OLA **OFFICE OF THE LEGISLATIVE AUDITOR**
STATE OF MINNESOTA

EVALUATION REPORT

State Highways and Bridges

FEBRUARY 2008

PROGRAM EVALUATION DIVISION
Centennial Building – Suite 140
658 Cedar Street – St. Paul, MN 55155
Telephone: 651-296-4708 • Fax: 651-296-4712
E-mail: auditor@state.mn.us • Web Site: http://www.auditor.leg.state.mn.us
Through Minnesota Relay: 1-800-627-3529 or 7-1-1

Program Evaluation Division

The Program Evaluation Division was created within the Office of the Legislative Auditor (OLA) in 1975. The division's mission, as set forth in law, is to determine the degree to which state agencies and programs are accomplishing their goals and objectives and utilizing resources efficiently.

Topics for evaluations are approved by the Legislative Audit Commission (LAC), which has equal representation from the House and Senate and the two major political parties. However, evaluations by the office are independently researched by the Legislative Auditor's professional staff, and reports are issued without prior review by the commission or any other legislators. Findings, conclusions, and recommendations do not necessarily reflect the views of the LAC or any of its members.

A list of recent evaluations is on the last page of this report. A more complete list is available at OLA's web site (www.auditor.leg.state.mn.us), as are copies of evaluation reports.

The Office of the Legislative Auditor also includes a Financial Audit Division, which annually conducts an audit of the state's financial statements, an audit of federal funds administered by the state, and approximately 40 audits of individual state agencies, boards, and commissions. The division also investigates allegations of improper actions by state officials and employees.

Evaluation Staff

James Nobles, *Legislative Auditor*

Joel Alter
Valerie Bombach
David Chein
Christina Connelly
Jody Hauer
Daniel Jacobson
David Kirchner
Carrie Meyerhoff
Deborah Parker Junod
Katie Piehl
Judith Randall
Jo Vos
John Yunker

To obtain a copy of this document in an accessible format (electronic ASCII text, Braille, large print, or audio) please call 651-296-4708. People with hearing or speech disabilities may call us through Minnesota Relay by dialing 7-1-1 or 1-800-627-3529.

All OLA reports are available at our web site: http://www.auditor.leg.state.mn.us

If you have comments about our work, or you want to suggest an audit, investigation, or evaluation, please contact us at 651-296-4708 or by e-mail at auditor@state.mn.us

Printed on Recycled Paper

OLA

OFFICE OF THE LEGISLATIVE AUDITOR

STATE OF MINNESOTA • James Nobles, Legislative Auditor

February 2008

Members of the Legislative Audit Commission:

Shortly after the I-35W bridge collapsed in Minneapolis on August 1, 2007, you added state highways and bridges to OLA's evaluation work agenda. You specifically asked for an update to our 1997 report, *Highway Spending*, which forecast future problems in the state's ability to maintain its highways and bridges.

Ten years later, those problems have arrived. According to Minnesota Department of Transportation (MnDOT) data, state highway surfaces have deteriorated, construction costs have escalated rapidly, and the department will not be able to meet its core goals without additional funding. We have no basis to dispute the grim picture these data present.

In recent years, policy makers have tried to address transportation's financial problem by borrowing money for highway expansion projects. While some borrowing and some expansion projects may be appropriate, this approach does not resolve the long-term need for permanent and stable funding to maintain and preserve existing highways and bridges.

Recent debates over how to finance Minnesota's transportation needs have become increasingly divisive and show there is no easy solution. Yet, we remain hopeful that an honest assessment of the challenges and choices Minnesota faces will help policy makers resolve their differences and reach agreement on a transportation funding package during the 2008 legislative session.

I want to acknowledge and thank officials and staff at MnDOT for their assistance with our evaluation. Despite the extraordinary strain and difficulty of the past several months, they were cooperative and prompt in response to requests for data, documents, and interviews. And in those interviews, officials and staff throughout MnDOT were open, insightful, and forthcoming.

I also want to acknowledge and thank the staff who conducted our evaluation—Deb Junod (project manager) and Carrie Meyerhoff. These past months have been difficult for them as well. They tackled this complex and controversial topic in the midst of other assignments and with a short timeline. This report is the result of their long hours and hard work.

Sincerely,

James Nobles
Legislative Auditor

Room 140 Centennial Building, 658 Cedar Street, St. Paul, Minnesota 55155-1603 • Tel: 651-296-4708 • Fax: 651-296-4712

E-mail: auditor@state.mn.us • Web Site: www.auditor.leg.state.mn.us • Through Minnesota Relay: 1-800-627-3529 or 7-1-1

Table of Contents

List of Tables and Figures

Tables (continued) Page

Figures

Summary

In recent years, Minnesota has used debt financing for highway expansion projects but has not invested adequately to maintain many existing highways.

Major Findings:

- After 2003, inflation-adjusted revenues from Minnesota motor vehicle and fuel taxes declined, and the state made substantial use of debt financing to support the state trunk highway system (pp. 14-18).
- Although the Minnesota Department of Transportation (MnDOT) has a "preservation first" policy, over half of trunk highway construction spending since 2002 has gone toward system expansion, leaving important preservation needs unmet (pp. 71-78).
- Since 2002, the ride quality of state trunk highways has generally declined. The structural condition of bridges has generally improved (pp. 22-38).
- MnDOT estimates that it will need $672 million per year between 2012 and 2018 for trunk highway preservation, about equal to the forecasted revenues available for all trunk highway construction (pp. 80-82).
- MnDOT has consistently scheduled more state trunk highway projects than it could deliver given available funding (pp. 78-80).
- According to MnDOT districts, Minnesota does not have a shortage of certified bridge inspectors, but it needs additional resources to conduct specialized inspections of fracture critical bridges (pp. 50-54).
- MnDOT districts reported performing the high-priority work recommended by bridge inspectors, but said they are falling behind on routine maintenance (pp. 61-62).
- MnDOT does not adequately document how it follows up on bridge inspectors' maintenance recommendations (pp. 58-60).

Recommendations:

- Early in 2008, MnDOT should present to the Legislature the implications of its current financial projections, and it should adopt financial management policies to guide the use of debt financing for state trunk highway investments (pp. 82-83).
- MnDOT should ensure that the projects included in its trunk highway program plans can realistically be delivered within the funds projected to be available (p. 80).
- MnDOT should assess the sufficiency of districts' bridge maintenance staffing and make additional resources available, as needed (p. 62).
- MnDOT should provide the operating funds necessary to meet bridge inspection frequency requirements for fracture critical bridges (p. 54).
- MnDOT should establish standard procedures for documenting, communicating, and following up on bridge inspectors' maintenance recommendations (p. 60).

Report Summary

On August 1, 2007, the Interstate 35W bridge over the Mississippi River in Minneapolis collapsed. The tragedy raised many questions about the safety of Minnesota's highways and bridges and the state's investments in maintaining them.

Minnesota's trunk highway system consists of over 11,000 miles of roadway and 4,500 bridges and culverts. Funds for the construction, operation, and maintenance of trunk highways and bridges come from state motor vehicle and fuel taxes, federal revenues, bonds, and other sources.

Although MnDOT is spending more on construction than in the past, state trunk highway pavement conditions have deteriorated.

When adjusted for inflation, trunk highway funding in fiscal year 1998 totaled $1.4 billion. In the years since, inflation-adjusted funding reached a peak of $1.8 billion in fiscal year 2003, then decreased to $1.5 billion in fiscal year 2007, a 16 percent decline.

