recently released 25-year AVIATION plan identified the funding need for the 25 year timeframe at \$ 1.72 B, of which \$ 733 M is needed for preservation of current GA airports, \$ 261 M for modernization, and \$ 727 M for expansion needs. In addition, while the current focus of aviation security continues to be commercial service airlines, the natural outgrowth of those programs will be increased security requirements at general aviation facilities, requiring additional yet undefined funding. At the present funding levels only critical issues where pavements are either failing or very poor can be addressed, and is insufficient to appropriately address needs identified in the plans. FAA has granted funding through the AIP program which helps in narrowing the gap, but levels are inadequate. For the next fiscal year, FAA has allocated approximately \$ 9 M to GA airports in NC. At this level of funding it is expected that the general aviation infrastructure will continue to deteriorate.

**Safety**

Only 16 incidents/accidents have been reported so far at NC airports in 2006 vs. 26 in the same period in 2005. Total for 2005 was 42 incidents. Two of the accidents in 2006 resulted in fatalities (2 – One in Hickory, the other in Wilkesboro) vs. 3

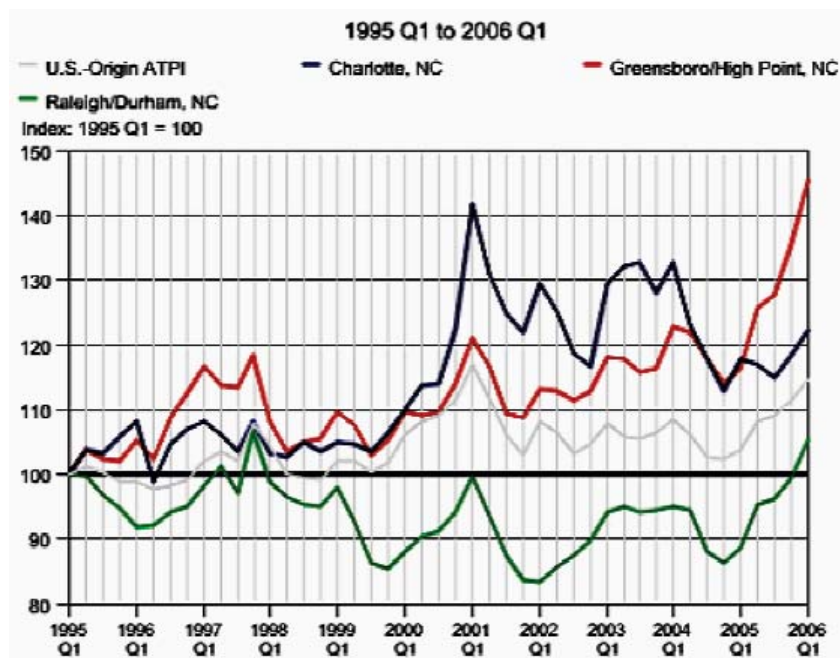
in the same period in 2005. In all of 2005, 10 aviation related fatalities were reported in the state. While a number of these accidents are still under investigation, in general causes for these accidents appear to be either pilot error or equipment (e.g aircraft) malfunction. Improvement in accidents and fatalities indicate that safety programs and their implementation are having a positive effect.

Local and state authorities are to be commended for their efforts in this area.

**Passenger Costs / Satisfaction**

Statistics and assessment in this area are based only on the major airports in the state.

Relative price per flight is monitored by the US Bureau of Transportation statistics and normalized on a regular basis. In the chart below pricing is compared to a national average (see gray line) for the three major airports in the state. The Raleigh Durham International Airport consistently provided better fares than the national average. Both the Charlotte Douglas International Airport and the Piedmont Triad International Airport (Greensboro) are consistently above national averages, although in the past 12 months prices in Charlotte have come a lot closer to the average while Greensboro prices have increased substantially.



When normalized for traffic, overall prices come close to the national average across the 3 airports.

	Arr	Dep
Asheville	77.9	81.4
Charlotte	79.4	80.0
Fayetteville	75.0	77.5
Greensboro	71.2	76.5
Kinston	71.0	83.9
Raleigh/Durham	73.6	77.8

Statistics for the last twelve months show that ontime arrival and departures percentage over the last 12 months are as follows:

On a more detailed analysis for 2006 through May the 3 major airports fared as follows

	ONTIME		ARRIVAL		FLIGHTS		
AIRPORT	ARRIVAL	ONTIME %	DELAYS	DELAY %	CANCELLED	CANCEL %	DIVERTED
Charlotte	38,744	80.4%	8,699	18.1%	670	1.4%	80
Greensboro	4,223	73.8%	1,353	23.6%	144	2.5%	5
Raleigh	17,189	76.3%	4,916	21.8%	381	1.7%	36
Total	60,156	78.7%	14,968	19.6%	1,195	1.6%	121
All Airports	2,249,393	77.4%	608,211	20.9%	42,326	1.5%	5,996

	ONTIME		DEPARTURE		FLIGHTS		
AIRPORT	DEPARTURE	ONTIME %	DELAYS	DELAY %	CANCELLED	CANCEL %	
Charlotte	38,879	80.7%	8,719	18.1%	590	1.2%	
Greensboro	4,476	78.1%	1,108	19.3%	146	2.6%	
Raleigh	18,094	80.4%	4,033	17.9%	364	1.6%	
Total	61,449	80.4%	13,860	18.1%	1,100	1.4%	
All Airports	2,321,365	79.9%	542,237	18.7%	42,323	1.5%	

In general the 3 major airports were close to the national average in terms of on time arrivals and departures.

In a 2006 North America Airport Satisfaction study conducted by JD Power and Associates whereby they developed an Airport Satisfaction Index based on a 1,000 point scale, in the Medium Airport Rankings (10-30 M passengers per year) Charlotte scored 675 points vs. a median

of 685 (range 626-722), and Raleigh scored 691 in the Small Airport Ranking (< 10 M passengers per year) against an average score of 692 (Range 654-718).

The Transportation Security Administration (TSA) conducts a survey to determine how passengers react to TSA screening at a number of TSA airports including Charlotte. In the 2005 survey Charlotte ranked 3-5% higher than the national average.

## GRADE

The overall grade was derived by weighing ratings for each category. Pavement Condition rating and Funding accounted for 30% each, Safety and Passenger Cost/Satisfaction accounted for 20% each.

For Pavement Condition rating using a grading system based on % of pavements rated Good or Excellent the grade for this section was F. The grade was upgraded to a D overall based on better conditions at the Air Carrier airports. The plan developed to address the GA airport's pavement is very good and deserved a grade of B or better, however the low PCI results are due to insufficient funds available to the general aviation airports to implement the plan.

Due to the significant shortfall in funding both for the short and long terms, grade for this section is F. It will be crucial for this situation to be resolved in order to maintain a safe and reliable General Aviation system in the state.

A grade of B has been assigned for safety because no fatalities should be the goal.

In terms of passenger cost/satisfaction, North Carolina ranked average in all categories reviewed and was thus given a C grade in this category.

The overall grade using the above allocation was D +.

## POLICY OPTIONS

North Carolina is projected to continue being one of the fastest growing states in terms of population and as a consequence there will be increased demand on aviation facilities. While the NCDOT Division of Aviation has developed a very comprehensive plan for the General Aviation airports under its jurisdiction, the funding necessary to implement the plans is woefully insufficient. An estimated funding shortfall of \$ 400-500 M over the next 5 years is certain to continue deterioration of the present General Aviation airport infrastructure. Expected shortfall is significantly larger for the 25-year Plan. Funding for the Air Carrier airports is mainly derived from the FAA through the Airport Improvement Program (AIP). This program funding relies partially on revenues generated by federal airline ticket taxes and fees. While still short of needs, it has been adequate to address immediate needs, while the shortfall in General Aviation is reaching a crucial stage. While FAA funds have helped in implementing some of the most crucial needs, significant additional funds need to be derived from state and local sources.

The 2004 Pavement Condition Survey indicates that pavement ratings are getting worse over the last 5 years pointing to insufficient investment of funding at the federal, state and local levels. Pavements that were rated good a few years ago now are slipping into lower rated categories. A significant part of the reason for these lower ratings is that many of the pavements have now reached or exceeded their design life. Funding has not kept pace with the need to enact repairs or increase capacity.

Both commercial service and general aviation airports should also take advantage of the latest advances in research regarding pavements developed under the Innovative Pavement Research Program (IPRF) and implement new design and maintenance practices.

Performance on safety has been very good in the state. Statistics indicate that safety is improving over time. Safety should be kept as a high priority and present plans continue to be funded and supported by the aviation industry.

Every step possible should be taken to insure that quality is improved. A number of innovative approaches that have been successful in other states could be more widely implemented such as Design/Build options and value engineering. Contracting practices should be reviewed, e.g. lowest initial cost is not necessarily the lowest cost for the consumer when taking into account delays, change orders, credit and bonding issues. Hold industry more responsible for the pavements they place under contracts. Use less prescriptive requirements and move toward performance based specifications.

An education program for the elected officials and the public should be instituted highlighting the importance of the aviation industry to continued growth and the economy of the state of North Carolina. A thriving aviation economy will attract new industry, jobs and mobility to the state of North Carolina.

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## RECOMMENDATIONS

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The North Carolina Section of the American Society of Civil Engineers specifically supports the following recommendations:

- Support efforts to implement newer, more innovative construction delivery practices such as Design/Build, Design/Build/manage
- Encourage development of realistic, fact based Life-Cycle costs analysis methods and implement them as primary decision tools as opposed to “lowest price”
- Encourage practices for lowering overall costs of construction by implementing value engineering principles.
- Consider alternatives for increasing funds available for general aviation airports through alternative funding sources such as state and local fuel taxes and user fees, additional bond issues, etc.
- Consider opportunities to earmark aircraft property taxes for airport improvements.
- Encourage local politicians to work diligently in the legislature to secure significant additional funds to support the General Aviation plan.
- Encourage a shift from prescriptive specifications to performance based specifications.
- Increase design life for pavements by increasing utilization of new technologies such as those developed under the IPRF program.

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## SOURCES

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US Bureau of Transportation Statistics, FHWA, State Transportation Statistics, 2005 and online data on Aviation Statistics at <http://www.bts.gov>

NC Department Of Transportation, Division of Aviation, published data.

US Federal Aviation Administration, Pavement Maintenance Program and statistics available at <http://www.faa.gov>

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<http://www.ncprogress.org>

US Department of Homeland Security, Transportation Security Administration, <http://www.tsa.gov>

US National Transportation safety Board statistics at <http://www.nts.gov>

NC DOT, Division of Aviation, North Carolina General Aviation Airport Development Plan, May 2004

NC DOT, Division of Aviation, North Carolina General Aviation Airport 25-year Development Plan, August 2006

JD Power and Associates, 2006 North America Airport Satisfaction Study <http://www.jdpower.com>

Thirty-two percent of North Carolina’s 17,803 highway bridges are considered structurally deficient or functionally obsolete, which contributes significantly to traffic congestion and places local communities at risk by forcing ambulances, fire trucks and school buses to take lengthy detours because of weight limitations. The cost to replace these deficient structures is estimated to be approximately \$8 billion. **As a result, the State’s bridge infrastructure has been given a grade of C-.**

## BACKGROUND

All bridges in North Carolina are inspected every 24 months using federal inspection criteria, and all inspectors are required to attend training to assure bridge conditions are properly coded and recorded. Numeric ratings are assigned to various parts of the structure and these codes are used to develop the structure’s sufficiency rating (SR). The SR indicates the overall condition of the structure and how critical its need for rehabilitation and/or replacement is.

While not necessarily unsafe for all vehicles, traffic on some bridges must be limited through weight and speed restrictions. In some cases, deteriorated structural components can lead to traffic on a bridge being restricted. In others, older design features that cannot safely accommodate current traffic volumes, vehicle sizes and weights will make a bridge

functionally obsolete, thus requiring a restriction on its traffic flow.

Another reason for classifying a bridge as structurally deficient or functionally obsolete is a change in the legal truck load limit. Some of the State’s older bridges were designed for a much lower truck load than is applied to highways today. Even if a bridge has not significantly deteriorated, an increase in the standard allowable truck weight can cause an older bridge to become weight restricted.

Restricting a bridge to less than the standard allowable weight and posted speed is a major contributing factor to traffic congestion and poses serious risks and inconveniences for school buses and emergency response vehicles.

## CONDITIONS

In May 2006, the North Carolina Board of Transportation awarded \$8.7 million for five bridge replacement projects. At that monthly spending rate, it will be 2083 before all the State’s deficient bridges are replaced. However, this assumes no additional bridges will become deficient in the next 77 years, which, considering the current bridge design life is assumed to be just 75 years, is very unlikely.

SRs from the 2005 Deficient Bridge List, compiled by the North Carolina Department of Transportation–Bridge Maintenance Unit, are as follows:

*Sufficiency Rating	Number of Bridges
Less than 10	130
10-20	250
20-30	490
30-40	620
40-50	1,160

A total of 2,650 bridges have an SR of less than 50.

*\* SRs range from zero to 100—with a lower SR indicating a more deficient structure.*

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The age of North Carolina's bridges is also a critical factor. Over 40 percent of deficient bridges were constructed in or before 1956, making nearly 2,300 of the State's bridges more than 50 years old. Structures constructed between 1957 and 1961 include an additional 1,300 deficient bridges, all of which will turn 50-years-old in the next 5 years.

While pedestrian bridges were not evaluated in this report, the tragic collapse of the Lowe's Motor Speedway pedestrian bridge placed these structures in the spotlight. This event prompted the state of North Carolina to require all pedestrian bridges built over highways to undergo the same testing methods and schedule as highway bridges carrying vehicular traffic. However, existing pedestrian bridges and those that do not cross highways are exempt from this requirement. All pedestrian bridges located on greenways, golf courses, etc., are exempt from the requirement,

## POLICY OPTIONS

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Solutions intended to ease increasing demands on the State's transportation system, and to improve bridge conditions, capacity and safety, are complex and do not always mean building more infrastructure. America must change its transportation behavior, increase investment at all levels of government and

and not subject to inspection by trained professionals.

The state of North Carolina also has many railroad bridges. These structures are inspected once a year using federal guidelines, but are not required to undergo inspection by the State and thus are excluded from this evaluation.

Grades were assigned to the bridges category in three areas. A grade of D was given to funding, due to the expected 75 years (at 2006 funding level) it will take to replace all the substandard bridges in the State. A grade of B was given to inspections, due to the exclusion of most pedestrian bridges from inspection requirements. And finally, a grade of D+ was given to condition because 32 percent of the State's bridges are considered substandard. Those three areas combined for an overall grade of C- for North Carolina's bridges.

## RECOMMENDATIONS

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- By 2020, the state and local governments of North Carolina should ensure that fewer than 10 percent of the State's bridges are classified as structurally deficient or functionally obsolete;
- Use of the Highway Trust Fund for non-transportation related projects must cease;
- Life-cycle cost analysis principles should be used to evaluate the total cost of bridge replacement projects;

make use of the latest technologies. Cities and communities must be better planned to reduce dependence on personal vehicles, and businesses must encourage more flexible schedules and telecommuting. Local governments should also have the option to raise bridge replacement funds with local option sales taxes.

- Environmental streamlining should be supported for bridge replacement projects;
- All pedestrian bridges should be required to be inspected every twenty-four months; and
- Funding for bridge replacement projects should be increased.

## SOURCES

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North Carolina Department of Transportation, Bridge Maintenance Unit: Deficient Bridge List 2005

ASCE, National Infrastructure Report Card 2005

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Twenty-two percent of North Carolina’s 5,250 dams are classified as high hazard. A high hazard dam failure would cause loss of life, significant damage to homes and businesses, and have other major economic impacts on the communities downstream. The estimated cost to rehabilitate the most critical deficient structures in North Carolina is approximately \$400 million. **As a result, the State’s dam infrastructure has been given a grade of D.**

## BACKGROUND

Dams provide water storage, cooling water for nuclear power plants, flood reduction, hydroelectric power, waste water storage and treatment, as well as recreation for the citizens of North Carolina.

All high hazard dams in North Carolina are inspected every 2 years and all low hazard dams are inspected every 5 years. Inspectors are also required to attend inspection training to assure conditions are properly noted and recorded. If problems are discovered during the inspection, a Notice of Deficiency (NOD) is sent to the owners. There are currently more than 140 NOD’s outstanding in North Carolina. The number of dams in North Carolina, by hazard classification, are as follows:

Hazard Classification	Number of Dams
High	1,148
Intermediate	764
Low	3,338

The State of North Carolina only owns 29 of the more than 5,200 dams. Approximately 10 percent of the dams—525—are “exempt”, which means that other entities are responsible for their inspection and maintenance. Almost 450 “exempt” dams are privately owned, and many others are owned by groups like the Tennessee Valley Authority (8 dams), the United States Army Corps of Engineers (16 dams), the North Carolina Utility Commission (6 dams), the National Park Service (4 dams) and the Federal Energy Regulatory Commission (44 dams).

The breakdown of North Carolina dam ownership is as follows:

Type of Owner	Number of Dams
Federal Government	13
State of North Carolina	29
Local Governments	60
Utilities	49
Private owners	3,128
Unknown owners	1,973

## CONDITIONS

Like all man-made structures, dams deteriorate. Deferred maintenance accelerates deterioration and causes dams to be more susceptible to failure. As with other critical infrastructure, significant investment is essential for maintaining benefits and ensuring safety. The design life of a dam is 50 years. The age of North Carolina’s dams is as follows:

Year Constructed	Number of Dams
Before 1901	65
1901 to 1920	105
1921 to 1940	157
1941 to 1960	579
1961 to 1980	610
After 1981	584
Unknown	3,150



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There are only 15 full-time inspectors covering all the dams in the state of North Carolina. Each year an inspector must review 69 high hazard dams and 46 intermediate hazard dams. In 2005, 1,485 dams were inspected in North Carolina, 694 high hazard, 261 intermediate hazard and 530 low hazard; and there were a total of 143 NOD cases noted, 93 high hazard, 28 intermediate hazard and 22 low hazard.

Only 195 of the 1,150 high hazard dams in North Carolina have an Emergency Action Plan (EAP) on record, and not one of them meets the Federal Guidelines for Dam Safety: Emergency Action Planning for Dam Owners (FEMA 64 October 1998, reprinted April 2004, pages 5-8). Also, no

funding is currently available at the state level for repair or removal of existing dams.

The annual budget for North Carolina's entire dam safety program is just under \$1.2 million.

Grades were assigned to the dams category in three areas. A grade of F was given to funding, due to the lack of a consistent source funding. A grade of F was given to EAPs because the few existing plans do not meet current federal guidelines. And finally, a grade of B was given to condition because only 93 of the 694 high hazard dams inspected in 2005 received a NOD letter. Those three areas combined for an overall grade of D for North Carolina's dams.

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## POLICY OPTIONS

The alarming lack of public support and understanding of the need for proper maintenance and repair of dams is dangerous and unacceptable. No one pays attention to a dam until it fails—although dam infrastructure is an issue that affects the safety of millions of people who live and work in the path a

sudden, catastrophic and deadly dam failure might take. ASCE supports the Dam Safety Coalition and its proposal to create a federal funding program to repair the nation's unsafe dams. ASCE also supports the Dam Repair and Rehabilitation Act, which failed to pass in Congress in 2005 (H.R. 1105/S. 2444).

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## RECOMMENDATIONS

- Increase staff and budget levels for the Dam Safety Office to accommodate for current and future inspection needs and permitting reviews;
- Create a national loan fund for repair, rehabilitation and removal of dams;
- Require full funding for the Small Watershed Rehabilitation Act;
- Develop a comprehensive information resource system to support the maintenance and improvement of dam safety;
- Develop EAPs for all high hazard dams in the State by 2010;
- Reauthorize the National Dam Safety Program Act in 2006 (S. 2735/H.R. 4981);
- Create a state funding program to assist dam owners with loans and matching grants; and
- Create a condition assessment inspection form for each high hazard dam with numeric ratings for the key aspects of each structure.

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## SOURCES

North Carolina Division of Land Resources, Dam Safety Office

National Dam Safety Review Board – State Dam Safety Evaluation Report for January 1, 2005 – December 31, 2005

ASCE, National Infrastructure Report Card 2005

2006 National Inventory of Dams (NID) Update Data Collection Results (2005)

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The 2003 Environmental Protection Agency (EPA) Drinking Water Survey documented a 20-year infrastructure need of \$10.98 billion for North Carolina. According to a recent study by the NC Rural Economic Development Center, Inc, North Carolina's water systems have a documented funding need in excess of \$2.5 billion over the next five years with over \$4.5 billion of additional water infrastructure investment needs through year 2030. These funds are needed to replace aging facilities, comply with mandated Safe Drinking Water Act (SDWA) regulations and boost economic development. Although the outbreaks of waterborne caused sickness is at or near zero, remarkably due to water supply challenges, water quality degradation and tightened regulations, the number of drinking water systems with regulatory violations is on the rise. The American Society of Civil Engineers (ASCE) supports an increased state role in the funding of needed drinking water infrastructure. If funding needs are not met, the state risks reversing the improved public health and economic gains that have been realized over the past years.

**A Grade of C+ is assigned to this component of the state's infrastructure.**

## BACKGROUND

North Carolina is currently growing at a rate to soon become the 8th most populous state by 2010. North Carolina has about 7,000 public water systems that serve water to approximately 5.5 million people or about 70% of the states population. Most of the larger systems are owned and operated by municipalities and counties.

The water supply (reservoirs, rivers, wells and interconnections) is the life blood of our state and a critical link along with conservation to our sustained drinking water infrastructure. In 2002, after consecutive drought seasons, over 90 systems were placed under mandatory water restrictions and many others agreed to voluntary conservation measures. Even now that drought conditions are a recent memory, still the groundwater underlying the eastern part of the state is in danger of becoming contaminated from saltwater intrusion due to fresh water over pumping. This recent strain on our state's groundwater has caused the regulation of withdrawal and a delineation of a Capacity Use Area encompassing over 15 counties aimed at the reduction of groundwater use. A Capacity Use Area is an area of regulated groundwater withdrawal.

Our state is diverse in many areas from ecology and geology, to economic status and the ability of our public water

systems to maintain their status quo. About half of North Carolina's water systems serve 2,500 people or less and 70% serve fewer than 5,000. That means that about 375 of the state's systems serve less people than typically contained in three to four large subdivisions in an urban area. This means that the smaller systems must charge significantly higher rates than the larger systems to offset the absence of large economies of scale.