When adjusted for inflation, tax revenues directed to the State Trunk Highway Fund have decreased since 2003, and MnDOT staffing has declined as well.

Historically, Minnesota has relied heavily on state transportation taxes to fund the trunk highway system, but receipts from these taxes have not kept pace with inflation. Motor vehicle and fuel taxes accounted for about two-thirds of trunk highway resources in 1998. By 2007, these taxes accounted for about half. Since 2003, the state has made substantial use of debt financing techniques to support the state trunk highway system.

Between fiscal years 1998 and 2007, MnDOT staffing peaked at 5,649 in fiscal year 2001 and fell to a low of 4,555 in fiscal year 2007. MnDOT employed more professional and paraprofessional engineers in 2007 than 1998, but the number of front line workers for trunk highway operations and maintenance has declined.

MnDOT is spending more—and a greater percentage of its resources—on trunk highway road and bridge construction than it did ten years ago.

MnDOT has increased the proportion of trunk highway spending dedicated to system construction, and decreased the proportion spent on operations, research, and support. In the 2002-03 biennium, about 63 percent of department spending was for road and bridge construction. Between 2003 and 2004, MnDOT reallocated over $36 million from its operating budget to fund highway construction. By the fiscal year 2006-07 biennium, spending on trunk highway road and bridge construction had increased to 71 percent of total spending.

Overall, the condition of trunk highway pavements has deteriorated since 2002, while the structural condition of bridges has improved.

The road quality index that MnDOT uses to gauge pavement conditions shows that about 66 percent of expressways and other principal roads were in good condition in 2007, compared to 72 percent in 2002. A similar decline has been measured on nonprincipal roads, which fell from 65 percent in good condition in 2002 to 59 percent in 2007. Over the same time period, the percentage of roads in poor or very poor condition increased. MnDOT predicts that, under its current spending plan, the number of trunk highway miles in poor condition will double by 2011.

In contrast, the overall structural condition of state trunk highway bridges improved. Between 2002 and 2006, the condition of bridges over 20 feet long on expressways and other principal roads improved, from 51 percent in good condition (weighted by deck area) to 55 percent, and from 5 percent in poor condition to 3 percent. The condition of trunk highway bridges on nonprincipal roads also improved. In addition, between 2002 and 2006, MnDOT reduced the number of state trunk highway bridges deemed "structurally deficient."

If it adheres to its "preservation first" policy, MnDOT will need to spend virtually all of its construction funds on preservation in the coming years.

Acting on 1997 recommendations from the Legislative Auditor, MnDOT established performance-based criteria for choosing state trunk highway projects.

In 2003, MnDOT issued a 20-year statewide transportation plan that laid out three strategic priorities: preserving existing infrastructure, improving traffic safety and mobility, and operating the department efficiently. The plan states that preservation and safety are MnDOT's top priorities, with resources going to system enhancements only after preservation of the existing system has been considered. MnDOT also established performance targets for the condition of trunk highway roads and bridges.

Overall, trunk highway project investments have not aligned with the department's stated policy of "preservation first."

Between fiscal years 2002 and 2007, over half of MnDOT's spending on construction contracts for trunk highway pavements was allocated to system expansion rather than preservation. In contrast, in fiscal year 2001, only 25 percent of pavement contract spending was allocated to expansion projects.

Between fiscal years 2001 and 2007, roughly 50 to 60 percent of bridge investments were for bridge replacement. Investments intended to preserve existing bridges—such as painting, deck repair, and joint repair—remained fairly steady at about $13 to $14 million per year between fiscal years 2001 and 2006, increasing to $26 million in 2007.

By 2004, state trunk highway pavement conditions were worsening, but commitments for major expansion projects, decreasing resources, and rising costs for construction materials limited MnDOT's ability to redirect resources to preservation.

To meet expected needs in the coming years, MnDOT will need to direct virtually all available funds to preservation projects.

According to MnDOT executives, to meet preservation needs from 2012 to 2018, the department will need to devote virtually all of the state trunk highway construction budget to preservation. MnDOT estimates that the state should invest about $672 million per year for fiscal years 2012 to 2018 in order to meet ride quality and bridge condition performance targets. This is about $350 million more per year in preservation spending than is currently planned.

MnDOT has not enacted policies to guide the use of debt financing for state trunk highway projects.

Historically, Minnesota financed trunk highway construction projects on a pay-as-you-go basis. But in 2003, the state financed $800 million of trunk highway expansion projects through a combination of bond sales and use of federal advance construction authority (also a form of debt financing). Given the risks associated with these financing techniques, we think it prudent for MnDOT to work with the Legislature to (1) establish the parameters under which the state should use debt financing techniques and (2) adopt formal policies guiding their use.

MnDOT needs to better document the maintenance recommendations and activities that result from bridge inspections.

MnDOT's district offices say they have enough certified bridge inspectors, but MnDOT needs additional resources to inspect fracture critical bridges.

In Minnesota, "Bridge Inspector" is generally not a full-time position. Rather, most inspectors are maintenance staff employed by MnDOT district offices, counties, and cities. Minnesota had 329 certified team leaders (73 in MnDOT districts) and another 354 certified assistant inspectors as of October 2007. In the Twin Cities Metro District and two others we visited, officials responsible for the bridge inspection program told us that their districts have sufficient resources—people, time, and equipment—to conduct thorough, timely routine inspections because MnDOT makes inspection a priority. However, MnDOT will need additional resources to fully implement a 2005 change in federal standards, which requires specialized inspections of fracture critical bridges every two years.

MnDOT districts told us they are completing high-priority bridge repairs, but said they are falling behind on routine maintenance.

District officials said they promptly address safety-related and other high-priority bridge maintenance needs. However, they also reported having too few bridge maintenance crews and staff for the amount of maintenance that should be performed. For example, in 2001, the Metro District operated 6 bridge maintenance crews with 32 bridge workers, and it hired 2 to 3 seasonal workers per crew. In 2007, the district operated 5 crews with 25 bridge workers and did not hire any seasonal staff to assist them. District officials said the staff reductions are the result of budget restrictions.

MnDOT does not adequately document its follow-up on inspectors' maintenance recommendations.

MnDOT does not have formal, standard procedures for conveying inspectors' findings to maintenance crews or documenting decisions on the maintenance work to be performed. District officials told us there is direct, frequent communication between inspectors and maintenance supervisors about needed bridge repairs. However, we think a more formal, standard process is needed to ensure that inspection findings are addressed. The Metro District was piloting such a process in January 2008.

Introduction

On August 1, 2007, the bridge carrying Interstate 35W over the Mississippi River collapsed. In the wake of this tragedy, questions arose about the safety of bridges in Minnesota and the condition of the state's transportation infrastructure more generally. Minnesota's transportation infrastructure is vast, with over 135,000 roadway miles and 19,000 bridges and culverts. Responsibility for maintaining the infrastructure is shared among the Minnesota Department of Transportation (MnDOT), counties, and cities.

In 1997, the Office of the Legislative Auditor issued *Highway Spending,* a report that provided information about state and local streets, bridges, and funding. That evaluation concluded that (1) the state had a backlog of bridges needing replacement and an emerging problem with steel fatigue in bridges, (2) state highways faced increasing resurfacing needs, and (3) MnDOT probably did not perform enough preventive maintenance. In addition, the report found that MnDOT did not provide policymakers with adequate information on future highway and bridge needs or the funding that would be required to meet them.

In August 2007, after the collapse of the I-35W bridge, the Legislative Audit Commission directed the Office of the Legislative Auditor to reevaluate highway spending in Minnesota, with a focus on the state trunk highway system. In this report, we address the following questions:

- **How have resources and spending for the state trunk highway system and the condition of the system's roads and bridges changed?**
- **What are Minnesota's practices for inspecting bridges and culverts, and how do they compare to state and federal requirements?**
- **What standards and criteria guide the allocation of resources to the preservation of state trunk highway roads and bridges?**
- **How has actual trunk highway spending aligned with the Minnesota Department of Transportation's stated priorities?**

To address these questions, we interviewed many executives, managers, and staff from the MnDOT central office and districts. We met extensively with staff in MnDOT's Bridge Office, Office of Materials, and Office of Investment Management. We visited four of MnDOT's eight district offices, including the Metro, Brainerd, Rochester, and Mankato districts. We also recorded interviews with members of the department's leadership team, including the Lt. Governor/Commissioner; Assistant to the Commissioner for Policy and Communications; and directors of Engineering Services; Operations; Finance and Administration; and Planning, Modal, and Data Management. We contacted a number of former MnDOT executives and managers, and we interviewed those who agreed to meet with us.

To identify trends in state trunk highway revenues and spending, we obtained and analyzed historical data on state motor vehicle and fuel taxes receipts, State Trunk Highway Fund revenues and expenditures, and MnDOT staff levels. To understand changes in the condition of trunk highway pavements, we analyzed MnDOT data on two indicators of road condition: pavement smoothness and remaining service life. To understand changes in the condition of Minnesota's trunk highway bridges, we analyzed bridge inspection data using various state and federal measures of structural condition.

To evaluate Minnesota's bridge inspection program, we reviewed state and national inspection standards, MnDOT inspection manuals and other technical guidance, and Federal Highway Administration reports. We reviewed information from a database of MnDOT-certified bridge inspectors and analyzed data on the frequency of bridge inspections. We interviewed officials from the MnDOT Bridge Office who are responsible for the statewide bridge inspection program as well as inspection program and bridge maintenance officials at four district offices. In addition, we selected four trunk highway bridges and conducted in-depth interviews with the lead inspector who conducted the most recent inspection of each bridge.

To understand how MnDOT selects road and bridge projects for the state trunk highway construction program, we reviewed a variety of planning documents and performance reports. We interviewed current and former MnDOT officials about the sufficiency of state trunk highway resources and how the department makes decisions about the allocation of resources. In addition, to assess how trunk highway spending aligns with MnDOT's performance goals, we analyzed data on contracts for trunk highway road and bridge projects.

This evaluation was never designed to investigate the collapse of the I-35W bridge. However, the bridge was one of four trunk highway bridges that we used as the basis of detailed interviews with MnDOT bridge inspectors. We also examined inspection reports, consultant reports, and other information about the I-35W bridge. We used this information in our evaluation of the bridge inspection program, but we did not independently verify details about MnDOT's work on the bridge before it collapsed.

The report is divided into four chapters. The first chapter provides an overview of Minnesota's road system, transportation funding, and MnDOT's organization and staffing. Chapter 2 provides trend information on state trunk highway revenues and expenditures and the condition of state trunk highway roads and bridges. In Chapter 3, we discuss Minnesota's bridge inspection program, including information on inspector certification, the frequency of bridge inspections, inspection procedures, and post-inspection activities. Chapter 4 reviews MnDOT's process for establishing the state trunk highway construction program, and the extent to which trunk highway investments have aligned with state priorities. The five appendices at the back of the report contain more detailed data about trunk highway bridges and excerpts from an interview with the Director of the MnDOT Bridge Office.

1

Background

SUMMARY

With over 135,000 miles of roads and 19,000 bridges and culverts, Minnesota has one of the largest public road systems in the country. Jurisdiction for building and maintaining this system is shared by the State of Minnesota, counties, cities, and townships. The roads and bridges owned by the state are referred to as the state trunk highway system. Although it includes only 9 percent of road miles, the state trunk highway system carries close to 60 percent of Minnesota's traffic. Funding for road and bridge construction, operation, and maintenance comes from a combination of state taxes, federal aid, and—for local roads and bridges—property taxes. The Minnesota Department of Transportation administers transportation programs and manages construction, operation, and maintenance of the state trunk highway system through its eight district offices.

In a 1997 report, *Highway Spending*, the Office of the Legislative Auditor said (1) the state had a backlog of structurally deficient bridges and an emerging problem with steel fatigue in bridges,[1] (2) state trunk highway pavements faced increasing resurfacing needs, and (3) the Minnesota Department of Transportation (MnDOT) probably did not perform enough preventive maintenance. In addition to identifying these growing preservation needs and presenting trend data on trunk highway funding and spending, the report found that MnDOT did not provide policymakers with adequate information on future pavement and bridge needs and the funding that would be required to meet them.

Following the collapse of the Interstate 35W bridge in Minneapolis on August 1, 2007, the Legislative Audit Commission directed our office to update the 1997 report, with a particular focus on the state's efforts to ensure the safety and preservation of Minnesota's bridges. As background for the evaluation, this chapter addresses the following questions:

- **How big is Minnesota's road and bridge system, and how is responsibility for it divided between the state and local jurisdictions?**
- **How are road and bridge construction and maintenance funded in Minnesota?**
- **How is the Minnesota Department of Transportation organized and staffed to manage state highways and bridges?**

[1] A bridge is classified as structurally deficient if any of its major components—deck, superstructure, or substructure—has received a "poor" condition rating under national bridge inspection standards or if the road approaches regularly overtop due to flooding. Classification as structurally deficient does not mean that the bridge is unsafe.

To answer these questions, we reviewed state and federal laws and regulations, policy manuals, and previous reports on the size and nature of Minnesota's transportation system. We interviewed officials from MnDOT, and we analyzed department data on the size, location, and use of roadways and bridges.

MINNESOTA'S ROADS AND BRIDGES

The "state trunk highway system" includes all roads and bridges—interstate and noninterstate—under the state's jurisdiction.

Minnesota has one of the largest road systems in the country, primarily because of its extensive system of rural roads. Jurisdiction for building and maintaining this system is shared by the State of Minnesota and various local units of government, including counties, cities, and townships. The roads and bridges under the state's jurisdiction are referred to as the "state trunk highway system." The state trunk highway system includes interstate highways and urban freeways as well as many other major routes in the state. Throughout the report, the terms "state highway" and "state-owned" refer to roads and bridges included in the state trunk highway system. Similarly, we refer to county, city, and township roads and bridges collectively as the "local system."

Table 1.1: Size of Minnesota's Road and Bridge System, 2006

	ROAD MILES					
	State System		Local System		Total	
	Miles	Percentage of Total Miles	Miles	Percentage of Total Miles	Miles	Percentage of Total Miles
Metropolitan Counties[a]	1,015	1%	14,120	10%	15,136	11%
Other Counties	10,867	8	109,583	81	120,450	89
Total	11,882	9%	123,703	91%	135,586	100%

	BRIDGES AND CULVERTS					
	State System		Local System		Total	
	Number	Percentage of All Structures	Number	Percentage of All Structures	Number	Percentage of All Structures
Metropolitan Counties[a]	1,191	6%	1,008	5%	2,199	11%
Other Counties	3,309	17	13,647	71	16,956	89
Total	4,500	23%	14,655	77%	19,155	100%

NOTES: Road miles are measured in "centerline miles"—the sum of the length of roads, as measured along their centerlines. Counts of bridges and culverts include all structures ten or more feet in length.

[a] The metropolitan counties are Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation's Transportation Information System.

The trunk highway system carries about 60 percent of the state's traffic.