Unfortunately, the rural and sometimes poverty stricken portions of the state know the harsh reality of paying an average utility bill (water and wastewater service) above the state defined High Unit Cost threshold of 1.5% of local median household income. Reportedly, the EPA's current measure of affordability is a system wide average of 4.5% of median household income. Therefore, North Carolina defines a target rate significantly lower than those recommended nationally by the EPA. What this means is that North Carolina providers collect smaller amounts for their utility (water and wastewater) service and without state supported funding the required and mandated water supply and treatment improvements within these smaller systems will either go uncompleted or be completed via private funding. This in turn will serve to make water service even less affordable to low-income residents.

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## CONDITIONS

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In 2006, The North Carolina Rural Economic Development Center completed an initiative to collect detailed information about water systems statewide and document the current and the future capital improvement needs of over 530 of the larger public water systems (Water 2030 Initiative). This survey identified approximately \$7.64 billion in required funding over a 25-year period. Most of these public systems have aging water distribution systems and treatment plants and are also being driven to utilize new water sources that may require more advanced treatment.

For example, if a water system was developed during the textile mill boom days and pre WWII years, it was most likely constructed of unlined cast iron pipe. Cast iron is a durable and structurally strong material that holds up well to external corrosion and soil settlement. However, over time the corrosive natural of water can pit and break down the cast iron material from the inside causing reduction in main capacity and increased leaks. If the industry average service life for this type of pipe is 50 years, then all pipes installed prior to the 1950's have exceeded their average service life and are in need of replacement.

Additionally, during WWII and the years immediately following, a majority of water pipes being installed were

constructed of Asbestos Cement (AC) material due to the iron and steel needs of the war effort. These pipes traditionally provide good internal resistance to corrosion and deterioration, but become brittle and readily subject to failure from physical forces. Water system staff and third party construction crews must take extreme precautions when tapping new services or working on or around these type of mains. Airborne asbestos has been documented to be a carcinogen and poses a health risk outside of water system integrity.

All systems regardless of the water main material experience leaks. Typically, the older more brittle materials will experience more leaks due to wearing at fittings, inconsistency with years of service tapping and construction related upsets. Some small systems loose as much as 20% of their total treated water. Systems statewide lose an average of 11% of treated water annually to leaks and other means and the amount lost is labeled "unaccounted for". This unaccounted for water is an amount loss that generates no revenue as well as results in wasted time, money and treated water. The statewide average of 11% total is approximately 35 billion gallons of treated water that is lost each year; enough to supply the entire Charlotte-Mecklenburg region for a full year.

## POLICY/FUNDING

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Historically, numerous federal and state programs have provided funding assistance to help offset the rising cost of water infrastructure. These programs are aimed at addressing an array of differing needs from improving public health and water quality to furthering economic development. The level of funding available through these programs has been decreasing in recent years. Additionally, the increasing and ever changing regulations imposed on public water supply systems can easily and sometimes unexpectedly deplete a system's budget in absence of governmental assistance. The U.S. EPA has the primary regulatory authority over drinking water systems and was once a primary source of funding, but since about 1990 these grant/loan funds have been limited and reduced. The decline in these funding sources coupled with the increased

demand for safe, efficient drinking water infrastructure calls into question the role of the state. State contributions to infrastructure financing are becoming more important. Most recently, the State of North Carolina made available \$800 million of grant and loan funds financed through general obligations bonds. These funds led to remarkable improvements in drinking water systems in 97 of the state's 100 counties. These funds have been exhausted and we now face a period of record low funding for needed drinking water improvements.

Private loans from banks and other private lending institutions has become the largest single source of capital investments for public water construction projects. These loans take several

forms, including general obligation bonds, revenue bonds, special obligation bonds, tax increment bonds, and installment or lease-purchase debt. Based upon financial data charted for years 1995 through 2005, private loans accounted for 70% of

total financing of water and wastewater projects. Conversely, because of poor bond ratings, approximately 60% of N.C. local governments cannot qualify for most private infrastructure lending programs.

## GRADE

The overall grade for North Carolina's drinking system is a C+.

The grade is comprised of the following:

- C for North Carolina's drinking water system's ability to match their required system improvements with available funds.
- C+ for North Carolina's drinking water system's physical condition and current need to reduce the system wide treated water loss thereby reducing overall water related expense.
- C- for North Carolina's drinking water systems ability to meet their funding needs without state subsidy.

## RECOMMENDATIONS

- The North Carolina Section of the American Society of Civil Engineers (ASCE) encourages the Governor, the State Legislature and public to support long-term funding of water infrastructure projects that would enable the state to reduce the individual system's funding gap and assist the state's water systems in continuing to serve the public health and support economic development. This funding support will enable the planning and construction of projects needed to maintain and/or improve the current levels of service and provide the additional capacity necessary for future economic growth.
- The overall reduction of "unaccounted for water" should be the focus of each utility and customer to reduce the drain on water and financial resources. A statewide initiative should be implemented to educate and assist utilities on ways to reduce their "unaccounted for water". Incentives and/or recognition to those systems that expedite a leak detection program and consistently document the reduction of leaks and the eradication of un-metered services should be provided.
- Engage the state's utilities managers in developing sound and equitable rates that are based upon the need for repairs and replacement of capital infrastructure, while at the same time implement a public education campaign to help our state's citizens recognize and accept rates that can support life cycle asset management funding. Typically, utilities charge at or below the actual cost to pump the raw water, treat to potable standards, distribute the treated water, train and competitively pay staff, and have available funds to maintain and upgrade their system. Competition for the states existing water supplies will dictate new technology and larger more regional systems. Treatment is becoming more advanced and will require more highly trained staff and additional operation and maintenance (O&M) funds. The goal for each water system must be to become self sufficient and achieve a "sustainable utility" rate structure. The ASCE supports utility rates that encourage water efficiency, which will reduce drinking water consumption and demand on a limited supply. This will help ensure our continued statewide economic growth and extend the life of our limited water resources.

## SOURCES

North Carolina Rural Economic Development Center, Water 2030 Initiative, February 2006

2003 EPA Drinking Survey

2006 Report Card for Pennsylvania's Infrastructure

The condition of North Carolina’s rail infrastructure has a direct impact on the state’s economy, with more than 15.5 million tons of goods originating in, and more than 61.1 million tons of goods terminating in the state in 2004. Currently, only 30 percent of the state’s short lines can accommodate the new, heavier rail cars being used, and it is estimated that freight rail investment needs over the next 25 years will total \$545 million.

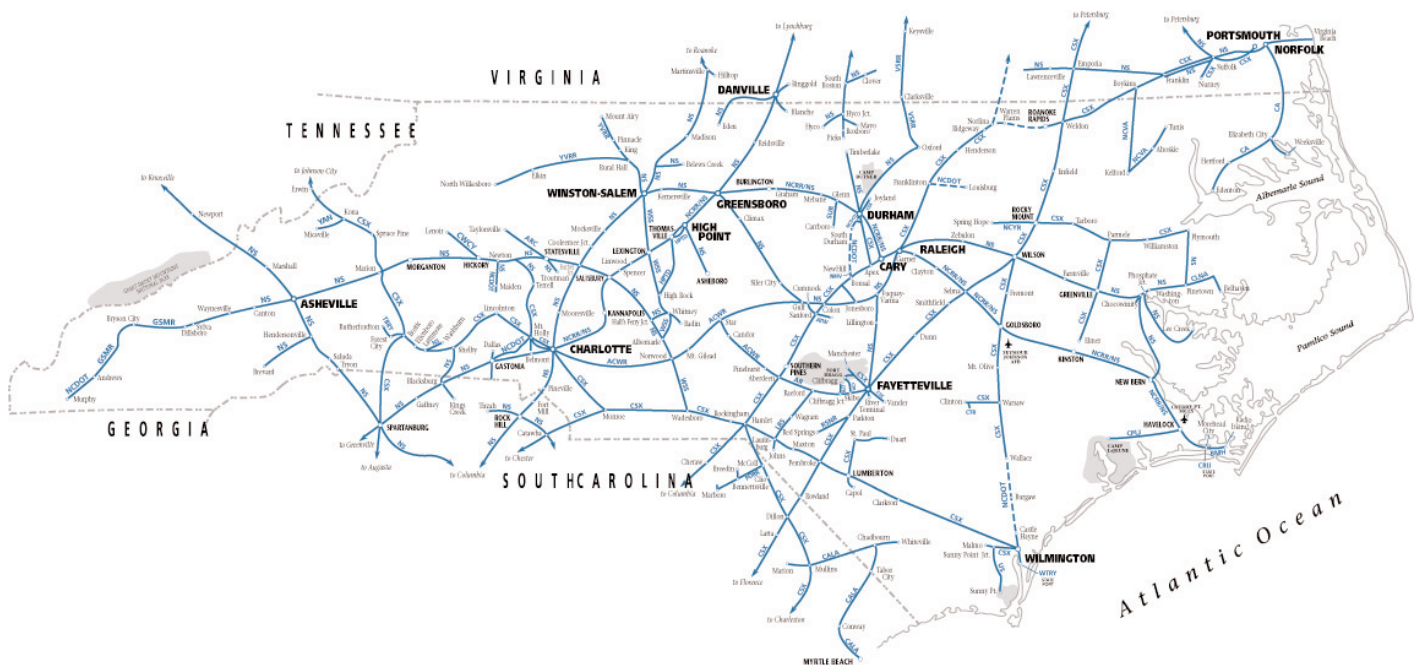
In addition to the state’s freight rail needs, passenger rail modernization needs currently top \$3.5 billion over the next twenty-five years—83 percent of the total passenger rail investment needed. In 2005, there were more than 520,000 Amtrak passenger boardings in the state. Despite being named one of five future high-speed rail corridors in 1992, many of the state’s fastest growing areas have no passenger rail service—thus making rail travel less competitive than the automobile, and therefore a less viable alternative transportation mode. **As a result, the state’s rail infrastructure has been given a Grade of B-.**

## BACKGROUND

In 2004, North Carolina ranked nineteenth in the nation for total rail miles, with approximately 3,200 passenger and freight miles. There are two Class I freight, thirteen local and eight switching and terminal railroads in the state, as well as 4,121 public and 3,145 private at-grade crossings. There are also three regional transit systems, Charlotte Area Transit System (CATS), Piedmont Authority for Regional Transportation (PART) and Triangle Transit Authority (TTA) with proposed passenger rail transit programs.

Representing the “spine” of state rail traffic, North Carolina owns the North Carolina Railroad Company (NCCR), a 317-mile rail corridor linking Charlotte, Greensboro, Raleigh and the state’s seaport at Morehead City. More than 100 industries and several major military installations are served by the NCCR.

Norfolk Southern operates trains along the entire NCCR corridor under a lease agreement, and the segment between Charlotte and Greensboro is a key part of Norfolk Southern’s mainline between Atlanta and northeastern United States.





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CSX Transportation (CSXT) also shares operation on a portion of the NCRR corridor between Raleigh and Cary. Norfolk Southern and CSXT are responsible for the maintenance and operation of their rail lines, and these private corporations must provide investment to improve their facilities, such as the replacement of ties and rail.

Amtrak operates interstate and intrastate passenger trains, including the *Piedmont* between Charlotte and Raleigh, and the Washington-Charlotte segment of the *Carolinian*, both under contract with the state of North Carolina. Each train provides a single daily roundtrip, with the *Piedmont* serving the cities of Raleigh, Cary, Durham, Burlington, Greensboro, High Point, Salisbury, Kannapolis and Charlotte, and the *Carolinian*, which

serves the cities of Rocky Mount, Wilson and Selma in addition to those served by the *Piedmont*.