As shown in Table 1.1, Minnesota has over 135,000 miles of roads and 19,000 bridges and culverts.[2] About 90 percent of the roads and 77 percent of the bridges and culverts are owned and operated by local governments. Most of the system is geographically located outside of the Twin Cities metropolitan area.

Although most of Minnesota's road miles, bridges, and culverts are owned and maintained by local governments, the state trunk highway system carries close to 60 percent of the state's traffic, as shown in Table 1.2. State trunk highway system roads in the Twin Cities metropolitan area account for only 1 percent of

Table 1.2: Distribution of Traffic and Bridge Area, 2006

	ROADWAY TRAFFIC (daily vehicle miles traveled, in millions)					
	State System		Local System		Total	
	Miles Traveled	Percentage of Total Miles Traveled	Miles Traveled	Percentage of Total Miles Traveled	Miles Traveled	Percentage of Total Miles Traveled
Metropolitan Counties[a]	42.4	27%	30.5	20%	73.0	47%
Other Counties	49.3	32	32.8	21	82.1	53
Total	91.7	59%	63.4	41%	155.1	100%

	BRIDGE DECK AREA (square feet, in millions)					
	State System		Local System		Total	
	Deck Area	Percentage of Total Deck Area	Deck Area	Percentage of Total Deck Area	Deck Area	Percentage of Total Deck Area
Metropolitan Counties[a]	23.5	36%	5.3	8%	28.8	44%
Other Counties	20.6	32	15.6	24	36.3	56
Total	44.2	68%	20.9	32%	65.1	100%

NOTES: Daily vehicle miles traveled is the daily traffic along a segment of road multiplied by the length of that segment of road. Bridge deck area is a measure that generally applies to bridges; hence, most culverts are excluded from this analysis.

[a] The metropolitan counties are Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation's Transportation Information System.

[2] Miles of road can be measured in different ways. For this analysis, we use "centerline miles," the sum of the length of roads, as measured along their centerlines. A culvert is a drainage opening beneath an embankment, generally with structural material all around the perimeter; culverts are often constructed with concrete pipe. Information on bridges and culverts presented in our report is for structures at least ten feet long.

Traffic on trunk highways grew by 13 percent between 1998 and 2006.

all road miles in the state, but they carry about 27 percent of the state's total traffic. Similarly, when considering the size of Minnesota's bridges, not just the number, the state trunk highway system includes about 68 percent of bridge deck area.[3] Of this 68 percent of bridge deck area, over half is located in the Twin Cities metropolitan area.

Use of the state trunk highway system has been growing. As shown in Table 1.3, between 1998 and 2006, traffic on the state trunk highway system increased by about 13 percent, rising from 81.3 million miles traveled per day to 91.7 million miles per day. Heavy commercial vehicle traffic increased by nearly 20 percent, from 6.2 million miles per day to 7.5 million miles per day. Traffic grew more in counties surrounding the Twin Cities metropolitan area and counties to the north. For example, heavy commercial traffic increased by about 22 percent between 1998 and 2006 in Greater Minnesota counties compared to a 16 percent increase in the Twin Cities area. Growing vehicle and truck traffic in the state trunk highway system has important implications because it contributes to faster deterioration of road pavements and bridges and higher maintenance demands.

Table 1.3: Daily Vehicle Miles Traveled on the State Trunk Highway System, All Vehicles and Heavy Commercial Vehicles, 1998 to 2006

	Daily Vehicle Miles Traveled (in millions)						Percentage Change 1998-2006[a]	
	All Vehicles			Heavy Commercial Vehicles				
	1998	2003	2006	1998	2003	2006	All Vehicles	Heavy Commercial Vehicles
Metropolitan Counties[b]	38.4	41.6	42.4	2.0	2.2	2.3	10.3%	16.3%
Other Counties	42.9	48.0	49.3	4.3	4.9	5.2	15.0	21.5
Total	81.3	89.6	91.7	6.2	7.0	7.5	12.8%	19.9%

NOTES: Daily vehicle miles traveled is the daily traffic along a segment of road multiplied by the length of that segment of road. Amounts may not sum due to rounding.

[a] Percentages are based on unrounded vehicle miles traveled.

[b] The metropolitan counties are Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation's Transportation Information System.

For the purposes of managing and maintaining the road system, roads are categorized into classifications that describe how the road is used to connect and serve the region and the role it plays in providing access and mobility. The functional classifications used in Minnesota include:

[3] Deck area is a measure that applies to bridges, not culverts.

- **Principal arterials** include interstate and noninterstate highways and other major roadways serving high-speed, long-distance travel. They serve virtually all urban areas with a population of 25,000 or more and a majority of those with a population of 5,000 or more. They provide little or no access to adjacent property.

- **Minor arterials** are intermediate roadways that emphasize mobility but provide more property access than principal arterials. They handle medium-length trips and, when combined with the principal arterial system, connect most cities, larger towns, and other traffic generators with one another.

- **Collectors** have an equal emphasis on mobility and land access and provide for trips within neighborhoods and between small cities. Collectors provide the intermediate connection between local streets and the arterial system.[4]

- **Local streets and roads** facilitate travel over relatively short distances and primarily provide access to property.

In this report, we will follow MnDOT's practice of grouping roadways into two categories based on the extent of use: principal arterials (as defined above) and nonprincipal roadways (minor arterials, collectors, and local roads).

As shown in Table 1.4, about 4 percent of Minnesota's road miles are principal arterials, but these highways carry half of the state's traffic. Nearly all principal

Table 1.4: Percentage Distribution of Road Miles and Traffic on Principal and Nonprincipal Roadways, 2006

	Road Miles			Daily Vehicle Miles Traveled		
	Principal	Nonprincipal	Total	Principal	Nonprincipal	Total
State System	4%	5%	9%	49%	10%	59%
Local System	<1	91	91	1	40	41
Total	4%	96%	100%	50%	50%	100%

NOTES: Percentages are based on 135,586 miles of road and 155,077,457 vehicle miles traveled per day. Road miles are measured in "centerline miles"—the sum of the lengths of roads, as measured along their centerlines. Daily vehicle miles traveled is the daily traffic along a segment of road multiplied by the length of that segment of road.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation's Transportation Information System.

[4] In rural areas, minor collectors collect traffic from local roads and small communities and link them with more heavily traveled roads. Major collectors provide service to moderately-sized communities within a county and link those communities with larger population centers nearby.

arterials are in the state trunk highway system. About 91 percent of roads are nonprincipal roads in local systems, and they carry 40 percent of the state's traffic.

TRANSPORTATION FUNDING

Funding for the construction, maintenance, and administration of state and local transportation systems differ. The state trunk highway system is funded predominantly through the State Trunk Highway Fund, with its revenues coming from both state taxes and federal aid. Counties rely heavily on funding from state tax revenues (through the Highway User Tax Distribution Fund). Local property taxes are a significant revenue source for county, city, and township transportation needs. In this report, we focus on funding for the state trunk highway system.

Most state revenue for the state trunk highway system comes from state motor vehicle and fuel taxes.

Most state trunk highway transportation revenue is generated from motor fuel, vehicle registration, and vehicle sales taxes. The Minnesota Constitution requires that most of the revenues from these three taxes be used for highway purposes, and a large proportion be deposited in the State Trunk Highway Fund. As shown in Figure 1.1, the tax revenues flow through the Highway User Tax Distribution Fund (HUTD). A constitutional formula dictates that 5 percent of the HUTD is set aside in a "flexible fund" for purposes designated in statute.[5] Of the remaining 95 percent HUTD distribution, 62 percent flows to the State Trunk Highway Fund with the remainder flowing to the County State Aid Highway Fund and Municipal State Aid Street Fund. In 2006, the total contribution to the State Trunk Highway Fund from state motor vehicle and fuel taxes was $767 million.

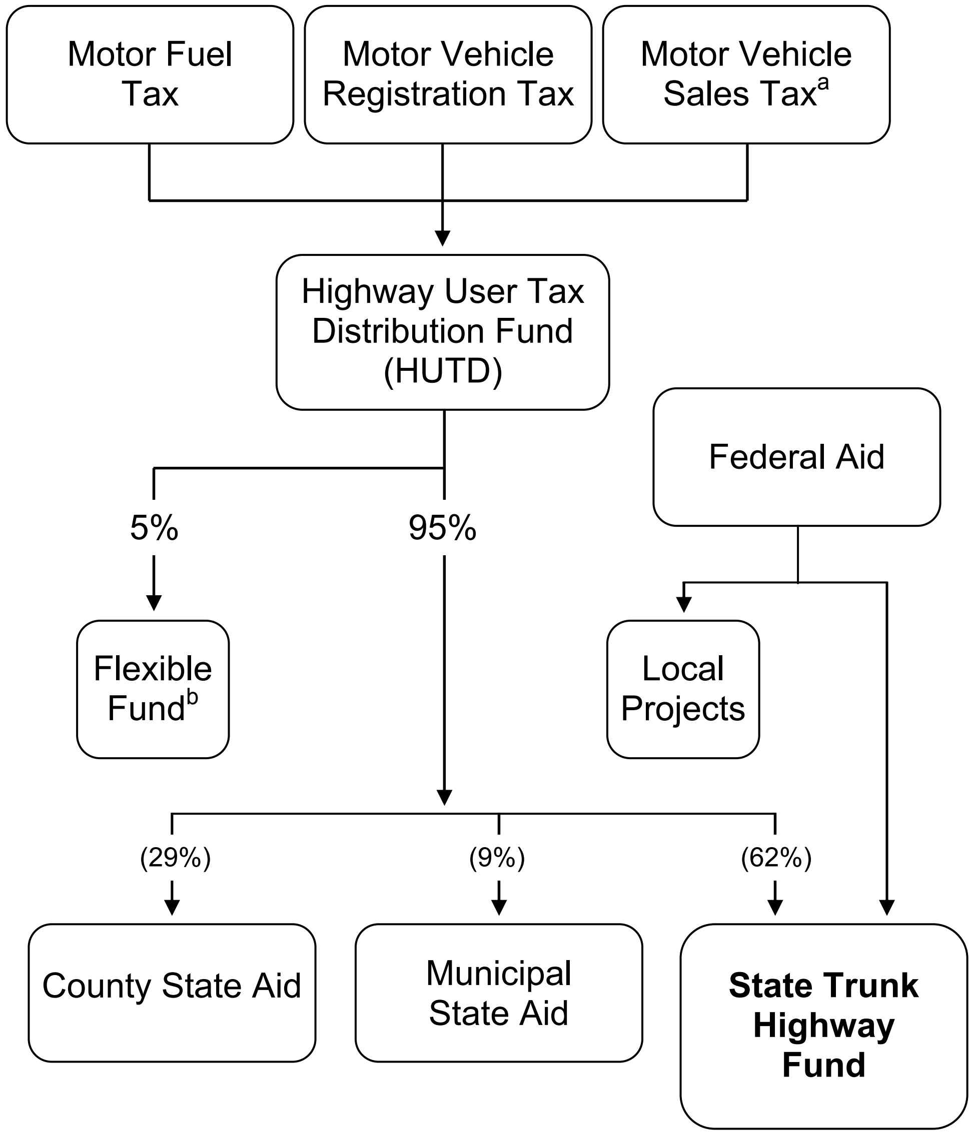
Minnesota also raises revenue for the state trunk highway system through the issuance of state trunk highway bonds. The legislature must authorize the bonds before they can be issued, and the Minnesota Department of Finance sells the bonds as required to pay construction costs when they become due. Bonds are typically repaid over 20 years, and they must be repaid with revenues from the State Trunk Highway Fund.

Federal funds for state trunk highway projects flow directly to the State Trunk Highway Fund. There are different categories of federal funding. Federal earmarked funds are appropriated for congressionally-selected MnDOT or local projects. Federal formula funds are federal dollars granted to states for various categorical types of spending and, unlike earmarked funds, they are not linked to specific projects. In 2006, federal aid contributions to the State Trunk Highway Fund totaled $361 million.

---

[5] Currently, the 5 percent set aside for the flexible fund is distributed as follows: 53.5 percent to the Flexible Highway Account; 30.5 percent to the Town Road Account; and 16 percent to the Town Bridge Account.

Figure 1.1: Highway Funding Sources and Distribution, 2007



[a] Starting in fiscal year 2012, after a phase-in period, motor vehicle sales tax receipts will be statutorily allocated with up to 60 percent to roads and at least 40 percent to transit.

[b] The flexible fund is distributed by statute. The funds must go to the trunk highway, county state aid, or municipal state aid funds, with the apportionment among them set in statute. The distribution percentages cannot be changed more than once every six years.

SOURCE: Minnesota Department of Transportation.

MINNESOTA DEPARTMENT OF TRANSPORTATION

The Minnesota Department of Transportation has a biennial budget of over $4 billion.

MnDOT is the principal state agency responsible for the "development, implementation, administration, consolidation, and coordination of state transportation policies, plans, and programs."[6] MnDOT is organized into five major divisions: (1) Operations, responsible for construction, operation, and maintenance of the state trunk highway system; (2) Engineering Services, which includes centralized bridge and pavement engineering services, land acquisition, and environmental services; (3) Planning, Modal, and Data Management, responsible for investment management, aeronautics, transit, and freight programs; (4) State Aid for Local Transportation; and (5) Finance and Administration. At the close of fiscal year 2007, MnDOT had 4,555 staff.

As shown in Figure 1.2, MnDOT is divided into eight districts, with one district encompassing the Twin Cities metropolitan area and seven districts dividing the rest of the state.[7] Most of MnDOT's day-to-day operations, including trunk highway system construction projects, maintenance, and right-of-way issues, are managed by the eight district offices. According to MnDOT staff, the districts have different transportation challenges and needs. For example, the Metro District includes over half of the state trunk highway bridge area, and the Duluth and Rochester districts share another 25 percent. These three districts, then, have to devote more resources to bridge maintenance than the other districts.