Amtrak also operates four long-distance trains with stops in North Carolina: the *Crescent*, providing daily service to Gastonia, Charlotte, Salisbury, High Point and Greensboro; the *Palmetto*, making passenger stops in Fayetteville, Selma, Wilson and Rocky Mount; the *Silver Meteor*, operating daily between New York and Miami, with stops in Rocky Mount and Fayetteville; and the *Silver Star*, providing daily service to Hamlet, Southern Pines, Cary, Raleigh and Rocky Mount. In fiscal year 2005, Amtrak served sixteen North Carolina municipalities with approximately 520,698 boardings.

## CONDITIONS

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### Enhancements

The ability to increase railroad capacity, through track and signal improvements, is critical to the efficient movement of passengers and goods. In order to facilitate such improvements, an agreement was executed between NCRR, the North Carolina Department of Transportation (NCDOT), Norfolk Southern and CSXT. The North Carolina Railroad Improvement Project (NCRRIIP) has since allowed for \$30 million in rail improvements to be made between Raleigh and Charlotte, including such projects as:

- A \$4.3 million sidings upgrade and lengthening in McLeansville, Mebane and West Durham to increase siding speed and capacity;
- A \$5 million interlockings upgrade at East Durham and downtown Greensboro to provide for higher speeds and improved capacity;
- A \$5 million curve superelevation (banking) increase and realignment, including modifications on some bridge decks and culverts, to accommodate higher speeds; and
- Installation of a \$12.1 million Centralized Traffic Control system between Cary and Greensboro to allow passenger trains to operate at up to 79-miles-per-hour (previous

maximum authorized passenger train speed was 59-miles-per-hour), and to reduce delays associated with meeting and passing trains.

Since 2001, these upgrades—which reduced rail traffic congestion by allowing longer freight trains to move safely on longer sidings, permitting faster passenger trains to pass—have reduced travel time for passenger trains between Raleigh and Charlotte by 30 minutes. The NCRRIIP funding used in these projects came from a variety of federal and state sources, including an earmarked portion of the Federal National Highway System funds for the traffic control signal system. Federal Congestion Mitigation Air Quality funds were also used for those projects in metropolitan counties that did not meet federal standards for air quality.

To date, the state has also received more than \$2.8 million in Section 1010 funding (provided under the Intermodal Surface Transportation Efficiency Act), more than \$1.9 million in Section 1103(c) funding (provided under the Transportation Efficiency Act for the 21st Century) and \$8 million in Next Generation High Speed Rail (NXTG) program funding from the Federal Railroad Administration for safety improvement projects at railroad crossings along the Raleigh to Charlotte corridor. NCDOT has aggressively pursued this work in an effort to eliminate highway/rail at-grade crossing hazards along

the Southeast High Speed Rail corridor, enabling pursuit of higher speeds for passenger trains between Raleigh and Charlotte—thus providing a safer, more efficient and environmentally sensitive form of travel.

In addition to the NCRRIP projects, the North Carolina Railroad Company has invested in improvement projects along its corridor, including:

- A \$5.5 million bridge replacement at NC 54 in Research Triangle Park (near Durham) to a double-track structure that can accommodate regional transit needs, increase rail capacity, improve vehicular traffic flow and eliminate substandard clearances;
- An \$8.5 million bridge replacement in Kinston that will keep the rail route open into eastern North Carolina and the state seaport at Morehead City by permitting the use of heavier and larger freight cars;
- A \$2.7 million installation of new crossies between Raleigh and Selma; and
- \$19 million in construction of new passing sidings at Auburn, Powhatan and Selma and restoration of the Selma rail yard.

The state has also undertaken an initiative to rebuild and improve many of its historic train stations. This has included such projects as: a new platform to allow the *Silver Star* to stop in Cary (\$300,000); a \$32.6 million renovation and reopening of the Southern Railway Station in downtown Greensboro for passenger rail and local and intercity bus service; passenger station restoration and rehabilitation at High Point (\$6.8 million), Marion (\$1.6 million), Morganton (\$1 million), Old Fort (\$1.4 million), Rocky Mount (\$9.3 million), Salisbury (\$4 million), Selma (\$3.6 million), Southern Pines (\$800,000), and Wilson (\$2.5 million); a \$11.7 million relocation and restoration of the former Hamlet Seaboard Station; and a \$2.7 million new station in downtown Kannapolis.

### Future Passenger Rail Needs

The ability to reduce travel times and increase reliability of passenger trains is essential to making passenger rail travel

competitive with the automobile; and therefore a more viable alternative transportation mode. However, operation of passenger trains on private freight rail corridors must not be at the expense of existing or future freight capacity needs because the ability of freight rail to transport goods in a safe and efficient manner has a direct impact on the state's economy.

In 1992, United States Department of Transportation designated the Washington, D.C.-Raleigh-Charlotte (Southeast High Speed Rail Corridor) as one of five future high-speed rail corridors, and more importantly, as the most economically viable high-speed rail corridor in the country. The corridor has since been extended to Atlanta and Macon, Georgia, Columbia, South Carolina and Jacksonville, Florida.

NCDOT and the Virginia Department of Rail and Public Transportation have partnered to complete the Tier I Environmental Impact Statement (EIS) for the Southeast High Speed Rail Corridor (SEHSR) from Washington, DC to Charlotte, NC. This document covered a project length of approximately 450 miles and resulted in a Record of Decision setting the project purpose and need, the modal approach, and the preferred corridor. The two states are currently working on a Tier II EIS for the Richmond, VA to Raleigh, NC portion of the corridor. This document is anticipated to be finalized by the end of 2008 and will identify the preferred track alignment and associated roadway work for this 170-mile portion of the SEHSR corridor.

The current planning for high-speed rail anticipates eight (8) daily round trips between Charlotte and Raleigh, with four (4) of these trips continuing on to New York. Feasibility work has also begun for the portion of the corridor south of Charlotte to Atlanta and beyond. The Georgia Department of Transportation is managing that work.

Numerous NCRRIP projects have also been proposed to increase speed and capacity, decrease delays and improve overall safety, including:

- Addition of a second, 9-mile, mainline track from High Point to Greensboro to improve capacity and ease delays caused by meeting or passing trains on the mainline (\$20 million);



- Installation of bi-directional train signals from Raleigh to Cary to allow for a 79-mile-per-hour maximum speed and to increase track capacity (\$7 million);
- Construction of a 10,400-foot passing siding in East Durham (\$6.5 million);
- Installation of crash beams and sensors on various railroad bridges between Greensboro and Durham to protect these structures, with substandard clearances, from being struck by trucks (\$1 million);
- Replacements of turnouts in Kannapolis and Salisbury to accommodate faster speeds (\$3 million);
- Realignment and increased superelevation of curves from Greensboro to Charlotte to allow for a 79-mile-per-hour maximum speed (\$1.5 million);
- Construction of a 10,000-foot passing siding in Haw River (\$12 million); and
- Construction of a second main track to improve railroad capacity and passenger train reliability between Thomasville and Lexington (\$12 million).

It is estimated that over the next 25 years passenger rail needs, both capital costs (e.g., acquisition of train sets) and operating costs (e.g., recurring costs such as labor and utility bills), will total \$3.5 billion. This need is focused primarily—83 percent of the total investment needed—on modernization projects such as, track upgrades in the Raleigh to Charlotte corridor to accommodate higher speed service and increased frequency (from two to three round trips per day), and a potential station in Winston-Salem. The remaining 17 percent of needed investment would go to expansion of the existing system through projects such as, creation of passenger rail service between Salisbury and Asheville (providing two daily round trips) and between Wilmington and Raleigh (providing one daily round trip).

### Future Freight Rail Needs

Also impacting the future of rail is the freight industry’s transition to 286,000-pound capacity cars—in lieu of the older cars with a 263,000-pound capacity—to more efficiently transport commodities. Unfortunately, many light density

branch lines cannot handle these larger cars, as they have light weight rail in sections, shallow or poor ballast and/or deferred tie maintenance—thus decreasing their capacity and operating speed. Currently, only 30 percent of the state’s short lines can accommodate the new, heavier rail cars.

Rail-freight shipments using intermodal containers have also increased within the past decade, in an effort to improve efficiency through double-stacking containers on flatcars. The ability of the rail lines in North Carolina to handle these double stack containers will become critical should the new international port at Southport be constructed.

Projects in Fayetteville and Greenville will identify and implement track improvements on freight railroads to improve and streamline operations of the rail network to minimize the blocking of highway/railroad at-grade crossings in those cities. Fayetteville has \$8 million earmarked in federal funds to date for these improvements and Greenville is estimated at about \$5 million, but no committed funding yet beyond preliminary engineering.

A Pembroke Northern Bypass Project Planning Study will evaluate the possibility of a railroad track connection between the CSXT north–south “A” Line and the CSXT east-west Wilmington Subdivision in Pembroke, NC in order to permit a direct east to north rail route. This connection would allow freight trains to operate from Wilmington to Fayetteville and points north. Key locations directly served by this connection include the North Carolina State Port facilities at Wilmington and the US military facilities located at Fort Bragg, near Fayetteville. The connection will have the ability to provide enhanced rail service between Fort Bragg and the NC State Port.

While this connection is not the sole solution for improving rail service between Wilmington and Fayetteville, it is an integral component to an overall program of needs that have been identified for these corridors. This study has received a \$350,000 earmark for the planning and design of this connection.

It is estimated that freight rail investment needs over the next 25 years will total \$545 million. This need is also focused primarily—93 percent of the total investment needed—on modernization projects such as, track and terminal improvements to both Class I railroads and upgrades to short line railroads.

## POLICY OPTIONS

One in every four of the state's top 200 manufacturer's import and/or export materials via freight rail.

Acknowledging the vital role rail access plays for many prospective industries, NCDOT began the Rail Industrial Access Program in 1994 to assist companies with construction of railroad tracks needed to transport their freight and materials. State funds are invested in the construction and refurbishment of tracks by new or expanding industries to encourage economic development. State participation is contingent upon private and local sources providing matching funds. Local governments, community development agencies, railroad companies and industries are eligible for funds to improve rail access. Since the program's inception, NCDOT has awarded \$7.3 million in RIAP funds for 67 different projects.

Significant upgrades to short line railroads are also needed to encourage economic development in rural and small urban areas. Increased RIAP funding is a component to sustain North Carolina's economic prosperity. In addition, the Short Line Infrastructure Assistance Grant Program, also administered by NCDOT, was created to help finance track and bridge rehabilitation projects for short line railroads as part of a statewide effort to upgrade the transportation infrastructure required to attract and retain industry. In fiscal year 2006, NCDOT awarded \$1.5 million in grants under this program.

In 2003, the state General Assembly began allocating funds annually to NCDOT for rail infrastructure maintenance in the amount of \$2.1 million. These funds are intended to help maintain completed rail capital projects, including "Sealed Corridor," inactive rail corridors, NCRRIP, facilities maintenance and passenger stations. The General Assembly also began allocating funds annually to rail capital and safety in 2003, in the amount of \$2.8 million. Those funds are intended to support NCDOT Rail Division's capital and safety

programs, including major track and signal upgrades and capacity expansion, initiatives to grade separate highway and rail traffic on major highway corridors, expansion of rail maintenance facilities and the purchase and renovation of rolling stock as necessary.