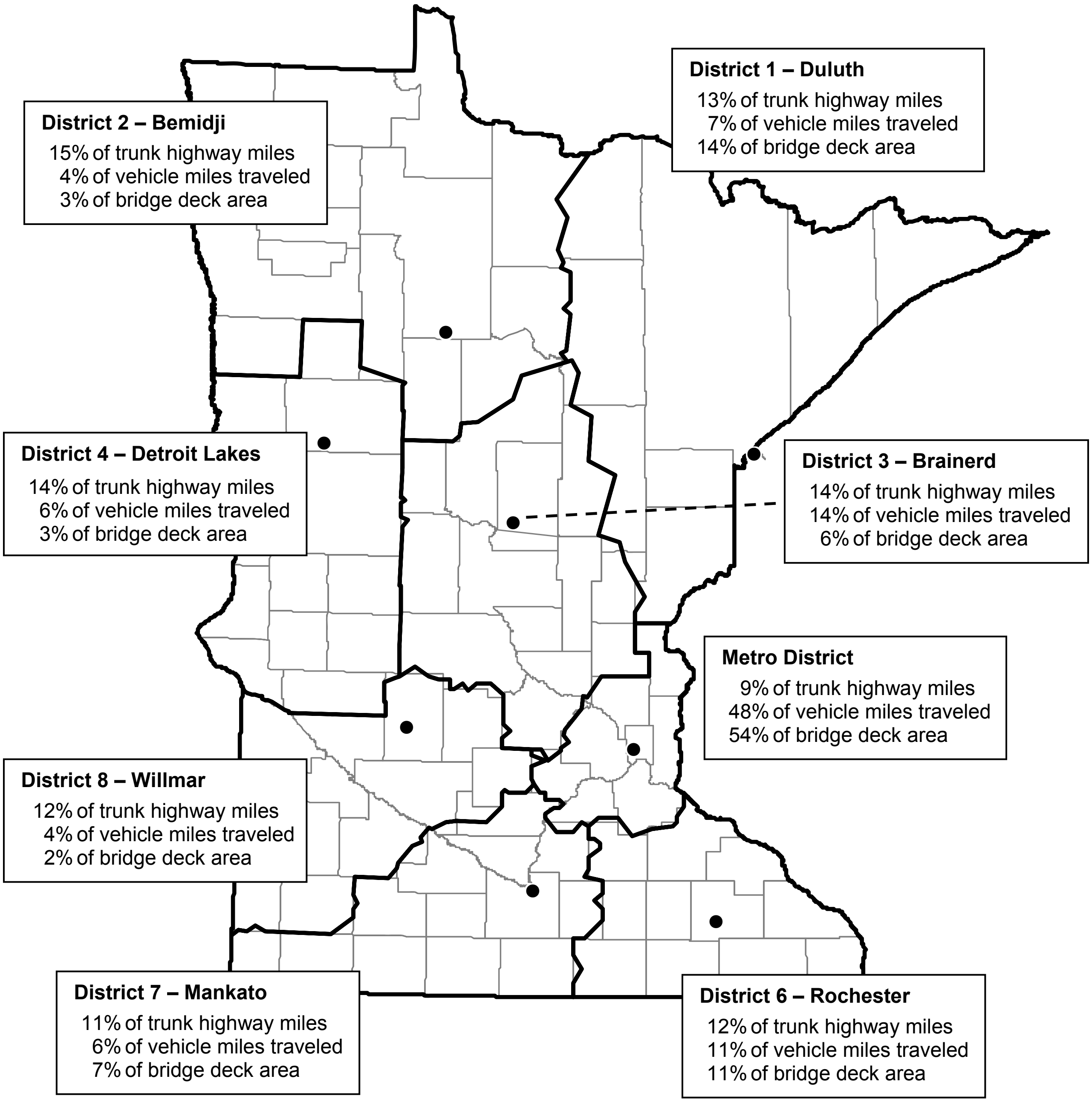
MnDOT has a biennial budget of over $4 billion, as shown in Table 1.5. Nearly 90 percent of MnDOT's budget goes toward state and local road and bridge programs. Looking at MnDOT's budget by budget category, capital and property investments for the state trunk highway system and aid payments to local governments account for the largest shares. In the 2006-07 biennium, each accounted for about 37 percent of spending, with total compensation expenses for MnDOT employees accounting for another 15 percent. In the ten-year period shown in the table, MnDOT spending (adjusted for inflation) increased over the first three biennia and decreased thereafter. Overall, spending in 2006-07 was 2 percent lower than in 1998-99. We discuss MnDOT funding, spending, and staffing trends in more detail in Chapter 2.

---

[6] *Minnesota Statutes* 2007, 174.01, subd. 1.

[7] The Twin Cities metropolitan area, or the Metro District, includes Anoka, Carver, Chisago, Dakota, Hennepin, Ramsey, Scott, and Washington counties.

Figure 1.2: Characteristics of the State Trunk Highway System, by Department of Transportation District, 2006



NOTES: Percentages are based on the following data for the state trunk highway system: 11,882 road miles, 91.7 million daily vehicle miles traveled, and 44.2 million square feet of bridge deck area. Road miles are measured in "centerline miles"—the sum of the length of roads, as measured along their centerlines. Daily vehicle miles traveled is the daily traffic along a segment of road multiplied by the length of that segment of road.

SOURCE: Office of the Legislative Auditor, analysis of bridge inventory and Transportation Information System data from the Minnesota Department of Transportation.

Table 1.5: Minnesota Department of Transportation Inflation-Adjusted Spending by Biennium, Fiscal Years 1998-2007

	2007 Dollars (in millions)				
	1998-99	2000-01	2002-03	2004-05	2006-07
By Budget Program					
State Roads	$2,365	$2,676	$3,173	$2,604	$2,502
Local Roads	1,516	1,574	1,670	1,600	1,356
Multimodal Systems	377	368	556	449	339
General Support and Services	162	197	164	129	125
Total	$4,420	$4,815	$5,563	$4,783	$4,322
By Budget Category					
Capital Outlay and Real Property	$1,645	$1,779	$2,421	$1,731	$1,580
Local Government Assistance	1,468	1,623	1,794	1,829	1,616
Employee Compensation	753	784	800	726	652
Other Operating Expenses	532	596	530	483	442
Miscellaneous Transactions	22	33	17	14	32
Total	$4,420	$4,815	$5,563	$4,783	$4,322

NOTES: Spending amounts include cash expenditures, encumbrances, and requisitions, and amounts may not sum to totals due to rounding. Spending amounts were adjusted for inflation using the U.S. Bureau of Economic Analysis Price Indexes for Government Consumption Expenditures and Gross Investment, State and Local Government.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

2

Trends

SUMMARY

When adjusted for inflation, Minnesota motor vehicle and fuel tax receipts have declined since fiscal year 2003 and will likely continue to do so through fiscal year 2011. Also since 2003, the Minnesota Department of Transportation (MnDOT) increased the proportion of state trunk highway funds spent on system preservation and construction and decreased the proportion spent on operations, research, and support. MnDOT staffing has declined as well. Since 2002, the condition of trunk highway pavements has generally deteriorated, and road conditions have not met MnDOT performance targets. The department predicts that by 2011, there will be twice as many road miles in poor condition than there were in 2007. In contrast, the overall structural condition of state trunk highway bridges improved between 2002 and 2006. Bridge replacement and preservation demands will increase in the next 20 years.

Construction of new roads and bridges to improve mobility and safety is an important public objective, but preservation of the existing infrastructure is essential. Accordingly, this chapter focuses on the condition of state trunk highway roads and bridges over time and how Minnesota has allocated resources to construct and maintain them. Specifically, we address the following questions:

- **How have state trunk highway resources and expenditures changed over time, and what factors influenced these trends?**

- **How has the condition of trunk highway pavements and bridges changed over time, and what factors influenced these trends?**

To answer these questions, we obtained and analyzed historical data on state motor vehicle and fuel taxes receipts, State Trunk Highway Fund revenues and expenditures, and Minnesota Department of Transportation (MnDOT) staff levels. To understand changes in the condition of trunk highway pavements, we obtained and analyzed MnDOT data for fiscal years 2002 to 2007 on two indicators of road condition: pavement smoothness and remaining service life. Comparable data for prior fiscal years were not readily available. To understand changes in the condition of Minnesota trunk highway bridges, we obtained bridge inspection data for 2002 to 2006 and analyzed it using various state and federal measures of structural condition. Comparable data for 2001 and earlier were not readily available. For both state trunk highway roads and bridges, we reviewed MnDOT performance reports, planning documents, and manuals. In addition, we interviewed officials from MnDOT's Finance Division, Bridge Office, Office of Materials (responsible for collection and analysis of data on road condition), Office of Investment Management, and four district offices.