Safety is also a primary concern for the rail industry. Not only do train-vehicle collisions pose a threat to public health and safety, they reduce the capacity and reliability of train operations. In 2005, North Carolina had 66 crashes, resulting in 6 deaths and 33 injuries.

Rail-highway incidents not only result in death and injury, but also may cause destruction of property, fires and explosions, and train derailments that can result in hazardous material spills. Since 1993, NCDOT has eliminated approximately 114 public at-grade crossings statewide. The state also conducted a study, *Private Crossing Safety Initiative*, which evaluated 46 private crossings between Raleigh and Charlotte and identified \$2.5 million in investment needs. However, project implementation will need to be completely funded through grants from the Federal Railroad Administration's NXTG and Section 1103(c) programs because NCDOT is not authorized to use state funds on private roads or access.

In addition, since 2005 the state has planned a total of \$20.7 million—\$10.1 million in fiscal year 2005 and \$10.6 million in 2006—for installation of crossing warning devices statewide. In 2005, 74 crossing warning device projects were constructed, 75 crossing warning device projects were authorized for construction and 132 crossing warning device projects were authorized for engineering. In 2006, 86 projects were planned statewide. In 2007, NCDOT proposes to program approximately 100 crossings for safety improvements. Despite these efforts, as the number of freight and passenger trains increases, and highway traffic grows, the need for crossing consolidation and elimination projects will become more critical.

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## RECOMMENDATIONS

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- Increase funding for rail infrastructure maintenance and capital and safety improvements;
- Increase federal funds to address safety at private crossings statewide; and
- Support national legislation to increase funding for rail capacity, multi-modal stations and freight inter-modal traffic.

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The state of North Carolina is failing in implementing plans and funding to sustain, maintain and complete the state road system. While comprehensive programs and plans have been developed by the North Carolina Department of Transportation (NC DOT), there is a funding gap of \$ 29 Billion over the next 25 years between needs and funds available. Rising energy prices, rapidly increasing demand due to the state population boom and high construction inflation contribute to the funding gap. This gap is expected to broaden as funding provided under the newly signed federal Transportation Authorization legislation (Transportation Equity Act: a Legacy for Users – SAFETEA-LU) provides significantly lowered federal aid funding than past years and significantly lower than plans.

The condition of the roads in the state is crucial to the health of the economy in the state and to insure the safety of its drivers. It has been estimated that driving on roads in need of repair in the state costs the NC motorists about \$ 1.7 B a year in repairs and operating costs. The state’s economic health is at risk if these problems are not dealt with.

An assessment of the condition of the North Carolina roads was conducted taking into account pavement conditions, congestion, funding and safety. **As a result, the state’s roadway infrastructure has been given a grade of D.**

## BACKGROUND

There are a total of 102,637 public road miles in the State of North Carolina. Of these, the North Carolina Department of Transportation is responsible for the second largest state maintained highway system in the nation totaling 78,844 miles broken down as follows:

Interstate Routes	1,044 miles
Interstate Business Routes	66
US Routes	5,531
NC Routes	8,119
NC Secondary Routes	64,085
Total	78,844 miles

The remainder of the roads, are either maintained by local cities (19,824 miles), are state park roads (748 miles), or are federal roads (3,221). Total vehicle miles traveled are 95,627 Million per year as estimated by the NC DOT. Since a large proportion of the miles traveled are on DOT roads, and better records are available through the DOT, this study is based on the DOT maintained roads.

In 1996 the General Assembly created the North Carolina Highway Trust Fund. Revenues for this Fund are generated

from a state motor fuel tax, a 3% use tax on the sale of motor vehicles, titles and other fees. This fund is used to provide state matching funds for Federal Aid projects, to improve the road system and complete 3,600 miles of an intrastate system of four-lane highways, and for maintenance and paving of roads based on the vision developed by the NC legislature in 1989. The NC DOT under a plan instituted by Gov. Mike Easley has developed a State Transportation Improvement Program (STIP) to address the needs for the state covering 2006-2012 needs and estimate funding needed, sources, and any funding shortfalls. The NC DOT conducts an active inspection program of all roads under its jurisdiction and maintains a database to assist in developing priorities and identifying future needs.

Demands on the road system in the state have been significant as the population of the state grew at 27 % between 1990 and 2003. Major metropolitan areas in the state have been experiencing increasing congestion with significant costs for commuters in excess fuel, lost time and repairs.

In order to assess North Carolina road condition, funding vs. needs, urban congestion, and user costs were considered as detailed in the next section.

# CONDITIONS

## Pavement Condition Rating (PCR)

The NC DOT uses a rating system for pavements based on the Federal Highway Administration (FHWA) Present Serviceability Index (PSI) defined as Pavement Condition Rating (PCR). The survey to determine the PCR is conducted every two years. Results are reported according to DOT regions as defined in the graph below and reported according to type of pavement. According to this system, pavements are considered good if they have PCR > 80, fair for PCR between 60 and 80, and poor for PCR < 60.



Results for 2006 are tabulated below:

Asphalt Pavement Condition Survey - US, NC and SR Routes  
2006 Comparison Across Geographic Regions

All Sections						
Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	31216.25	60.8	20.2	19	79.4
East-Central	4,5,6	37541.07	66.8	21.6	11.6	83.2
West-Central	7,8,9,10,12	56119.72	70.5	18.9	10.7	84.7
Mountain	11,13,14	28524.15	65.3	20.1	14.6	82.1
State		153401.2	66.6	20	13.3	82.8

2006 NORTH CAROLINA INFRASTRUCTURE REPORT CARD

Primary (US and NC) Routes Only

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	8997.62	57.3	19.8	22.9	77.9
East-Central	4,5,6	8813.77	71.3	18.4	10.1	84.5
West-Central	7,8,9,10,12	10864.96	68.9	19.4	11.6	84.6
Mountain	11,13,14	6498.75	72.3	13.1	14.5	83.9
State		35175.1	67.2	18.1	14.7	82.7

Secondary (SR) Routes Only

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	22218.63	62.3	20.3	17.4	80.1
East-Central	4,5,6	28727.3	65.4	22.6	12	82.8
West-Central	7,8,9,10,12	45254.76	70.8	18.7	10.4	84.7
Mountain	11,13,14	22025.4	63.2	22.1	14.7	81.6
State		118226.1	66.5	20.6	12.9	82.8

Rural Sections

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	28176.11	61.3	19.9	18.9	79.7
East-Central	4,5,6	32914.78	67.6	21.3	11	83.6
West-Central	7,8,9,10,12	46942.76	71.1	18.9	10	85
Mountain	11,13,14	26504.01	65.2	20.2	14.5	82.1
State		134537.7	67	20	13	83


### Urban Sections

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	3040.14	56.8	22.9	20.4	77.4
East-Central	4,5,6	4626.29	61.2	23.5	15.2	80.7
West-Central	7,8,9,10,12	9176.96	67.4	18.6	14	82.8
Mountain	11,13,14	2020.14	66.4	17.9	15.7	82.1
State		18863.53	64	20.4	15.5	81.3

*Note that Lane Miles represents the number of lanes surveyed, not the total of the system as this number does not include unpaved or concrete routes.*

*Urban indicates any highway passing through a town. This could be a town of any size, not just large metro areas.*

**Good**=PCR>80

**Fair**=PCR between 60 and 80

**Poor**=PCR<60

### Interstate Pavement Condition Survey 2006 Comparison Across Geographic Regions

### Interstate Asphalt Sections

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	352	86.4	6.8	6.8	88.6
East-Central	4,5,6	1106	75	15.4	9.6	89.2
West-Central	7,8,9,10,12	1518	68.8	20.4	10.8	87.3
Mountain	11,13,14	712	57.3	35.4	7.3	86.6
State		3688	70.1	20.5	9.4	87.9



Interstate Jointed Concrete Sections

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	0	0	0	0	0
East-Central	4,5,6	489	69.7	15.1	15.1	84.4
West-Central	7,8,9,10,12	569	64	19.9	16.2	82.6
Mountain	11,13,14	212	57.5	8.5	34	70.7
State		1270	65.1	16.1	18.7	81.3

Overall Interstate

Region	Divisions	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
Coastal	1,2,3	352	86.4	6.8	6.8	88.6
East-Central	4,5,6	1595	73.4	15.3	11.3	87.7
West-Central	7,8,9,10,12	2087	67.5	20.3	12.3	86.0
Mountain	11,13,14	924	57.3	29.2	13.4	83.0
State		4958	68.8	19.4	11.8	86.2

*Note that Lane Miles represents the number of lanes surveyed.*

*Lane Miles refer to mile increments of a lane rather than highway miles, e.g. a one mile length of a 4 lane highway would be 4 Lane Miles.*

In general only 2/3 of the lane miles surveyed were considered good, and urban areas have lower PCR values than the rest of the state in spite of the higher traffic and VMT. The coastal regions also fared more poorly.

In spite of the efforts in improving the PCR under the STIP program, little progress has been made over the last few years, although slight improvement has been achieved. It must be kept in mind that an improvement in the good category of 3% translates in a shift of 3000 lane miles.

### All Sections

Year	Lane Miles	Percent Good	Percent Fair	Percent Poor	Average PCR
2000	143678.6	63.4	22.5	14.0	81.8
2002	147624.8	62.6	22.1	15.2	81.0
2004	150827.5	64.8	20.6	14.6	82.1
2006	153401.2	66.6	20.0	13.3	82.8

The improvements were mainly achieved through two approaches: 1) gradual implementation of pavement preservation activities. This includes the use of cost-effective chip seals and thin overlays on roads before they deteriorate to rehab/reconstruction levels, and 2) The North Carolina Moving Ahead program and prior to that, Senate Bill 1005 projects. This allowed the DOT to focus more dollars on rehabilitation and safety improvements for existing highways. Both programs required extensive planning and appropriate testing and design work to maximize the life of the rehabilitations. Repair of these "bad" sections allows more focus on preserving and repairing other pavements with current maintenance dollars.

Using a different rating system, the 2005 State Transportation Statistics publication from the US Bureau of Transportation Statistics identified that only 49.5 % of the NC road mileage was either very good or good. This was determined by converting the state rating to a national scale that is the only comparison that can be made from state to state. The results showed that the state is in the bottom 8 states in terms of "percent poor" interstates.

### Funding

Under the long range transportation plan by NCDOT the agency anticipated a shortfall in funding of \$ 29 B over the next 25 years. In the shorter term, the STIP plan for 2006-2012 appeared to be balanced in terms of needs versus fund availability, with revenues providing for \$ 9.4 B of funding for

highway projects in the state. In this report it was assumed that Federal Aid would be \$ 889 M/yr growing to over \$ 1B per year by 2012. The balance of the funds are planned to be derived from the State Trust Fund. The figures in this plan will need to be updated shortly based on a number of factors outlined below resulting in a significant shortfall in funds available versus needs.