REVENUES, EXPENDITURES, AND STAFFING

One of MnDOT's most significant challenges is balancing the preservation needs of an aging infrastructure with strong public expectations for improved safety and mobility in the trunk highway system. Managing trunk highway system resources is an important part of meeting that challenge. In this section, we present information on revenues available to the state trunk highway system, State Trunk Highway Fund spending, and MnDOT staffing.

Revenues

Tax revenues for the state trunk highway system have not kept pace with inflation.

As discussed in Chapter 1, the primary sources of revenue for state trunk highway road and bridge construction and preservation are state taxes, federal funds, and bonding. The largest share is from motor vehicle and fuel taxes.

Motor Vehicle and Fuel Taxes

As explained in Chapter 1, receipts from motor vehicle and fuel taxes are deposited in the Highway User Tax Distribution Fund. We analyzed historical data on these deposits and found that:

- **When adjusted for inflation, Minnesota motor vehicle and fuel tax receipts have declined since fiscal year 2003 and will likely continue to do so through fiscal year 2011.**

Historically, Minnesota has relied heavily on state transportation taxes to fund the trunk highway system and to fulfill other transportation needs, but receipts from these taxes have not kept pace with inflation. As shown in Figure 2.1, total inflation-adjusted receipts from motor vehicle and fuel taxes (in 2007 dollars) increased through fiscal year 2000, and they have declined steadily since 2002. Inflation-adjusted tax revenues are expected to further decline in value through 2011.[1]

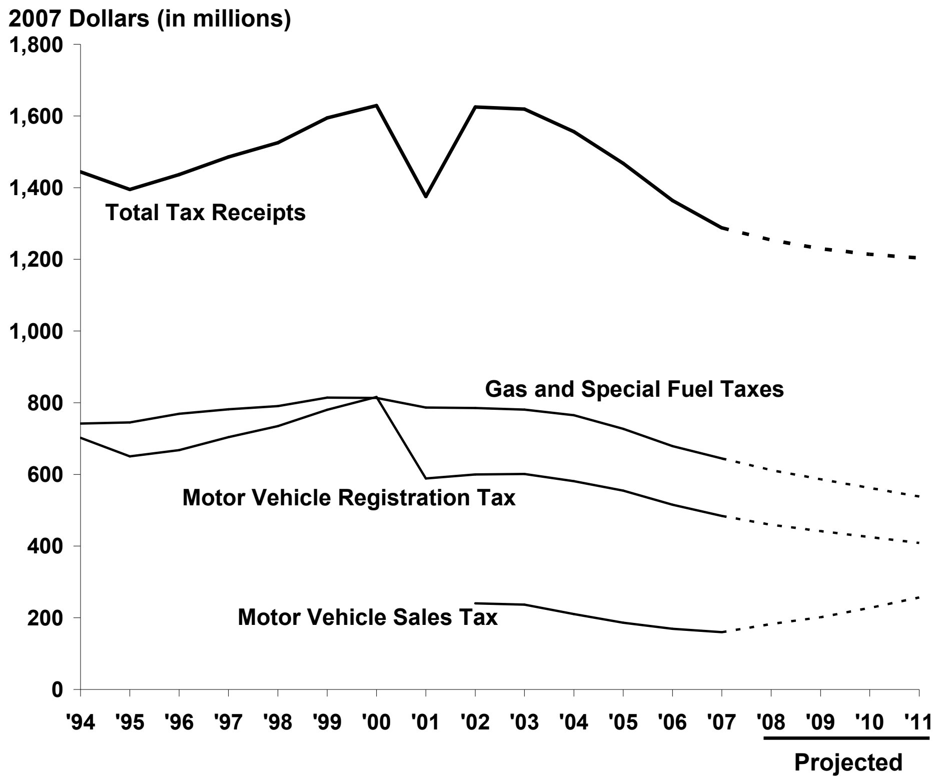
Several factors explain this pattern. The tax rate for gasoline and diesel fuel—at 20 cents per gallon—has remained unchanged since 1988, so inflation has eroded its value. According to analysts in MnDOT's Office of Investment Management, increasing gas tax revenue through 2000 can be explained by increasing road travel in Minnesota, growing populations, the phase-out of a two-cent tax credit for gasoline blended with ethanol, and relatively modest increases in the real price of gasoline. But after 2000, consumption patterns changed. The rate of increase in vehicle miles traveled slowed from 2000 to 2004 and showed little or

[1] Without taking inflation into account, total revenues from state motor vehicle and fuel taxes declined from $1.32 billion in fiscal year 2003 to $1.29 billion in fiscal year 2007. Due largely to the phase in of the constitutional dedication of the motor vehicle sales tax, total nonadjusted revenues from state motor vehicle and fuel taxes are projected to grow modestly from $1.32 billion in fiscal year 2008 to $1.46 billion in fiscal year 2011.

no growth in 2005 and 2006. The price of fuel also increased dramatically, influencing consumers to use less gas.

Receipts from the Motor Vehicle Registration Tax (often referred to as "tab fees") dropped sharply following a 2000 change in state law that enacted maximum registration fees for cars, pick-up trucks, and vans.[2] To compensate

Figure 2.1: Inflation-Adjusted Motor Vehicle and Fuel Tax Receipts to the Highway User Tax Distribution Fund, Fiscal Years 1994-2011



NOTES: Dollar amounts for fiscal years 1994-2006 were adjusted for inflation using the U.S. Bureau of Economic Analysis Price Indexes for Government Consumption Expenditures and Gross Investment, State and Local Government. We adjusted forecasted tax receipts for 2008-11 assuming no tax policy changes and 5 percent inflation per year.

A 2000 change in state law enacted maximum registration fees for cars, pick-up trucks, and vans, which reduced Motor Vehicle Registration Tax receipts beginning in fiscal year 2001. To compensate, the Legislature authorized a fiscal year 2001 transfer of $162 million from the General Fund to the Highway User Tax Distribution Fund and, from 2002 forward, directed a portion of motor vehicle sales tax receipts to the Highway User Tax Distribution Fund.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

[2] *Laws of Minnesota* 2000, chapter 490, art. 7, sec. 1.

for lower registration tax receipts, the Legislature authorized a fiscal year 2001 transfer of $162 million from the General Fund to the Highway User Tax Distribution Fund and, from 2002 forward, directed a portion of motor vehicle sales tax receipts to the Highway User Tax Distribution Fund. A constitutional amendment adopted in 2006 will phase in sole dedication of motor vehicle sales tax receipts to roads and transit, which accounts for the expected growth in revenue from this source through 2011. Starting in fiscal year 2012, after the phase-in, motor vehicle sales tax receipts will be statutorily allocated up to 60 percent to the Highway User Tax Distribution Fund and at least 40 percent to transit.[3]

State Trunk Highway Fund

By constitutional mandate, a large portion of motor vehicle and fuel tax receipts are transferred from the Highway User Tax Distribution Fund to the State Trunk Highway Fund. Since 1998, total state and federal funding for the state trunk highway system, when adjusted for inflation, increased by 11 percent, from about $1.36 billion in fiscal year 1998 to about $1.50 billion in fiscal year 2007. Looking more specifically at State Trunk Highway Fund resources over the past ten years, we found that:

- **In the face of declining revenue from state transportation taxes, Minnesota made substantial use of bonding and federal advance construction authority to support the state trunk highway system.**

As shown in Table 2.1, motor vehicle and fuel taxes accounted for about two-thirds of trunk highway resources in fiscal year 1998. By fiscal year 2007, these taxes accounted for about half. When adjusted for inflation (to 2007 dollars), state taxes flowing into the State Trunk Highway Fund increased from $897 million in fiscal year 1998 to a peak of $945 million in fiscal year 2000, and dropped to $762 million in fiscal year 2007—a 15 percent decline from fiscal year 1998 to fiscal year 2007.