Unfortunately, under the Transportation Authorization Bill passed in Congress in 2006 (SAFETEA-LU), the portion of Federal Aid Funding that NC is expected to receive will be less than the planned funding, with a return to the state of 90.5%, a significant drop from the last transportation authorization cycle. A portion of the shortfall can be made up by higher than planned income to the state trust fund due to higher gasoline prices, however only a portion of the gasoline tax is based on a percentage of the wholesale price, so increases due to the price of gas are small and the legislature recently capped that portion of the tax. So the increase in revenue will only compensate for a small proportion of the decrease in available funds. Unlike a number of other states that use less visible and additional means of generating revenue (such as property taxes, car sales taxes, etc.) the gasoline tax is very visible to consumers and it is a politically charged issue. As such, it is unlikely that the fund can be supplemented by an increase in gasoline taxes because NC is already in the top 10 states for gasoline taxes (although closer to the average when all revenue sources are accounted for), and there is pressure from the public to decrease the NC taxes to compensate for the rise in gasoline prices. In addition, construction inflation has been in the 12-16% range for the last

few years due to steel, cement, asphalt and fuel prices. Finally, about ½ of the projects for fiscal year 2004 were delayed to future years, including major loop projects around Charlotte. This was caused in part by diversion of funds from the Trust Fund to other purposes, driven either by DOT management or the Legislature, decreasing their availability for the initial intended purposes. The combination of shortfall in federal aid under the SAFETEA-LU bill and construction inflation resulting in delays in implementation are expected to increase the shortfall over the next 25 years.

### Congestion

According to the June 2006 TRIP report on the Interstate Highway system, 57% of all urban highway miles in NC are congested, and 47% of rural miles are congested. The degree of congestion is one of the highest in the country with only California and New Jersey reported higher level of overall congestion. The two largest metropolitan areas were ranked

19th for Charlotte area and Raleigh 45th in terms annual delay per vehicle due to congestion out of the top 85 urban areas in 2003. Charlotte was also ranked the 20th worst for congestion out of the top 50. It was estimated that this resulted in a cost of \$ 791/person per year in Charlotte for excess fuel and lost time, and \$ 460/person in Raleigh. These numbers have significantly increased since the estimate was made in 2003 due to higher fuel costs. In the state there were 95,900 Vehicle-Miles Traveled (VMT) per capita per year in 2004, or 10th in the US, and ranked 18th in VMT per capita.

### Safety

NC ranked 4th in the US in the number of traffic fatalities with a total of 1,557, exceeded only by California, Florida and Texas. However, it ranked 12th in terms of fatalities per registered vehicles (133% of national average) and 19th in terms of fatalities per VMT (114% of national average). The state has an active seat belt law and enforcement program.

## GRADE

The overall grade was derived by compiling individual grades in four categories applying a weight to each and developing a composite grade. Pavement Condition and Funding was each determined to be 30% of the overall grade, while Congestion and Safety each was 20% of the overall grade.

Less than 70% of the roads in NC are rated Good or Very Good, and therefore the Pavement Condition was graded as a D.

Due to the significant shortfall in funding long term and more recently with the new transportation bill, grade of F is assigned for Funding.

When you compare ranking in congestion vs. VMT rankings it is obvious that NC lags most other states in supplying sufficient roads to handle congestion as it relates to VMT.

In light of this a grade of D has been assigned to Congestion.

In safety the performance of NC was 10% worse than the average of the other states thus was given a grade of D.

The overall grade using the above allocation for the state's roadway infrastructure is therefore a D.

## POLICY OPTIONS

North Carolina is projected to continue being one of the fastest growing states in terms of population and as a consequence in terms of Vehicle Miles Traveled in the state. While the NC DOT has been active in developing medium and long term plans for roads to address this growth, the funding necessary to implement the plans is insufficient. The estimate of a shortfall of \$ 29 B over the next 25 years is likely to be conservative in light of the fact that Federal Aid funds are

expected to be significantly lower than projected based on new funding formulas for the state in the recently signed Transportation Authorization Legislation, and significant increases in construction costs. While a portion of the shortfall can be overcome through the NC Highway Trust Fund due to increased gasoline prices and taxes on the gas that are based on a percentage, only a small additional contribution can be expected due to the recent cap enacted by the state

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legislature. In addition, it is expected that voters will strongly resist increases in the fuel tax needed to compensate for the significant gap between needs and funding.

The Pavement Condition Survey indicate that while overall ratings have not gotten worse over the last few years, little improvement has been made in increasing the percentage of pavements that can be considered good, in spite of significant investments in roads over the last few years. Reasons for this are beyond the scope of this study, but in general it is prudent to insure that an effective maintenance program is funded in future years and steps taken to insure that design life is achieved or exceeded in all new construction. In the past, the focus has been more on building new pavements to fulfill the 3,600 miles vision rather than in maintaining existing pavements, resulting in premature deterioration and increased construction needs to replace pavements that did not meet the design life. Careful evaluation of life-cycle costs (LCCA) of practices and options in new construction should be instituted for all new construction, with basis for the evaluation derived from actual experience in NC and nationally. Steps should be taken to insure that decisions are made based on realistic LCCA rather than initial costs to insure long-term cost effectiveness, although the state DOT already uses LCCA for pavement type selection during the design process. Practices that tend to shorten life spans of pavements should be reevaluated and when necessary changed to increase life expectancy. Examples are use of deicing practices that are detrimental to pavement such as use of sand, slag and salt followed by less than ideal snow removal practices.

Congestion should be addressed on a state wide basis and be a key parameter used for prioritizing expenditures and investments in new roads. Presently the prioritization process is often influenced by politics and/or not addressed from an overall state perspective but is conducted on a regional basis. More could be achieved in addressing congestion in urban areas if priority was given to this goal rather than completing the vision of 4 lanes highways in rural areas where they are not needed. Mass transit systems have not been very effective in NC with ridership and utilization of systems being very low.

Charlotte is implementing a light rail project, but even with the most optimistic forecast it will have practically no effect on reducing congestion in the metropolitan area and the costs are very high compared to alternatives.

Every step possible should be taken to insure that costs are reduced in projects while quality is improved. A number of innovative approaches that have been successful in other states should be more widely implemented such as Design/Build options and value engineering. A number of projects using this technique have recently been conducted by the state and results appear to be positive. Contracting practices should be reviewed, e.g. lowest initial cost is not necessarily the lowest cost for the consumer when you take into account delays, change orders, credit and bonding issues. Hold industry more responsible for the pavements they place under contracts. Use less prescriptive requirements and move toward performance based specifications. Focus should shift from the quantity of building projects to better insuring that the projects that are built are durable, even if the quantity is reduced. More focus needs to be placed on maintenance efforts to better maintain the existing infrastructure rather than rebuilding. The state is experimenting with using a maintenance management company in order to better manage the maintenance program.

Plans need to be implemented as soon as possible to increase funding available. Unfortunately there are not many options that would be easily supported by the public. Options range from toll roads, to additional bond issues, and additional taxes. An education program for the public should be instituted and for industry in the state. Once all players understand what the costs are to the consumers and industry due to congestion and defective roads, perhaps it will be easier to institute some of these options. The most effective means to address the funding gap is to find more productive ways of utilizing the funds available, thus reducing the need rather than seeking significant funding increases.

Unless appropriate steps are taken to address the gap between funding and needs, the roads in North Carolina will start getting worse, and the overall gap will increase over time as the state gets further behind in implementation schedules.

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## RECOMMENDATIONS

The North Carolina Section of the American Society of Civil Engineers specifically supports the following recommendations:

- Support efforts to implement innovative construction practices such as Design/Build, and Design/Build/manage
- Encourage development of realistic, fact based Life-Cycle costs analysis methods and implement them as primary decision tools as opposed to “lowest price”
- Encourage practices for lowering overall costs of construction implementing systems such as value engineering principles. The gap between needs and revenue could be significantly decreased by more efficient use of funds available.
- Consider alternatives for increasing funds available for roads through alternative sources such as toll roads, additional bond issues, etc. An example is the presently debated I-540 toll road nearing NC Legislative approval.
- Encourage local politicians to work diligently in the appropriations process of the SAFETEA-LU authorization legislation to increase NC’s share of Federal Aid to get closer to past allocations.
- Encourage shift from prescriptive specifications to performance based specifications.
- Increase design life for pavements by carefully evaluating the potential of new innovative technologies such as high performance concrete and microchip asphalt developed under FHWA programs.

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ASCE 2005 Report Card

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The public education system is one of the most visible and debated issues in North Carolina today. While issues such as test scores, class size and safety receive broad attention from the media and the public, issues regarding the condition of the school system's infrastructure often go unnoticed. The physical condition of the state's public school buildings is critical to the success of other goals, but more than 46 percent of North Carolina's schools will need some form of renovation in the next five years. **As a result, the state's public schools have been given a Grade of C-.**

## BACKGROUND

Every five years, local school boards are required to submit their long-range plans to the state Board of Education, where the Department of Public Instruction (DPI) compiles the information into a Facility Needs Survey report. Following the last report from 2000–2001, DPI issued a *North Carolina Public Schools Facility Needs Survey Preliminary Report* in April, 2006, which outlined the condition of existing facilities and evaluated needs for the next five years.

## CONDITIONS

### Existing Facility Needs

As the state's population continues to grow, many public schools are being stretched to or beyond capacity and facilities are failing to meet the student's basic needs. DPI's Facts and Figures 2005-2006 and April 2006 North Carolina Public Schools Facility Needs Survey Preliminary Report recorded 2,242 public schools (excluding charter schools) in

the state of North Carolina, and determined their general condition by the number of schools reporting needed renovations. These necessary renovations were presented in seven categories: plumbing/air conditioning/electrical, site improvements, interior/finishes, building exterior/structure, building code/life safety, hazardous material/environmental and other renovations.

Inadequate Feature	Number Schools	Percent of Total Schools <sup>1</sup>
Plumbing/Air Conditioning/Electrical	797	35.5
Site Improvements	695	31.0
Interior/Finishes	696	31.0
Building Exterior/Structure	686	30.6
Building Code/Life Safety	522	23.3
Hazardous Material/Environmental	331	14.8
Other Renovations	483	21.5
<b>Total <sup>2</sup></b>	<b>1,034</b>	<b>46.1</b>

<sup>1</sup> Based on 2,242 schools

<sup>2</sup> Schools may have more than one inadequate feature

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The report concluded that more than 46 percent of North Carolina’s public schools require some form of renovation over the next five years. Approximately one-third of these needed renovations are considered “highest” priority, meaning they are

needed in less than two years. In addition, 18.7 percent of all needed renovations in the next five years are to replace obsolete facilities—over 190 public schools in the state will be considered obsolete in five years or less.

## **FUTURE FACILITY NEEDS**

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Funding to support increased capacity in the school systems has not grown at the same rate as the student body. DPI’s 2006 Preliminary Report noted that the use of mobile units and temporary classrooms in North Carolina’s public schools has increased by 1,500 in the last five years. There are approximately 178,325 students in mobile classrooms—13 percent of all public school students statewide—and more than 260 new schools will be required in the next five years, a 36 percent increase in needs from 2000. On top of the new schools, in order to meet projected enrollment growth, replace obsolete facilities, ease overcrowding (class size reduction) and reduce the use of mobile units, 1,111 of the state’s existing schools will require additions in the next five years.

The combination of new construction, additions and renovations, in conjunction with a 47 percent increase in construction costs over the past five years, indicates total facility funding need of \$9.7 billion over the next five years.

This represents a significant increase from the \$6.98 billion need identified in the 2000-2001 survey.

Grades were assigned for the Public Schools category in three areas. A grade of D was assigned for renovations due to the more than 46 percent of North Carolina’s public schools requiring renovation in the next five years. Due to the importance of maintaining our existing facilities to meet current and future needs, this grade was weighted more heavily than the other two assigned grades. A grade of B was assigned for the percentage of schools in the system that will be considered obsolete in the next five years—190 schools, or approximately 8.5 percent. And finally, a grade of C was assigned in the area of capacity, given that 13 percent of all public school students in the state are taught in mobile classrooms. Therefore, an overall grade of C- was given to North Carolina’s public schools.

## **POLICY OPTIONS**

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As the state’s population continues to increase, North Carolina’s public school system will continue to see a surge in enrollment. Without additional funding, existing facilities will continue to age and fall into disrepair—jeopardizing the students’ ability to succeed. The financial pressure created by these conditions, combined with escalating construction costs,

presents a real challenge for the public school system to keep pace with needs while competing for attention and funding.

ASCE strongly supports all levels of governments making primary and secondary education a priority and providing the resources to support the necessary infrastructure.

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## RECOMMENDATIONS

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- Support the increased use of school construction bonds;
- Encourage school districts to explore alternative financing to facilitate construction, including lease financing and financing/ownership/use arrangements;
- Encourage school districts to adopt and follow regular, comprehensive construction and maintenance programs;
- Increase emphasis on research and development for design and construction to meet the rapidly changing teaching environment;
- Encourage the use of life-cycle cost analysis principals to evaluate the total costs of projects;
- Consider direct funding for school construction; and
- Ensure that money earmarked for the public school system is used for its intended purpose.

## SOURCES

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All too often, local cities and counties pay little attention to storm water infrastructure. Only when major flooding from a rain event in an area with an inadequate drainage system occurs do storm water issues become newsworthy. Unfortunately, polluted runoff is the number one cause of water pollution in the state, and the effects of urbanization and the lack of adequate controls to protect natural resources—from shellfish water closings and beach advisories on the coast to extensive property damage from severe rain events in mountains—are being seen more and more. And, as North Carolina's population continues to grow, the state's water quality is at risk.

Communities across the state are now being required to address storm water and the water quality of their streams, as well as take steps to reduce polluted storm water runoff. However, dedicated funding for storm water infrastructure is not typically available, nor have communities consistently budgeted to clean their drainage systems. **As a result, the state's storm water infrastructure has been given a grade of C-.**

## BACKGROUND

The impact of storm water on replenishing our water supply, providing recreation, habitat for fish and wildlife, economic prosperity and a higher quality of life, is very important. For drainage and flood control purposes, storm water systems collect, store or transport rain or other storm water runoff. This runoff typically flows into the nearest creek, river, lake or ocean, but in North Carolina most storm water receives marginal treatment, if any, before it enters local waterways.

Land development and changes in natural ground cover and soil conditions alter the amount and rate at which storm water runoff occurs. If sufficient mechanisms are not in place to temporarily hold the extra runoff, or return it to the ground through infiltration means, streams and other conveyance systems will become inadequate to carry the additional load—resulting in flooding and erosion that can jeopardize public health, safety and welfare.

Additionally, development, combined with everyday activities associated with residential living (urban and rural), commercial business, industrial production and construction have increased the potential for non-point source pollution. Every time it rains, runoff from rooftops, lawns, streets and parking lots picks up dust and dirt, oil and grease, pet waste, pesticides and fertilizers, leaves and grass clippings, paint and other household products. Add to that the runoff produced by agricultural irrigation over the last 30 years, and the stress

on the state's water resources has significantly increased.

The state's existing storm water infrastructure consists of conveyance systems such as pipes, ditches and culverts, as well as natural and engineered facilities to control the quantity and quality of runoff—also known as detention facilities or water quality best management practices (BMPs)—and receiving streams, lakes and estuaries, including the intercoastal waterway and the ocean.

For years, the Federal Emergency Management Agency (FEMA) has maintained the National Flood Insurance Program (NFIP) to help communities identify areas subject to flooding, and to establish programs to minimize development within regulated floodplains. The United States Environmental Protection Agency (EPA) has also recognized the impact of storm water through the implementation of its National Pollutant Discharge Elimination System (NPDES) regulations. North Carolina's Department of Environment and Natural Resources (DENR) is administering this program. These regulations require designated communities to develop a storm water management plan based on six minimum measures, or BMPs: public outreach and education; public involvement and participation; illicit discharge detection and elimination; construction site runoff control; post-construction runoff control; and pollution prevention/good housekeeping for municipal facilities.

People swimming or playing in waters with high bacteria levels have an increased risk of developing gastrointestinal illness or skin infections. In order to comply with the Beaches Environmental Assessment and Coastal Health Act, DENR's Division of Environmental Health monitors beach water quality at both ocean and sound-side beaches weekly from April 1 to September 30, twice a month in October and on a monthly basis from November through March, as part of the Recreational Water Quality Program. When levels are exceeded based on a beach's usage, a swimming advisory or alert is issued. Many of these advisories are a result of storm water runoff or its secondary effects (e.g., wastewater collection pipe overflows due to excessive storm water infiltration).

The Clean Water Act (CWA) requires states to report their

water quality biennially to the EPA, including how well its designated uses, such as swimming, aquatic life support and water supply, are being supported and likely causes (e.g., sediment or nutrients) and sources (both point and non-point) of impairment. CWA also requires the state to develop a list of waters that do not meet quality standards or that have impaired uses. Listed waters must be prioritized, and a management strategy or Total Maximum Daily Load (TMDL) must be developed. In 2002 DENR set a goal to develop TMDLs for all impaired bodies of water within 10 years of their first placement on the list. In addition, non-point sources which have caused streams to get on the NC 303(d) list have caused wastewater treatment facilities to spend more dollars to meet higher standards under the development of TMDLs because it is easier for the State to regulate and monitor direct dischargers.

## CONDITIONS

North Carolina does not have a current, comprehensive inventory of storm water systems statewide or a record of community's past practices on operation and maintenance. However, in 2006 the North Carolina Rural Economic Development Center (REDC), through its Water 2030 Initiative, collected detailed information on storm water systems statewide, identifying 465 municipal systems that merited further consideration and analysis.

### Managing Growth

Growth in the state's storm water systems has generally been linked to growth in the state's largest municipalities. Policies are in place to curb added flooding on properties as a result of increased runoff to downstream conveyance systems or streams, and detention control programs exist in many cities and counties to control peak rate runoff from new developments. However, policies vary across the state on what magnitude of storm event mandates control.

As the population grows and more land is developed, the quantity of runoff increases, creating greater potential for flooding. And, as the state trends toward higher frequency and severity of hurricanes and flooding—resulting in increased monetary damages—efforts have increased to redefine flood-prone areas and remove or prohibit development in those areas.

In 2000, North Carolina began an effort to update FEMA floodplain maps statewide. Since then, over \$30 million has been invested in engineering, mapping and program management. The goal was to update data on all 17 river basins by the end of Fiscal Year 2005 (FY2005). Many of the eastern counties now have updated maps available. The program is now focused on the remaining counties in central and western North Carolina. Also, six out of every ten municipalities with storm water systems have guidelines preventing new development within the 100-year floodplain—the minimum standard for the NFIP.

Period of Record	1979 - 1982	1983-1988	1989-1993	1994-1999	2000-2003
Damage in 1995 Dollars	Less than \$1 Million	\$13.9 Million	\$8.82 Million	\$20.5 Million*	\$9.02 Million

\* excludes 1999 with \$2.9 billion in damages from hurricanes

### Maintenance

Historically, maintenance of a town's drainage systems has remained "out of sight, out of mind" until a problem occurs. Unfortunately, when communities do try to address the problem, all too often they find the cost of the solution is prohibitive or that it will have a significant impact on private properties. More than 75 percent of municipalities reported their system to be in fair or poor condition.

According to REDC's Water 2030 survey results, only 5.6 percent of municipalities currently apply fees to their storm water systems to raise revenue for future improvements, and reported operation and maintenance expenditures for 2004 were over \$38 million. Locating existing storm water systems is also a major challenge, with only 16 percent of North Carolina's towns reporting that they have a map of their storm water system, and only 8 percent using Geographic Information System (GIS) technology to keep updated records of the system's location and condition.

### Public and Environmental Health, Safety and Welfare

As part of the permitting process, EPA's NPDES program calls for considerable attention to educating and engaging the public, as well as controlling and preventing pollution. Six of North Carolina's largest municipalities have been held to the program's requirements since Phase I began in 1990, and in 2004 an additional 130 communities were included as a part of the program's second phase. However, while Phase I and II communities represent the highest concentration of population and growth in the state, they represent less than one third of the 465 communities with storm water systems. Some rapidly growing communities in sensitive areas may not be required to comply with these new water quality initiatives due to the criteria used by the NPDES program (i.e., smaller towns along the coast experiencing growth due to tourism).

Growth and lack of proper land use management can impact water supply as well. Currently, the state has more than 700 river segments, totaling nearly 3,000 miles, which are considered "impaired" by pollutants and unable to support designated uses. Also, a total of 46 swimming advisories

were issued on 31 beaches during the 2004 season, up from 35 advisories issued in 2003. Fortunately, the total days under advisory dropped significantly, from 874 days in 2003, to 555 days in 2004.

### Integrated Water Resource Planning and Management

Management and regulation of the state's water resources is a multi-jurisdictional effort in its current form. Consider that agencies separately address issues in water supply, flood management, water quality management, wastewater treatment, and environmental impact on receiving waters. Each promulgates regulations in a narrow range of applicability. The combined result is that many management tools have been ruled out in one context or another, often leading to the conclusion that nothing can be done to balance one issue against another and find some aggregate solution. It should be noted that some attempt to address this is being seen with the optional Universal Storm Water Management Program by the Division of Water Quality. This program attempts to provide a uniform, consistent set of design standards across jurisdictional boundaries addressing watershed protection, stormwater regulation, water supply watershed regulations, and others.

Grades were assigned for the Storm water category in four areas. A grade of C- was given to development regulation for the 60 percent of communities statewide that have guidelines to prevent new development in floodplains. A grade of D+ was given to management because only 16 percent of the state's systems possess a current map of their storm water infrastructure. A grade of B was given to policy and procedures because 135 communities—which make up the majority of the state's population—have established or will soon be under the new NPDES Phase II storm water permitting process which emphasizes additional requirements to protect water quality. And finally, a grade of D- was given to funding because less than six percent of communities reported having a dedicated revenue source for storm water infrastructure operations and maintenance. Those four areas combined for an overall grade of C- for North Carolina's storm water infrastructure.

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## POLICY OPTIONS

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Changes in land use and natural hydrology from increased development are adversely impacting storm water runoff, and the state's population is expected to continue its rapid increase. New innovations in storm water and water quality management are available, and applying these new solutions should be expedited—especially where results in the new technology are proven.

Development policies must also become a priority in light of the ever increasing cost of natural disaster relief. This should also include the implementation of the NPDES Phase II program—focusing on awareness, protection, prevention and evaluation.

In far too many cases, the approach to public infrastructure is reactive instead preventive—systems being built and operated with minimal maintenance. Without dedicated funding for the

state's storm water systems, the cost of maintaining pipes, channels and streams will only rise after the damage from a storm event is done.

The REDC Water Initiative found that by 2030 the state's storm water investment need would be \$1.47 billion, \$570 million of which would be needed by 2010. Because a considerable number of communities do not know the extent of their systems or their needs, these figures could be significantly underestimated.

While grants are available to help enhance and protect water quality, the demand usually outpaces the availability of funds by two to one. However, fully funding the Clean Water Management Trust Fund at \$100 million—adjusted annually for inflation—in addition to other permanent funding, such as the proposed Clean Water Bonds Act of 2006, will help to close the current funding gap.

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## RECOMMENDATIONS

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- Continuation of and support for the North Carolina Rural Economic Development Center's development of a statewide inventory database;
- Develop a permanent funding source for storm water improvements that can keep pace with the state's necessary improvements and population growth over the next 25 years;
- Encourage regional cooperation and management of systems, including state encouragement of inter-local agreements, including multi-objective planning and management for all water-related agencies throughout all levels of government;
- Implement NPDES Phase II permitting to guide communities in the management and maintenance of their

storm water—including providing suitable state staffing and resources to guide the educational and monitoring process over the next five years and encouraging more communities to enact the guidelines to prevent floodplain development;

- Develop Standards for Inspection and Maintenance of BMPs. With the aspect of the new storm water permit focusing on water quality protection and pollutant removal, communities will be faced with a high influx of engineered storm water devices for pollutant removal into the system (both the public and the private components of the storm water system). Privately-owned BMPs especially will be susceptible to infrequent maintenance thereby jeopardizing the integrity of the overall system.
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## SOURCES

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<http://www.ncstormwater.org>

North Carolina has documented a funding need in excess of \$3.4 billion over the next five years with over \$4 billion of additional wastewater infrastructure investment needs through year 2030. These funds are needed to replace aging facilities, comply with mandated Clean Water Act (CWA) regulations and provide, as well as keep pace, with economic development. As the state experiences unprecedented population growth we are also challenged to address water quality degradation. This degradation, which had led to fish kills and closing of sections of our waterways within certain river basins has led to promulgation of specific regulations aimed at further reduction of nutrients being discharged into receiving waters. These specific basin rules are a direct result of fish kills and algae blooms that brought national attention and unfavorable press to North Carolina. We have made significant improvements as the documented wastewater related fish kills and algae blooms are decreasing. The tightened discharge limits, increase treatment cost and, when coupled with aging infrastructure are challenging public utilities' ability to remain compliant. The American Society of Civil Engineers (ASCE) supports an increased state role in the funding of needed wastewater infrastructure. If funding needs are not met, the state risks reversing the improved public health, environmental and economic gains that have been realized over the past 30 years.

**A Grade of C- is assigned to this component of the state's infrastructure.**

## BACKGROUND

The water quality of our streams, creeks, rivers and estuaries is critical for human health, ecological health, and sustaining our economy. As a coastal state, North Carolina has a number of strong and growing business that depend on clean water. The state's seafood industry alone is valued at \$100 million. Water-based recreation, ecotourism, trout and catfish farming and boatbuilding industries continue to attract people and dollars to the state and clean water is integral to these industries.

North Carolina is fortunate that we have a diverse water landscape from fresh water trout streams in the mountains to one of the most complex and large estuary systems in the world. By design, most larger/interceptor sewer systems follow creek beds and the larger pump stations are generally located in flood plains and of course our wastewater plants discharge directly to the aforementioned diverse water landscape. Therefore it is our (public) duty to ensure these facilities are properly funded, maintained, and capable of providing a level of service advantageous to improving water quality.

According to a recent study by the NC Rural Economic Development Center, Inc., North Carolina has over 409 public wastewater systems statewide that provide

approximately 51% of the states's population with wastewater service and the majority of these systems (81%) are owned and operated by incorporated municipalities. Based upon reports from the state's public wastewater system managers, the actual number of people served by public wastewater service statewide is estimated to be over 4.4 million. With the state's rate of population growth expected to bring us to the 8th most populous state by 2010, human demands for adequate wastewater treatment and disposal will continue to drive costs for these systems.

Our state contains a wide range of local government economies that vary in their ability to fund and maintain the public's wastewater systems. For example, smaller rural systems must charge significantly higher rates than larger systems to offset the absence of large economies of scale. The monthly bills for some households on smaller systems often exceed twice that of similar customers of larger systems. Without proper planning needed improvements to these aging wastewater systems in upcoming years will only magnify the disparities. Based upon information from the NC Rural Economic Development Center as part of their Water 2030 initiative, if the cost for near term needed improvements were spread across all the state's wastewater systems customer base, the smallest wastewater system's



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monthly bill, based upon 6,000 gallons usage, would grow by an additional \$75 per customer. The larger system's monthly charge would increase by over \$50 per customer.

Unfortunately, the rural and sometimes poverty stricken portions of the state know the harsh reality of paying an average utility bill (wastewater and water service) above the state defined High Unit Cost threshold of 1.5% of local median household income. Reportedly, the EPA's current measure of affordability is a system wide average of 4.5% of

median household income. Therefore, North Carolina defines a target rate significantly lower than those recommended nationally by the EPA. What this means is that North Carolina providers collect smaller amounts for their wastewater service and without state supported funding the required and mandated wastewater improvements within these smaller systems will either go uncompleted or be completed via private funding. This in turn will serve to make wastewater service even less affordable to low-income residents.

## CONDITIONS

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In 2006, the Water 2030 initiative collected detailed information about North Carolina's 409 wastewater systems to document their current capital improvement budgets and determine future capital improvement needs. This survey concluded that wastewater system owners have identified approximately \$7.52 billion in funding needs over a 25-year period.

Several of the systems have aging wastewater collection systems and treatment plants that are unable to contain peak flows or provide adequate treatment. Additionally, biosolids (the residual solid part of the wastewater treatment process) disposal is becoming more difficult and challenging in the face of tighter application requirements, land use regulations and the pressures of increased development.

Several of our older sewer systems were constructed using mostly vitrified clay pipe (VCP) that was installed over 40 to 50 years ago. VCP standard pipe lengths ranged from 3 to 5 feet long with joint gasket material made of oakum or cotton fiber material. This means that a 400-foot long section of sewer installed with VCP may have over 130 pipe joints, many or all with deteriorated gaskets and cracking at the joints. Such failures in the sewer can allow root intrusion that can cause blockages or infiltration that can lead to problematic over-capacity issues.

That same 400-foot reach as installed today with a plastic or iron pipe material would typically have about 21 pipe joints (1/5th as many) including the connection with the manholes. Similarly, the older concrete pipe material commonly used for larger/interceptor sewer reaches (12-inch and above) and the brick with mortar used to build the older manholes are

deteriorating in the presence of the hydrogen sulfide that is inherent to domestic sewer systems.

The weakening in the integrity of the sewer system can easily lead to problems in the collection system and at the wastewater treatment plant. A root intrusion will catch debris and clog easier, leading to basement flooding or overflow condition. An excessively cracked pipe or manhole will allow inflow or infiltration of groundwater or storm water directly into the sewer system causing an overflow condition. In the case of failed pipe material the wastewater may actually leak directly from the sewer into the groundwater or surface water without the presence of an overflow condition and thereby going unnoticed.

All sewer systems, regardless of material of construction experience some level of infiltration and inflow (I&I). Typically, the older systems installed in areas with a high groundwater table will experience the most infiltration. It is reported that on some of the highest flow days (large rain events), wastewater flows exceed treatment capacity at 40% of the state's 351 wastewater treatment plants. The amount of rain and groundwater entering the sewer lines on these high-flow days (estimated at 158 million gallons) is double the average daily flow of North Carolina's largest wastewater system Charlotte-Mecklenburg. This results in a high percentage of wastewater systems under moratoria and Special Orders of Consent for either exceeding the permitted discharge flow limit or raw sewage overflows from the wastewater collection system. In addition, rural systems report more than twice the volume of infiltration and inflow as urban systems.

## POLICY/FUNDING

Historically, several federal and state programs have provided funding to offset the rising and on-going cost of constructing, maintaining and upgrading public wastewater systems. These programs are aimed at addressing differing needs from improving compliance limits at the treatment plant discharge to maintaining and upgrading the collection system to prevent overflows.

These programs are administered in the form of grants, low interest and market rate loans. The level of funding available through these programs has been decreasing in recent years. Additionally, the increasing and ever changing regulations imposed on public wastewater systems can easily and sometimes unexpectedly deplete a system's budget in the absence of governmental assistance. The U.S. EPA is the primary regulating authority over wastewater systems and was once a primary source of funding, but since about 1990 the grant/loan funds are being limited and reduced. The decline in these funding sources coupled with the increased demand for safe, efficient wastewater infrastructure calls into question the role of the State. State contributions to infrastructure financing

are becoming more important. Most recently, the State of North Carolina made available \$800 million of grant and loan funds financed through general obligations bonds. These funds led to remarkable improvements in wastewater systems in 97 of the state's 100 counties. These funds have been exhausted and we now face a period of record low funding for needed wastewater improvements.

Private loans from banks and other private lending institutions have become the largest single source of capital investments for public wastewater construction projects. These loans take several forms, including general obligation bonds, revenue bonds, special obligation bonds, tax increment bonds, and installment or lease-purchase debt. Based upon financial data charted for years 1995 through 2005, private loans accounted for 70% of total financing of water and sewer projects in North Carolina. Conversely, because of poor bond ratings, approximately 60% of N.C. local governments cannot qualify for most private infrastructure lending programs.

## GRADE

The overall grade for North Carolina's wastewater system is a C-.

The grade is comprised of the following:

- D for North Carolina's wastewater system's ability to match their required system improvements with available funds.
- C for North Carolina's wastewater system's physical condition and current need to reduce infiltration and inflow thereby reducing wastewater overflows.
- C- for North Carolina's wastewater systems ability to meet their funding needs without state subsidy.

## RECOMMENDATIONS

- The North Carolina Section of the American Society of Civil Engineers (ASCE) encourages the Governor, the State Legislature and public to support long-term funding of wastewater infrastructure projects that would enable the state to reduce the individual system's funding gap and assist the state's wastewater systems in continuing to serve the public health and economic development of its customers. This funding should support and enable projects to be planned and constructed in a regional manner that will maintain and/or improve the current levels of service and provide the capacity needed to support a growing economy.
- The overall reduction of infiltration and inflow should be the focus of each utility and customer to reduce the likelihood of wastewater system upsets and decrease the possibility of degradation of surface water quality. A statewide initiative should be implemented to educate and assist utilities with ways to reduce infiltration and inflow and to provide incentives and/or recognition to systems that

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expedite and maintain an active infiltration and inflow reduction program and consistently document the reduction of infiltration and inflow into the system.

- Engage the state’s utilities managers in developing sound and equitable rates that are based upon the need for repairs and replacement of capital infrastructure, while at the same time implement a public education campaign to help our state’s citizens recognize and accept rates that can support life cycle asset management funding. Typically, utilities charge at or below the actual cost to collect the wastewater, pump the wastewater, treat at or above discharge limits, dispose of the biosolids, train and competitively pay staff, and have available funds to maintain and upgrade their system. The competition for the state’s limited nutrient discharge and

biosolid disposal allocation will dictate new technology and larger more regional systems. The treatment is becoming more advanced and will require more highly trained staff and additional operating and maintenance funds. The goal for each public wastewater system must be to become self sufficient and versed in adequate rate making and to strive to achieve a “sustainable utility” rate structure. The ASCE supports utility rates that encourage water efficiency, which will not only reduce drinking water consumption and our demand on a limited supply, but will also decrease the volume of wastewater requiring treatment and discharge. This overall reduction will further ensure our continued statewide economic growth through long term conservation to extend the life of our limited water resources.

## SOURCES

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North Carolina Rural Economic Development Center, Water 2030 Initiative, February 2006

2006 Report Card for Pennsylvania’s Infrastructure

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