Part of the decline in state tax revenues has been offset with bonding.

Part of the decline in state tax revenues has been offset by bonding. For the first time since 1983, the Legislature authorized the sale of trunk highway bonds in 2000 to finance state transportation needs, and it did so again in 2002 and 2003. The bond authorizations totaled $100 million in 2000, $10 million in 2002, and $510 million in 2003. The 2000 authorizations were part of Governor Ventura's "Moving Minnesota" transportation initiative, and $400 million of the $510 million authorized in 2003 were associated with Governor Pawlenty's transportation package (referred to as the "Bond Accelerated Program").[4] The Minnesota Department of Finance sells bonds in the fiscal year that the proceeds are needed, and the bond revenues shown in Table 2.1 reflect the timing of the actual sales.

---

[3] *Minnesota Statutes* 2007, 297B.09.

[4] The remaining amounts ($10 million in 2002 and $110 million in 2003) were authorized to convert financing for selected projects from cash financing to trunk highway bond financing.

Table 2.1: State Trunk Highway System Resources, Fiscal Years 1998-2007

	2007 Dollars (in millions)									
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007[a]
State Motor Vehicle and Fuel Taxes	$ 897	$ 937	$ 945	$ 794	$ 920	$ 938	$ 920	$ 847	$ 805	$ 762
Federal Funds	343	403	429	506	405	730	355	396	379	543
Trunk Highway Bonds	0	0	0	39	70	16	168	134	117	129
Other Resources[b]	117	106	106	247	101	108	96	116	142	68
Total	$1,356	$1,446	$1,479	$1,586	$1,495	$1,792	$1,539	$1,492	$1,443	$1,501

	Percentage of Total									
	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007[a]
State Motor Vehicle and Fuel Taxes	66%	65%	64%	50%	62%	52%	60%	57%	56%	51%
Federal Funds	25	28	29	32	27	41	23	27	26	36
Trunk Highway Bonds	0	0	0	2	5	1	11	9	8	9
Other Resources[b]	9	7	7	16	7	6	6	8	10	4
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

NOTES: Dollar amounts were adjusted for inflation using the U.S. Bureau of Economic Analysis Price Indexes for Government Consumption Expenditures and Gross Investment, State and Local Government. Percentages may not sum to 100 due to rounding.

[a] Data for fiscal year 2007 are complete as of November 2007.

[b] "Other resources" includes investment and interest income, receipts from local governments on shared construction agreements, commercial vehicle permit fees, and sales of assets. In 2001, it also includes the trunk highway fund share, approximately $100 million, of a one-time transfer of $162 million from the General Fund to the Highway User Tax Distribution Fund.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Comprehensive Annual Financial Report, provided by the Minnesota Department of Transportation Finance Division.

Federal funding for the state trunk highway system fluctuated from year to year, as shown in Table 2.1. Inflation-adjusted federal funding, in 2007 dollars, ranged from a low of $343 million in fiscal year 1998 to a high of $730 million in fiscal year 2003. This variation is explained in part by the way states receive federal funding. Generally speaking, the federal government authorizes specified amounts of federal funding available to Minnesota each fiscal year. The Federal Highway Administration (FHWA) authorizes projects for which federal funds can be used and the amount of federal dollars that can be used for each project. States do not receive federal funds outright; instead, states pay for all project costs up front and then request reimbursement from the federal government. Hence, the flow of federal funds into the State Trunk Highway Fund depends on the timing of construction project activity and subsequent requests for federal reimbursement.

In addition to authorizing the sale of $400 million in state trunk highway bonds for the Governor's transportation initiative, the 2003 Legislature also authorized MnDOT to spend up to $400 million through fiscal year 2009 from federal funds designated by the FWHA as "advance construction" (AC) funds.[5] Under

[5] *Laws of Minnesota* First Special Session 2003, chapter 19, art. 3, sec. 1 and 3.

In 2003, the Legislature authorized an $800 million transportation initiative funded by trunk highway bonds and federal "advance construction."

traditional federal aid financing, MnDOT obligates the full federal share of a multi-year project in the first year of the project, and the total amount obligated cannot exceed the amount of the current federal appropriation. This method commits available federal funds even though much of it will not be needed until later years of construction. Essentially, AC allows the state to set aside current and estimated future federal appropriations to cover the full cost of a multi-year project, but to record on the state's books only the federal funds that are needed in each year of project construction. Use of this technique allows MnDOT to bundle multiple-year projects into one large contract, and the state may achieve cost savings in doing so. AC does not change the amount of federal funding that the state receives over a period of time, it only changes the timing when funds are recognized for accounting purposes.

Expenditures

Detailed, consistent data on state trunk highway spending is difficult to obtain, in large part because MnDOT's project management systems operate separately from the department's financial management systems. The financial management data, however, are more comprehensive and are used to support the state's financial statements.[6] We analyzed these data and found that:

- **Between fiscal years 1998 and 2007, the Minnesota Department of Transportation increased the proportion of state trunk highway funds spent on construction and decreased the proportion spent on operations, research, and support.**

As shown in Table 2.2, during the 1998-99 biennium, about 62 percent of trunk highway spending ($1.5 billion in 2007 dollars) went toward construction of state trunk highway roads and bridges.[7] About 33 percent of spending was allocated to trunk highway operations (which includes routine road and bridge maintenance), research, and support. For the 2006-07 biennium, the share of total spending allocated to construction and preservation increased to 71 percent, while the share devoted to operations, research, and general support declined to 23 percent.[8] Overall, in 2007 dollars, construction spending on state trunk highway bridges and roads in the 2006-07 biennium was $326 million higher than in the 1998-99 biennium.

---

[6] Use of federal advance construction can lead to substantial fluctuations in the amount of federal revenue recognized in a given fiscal year. To minimize the impact of this variation, we chose to present data by biennium rather than fiscal year.

[7] Trunk highway construction projects are often grouped into two categories—projects to add capacity or expand the system (referred to as "new construction" or "expansion" projects) and preservation projects, which are directed at extending the life of existing roads and bridges. The distinction between the two categories is not always clear because a project can have both preservation and expansion aspects. Construction spending amounts include construction project costs (materials and payments to contractors) as well as MnDOT staff costs associated with construction projects (e.g., planning, bridge design, and project management).

[8] MnDOT's project management data provide more detailed information on the allocation of construction contracts by type of preservation activity, such as preventive maintenance. We discuss our analysis of these data in Chapter 4.

Table 2.2: State Trunk Highway System Spending by Biennium, Fiscal Years 1998-2007

	2007 Dollars (in millions)				
	1998-99	2000-01	2002-03	2004-05	2006-07
Bridge Inspection	$ 4	$ 5	$ 5	$ 5	$ 4
Road and Bridge Construction[a]	$1,465	$1,521	$1,775	$1,950	$1,792
Bridge Preservation[b]			118	68	72
Bridge Preservation with Added Capacity[b]			30	25	34
Bridge New Construction[b]			113	213	268
Bridge Subtotal	$ 176	$ 169	$ 260	$ 306	$ 374
Road Preservation[b]			745	568	627
Road Preservation with Added Capacity[b]			471	846	448
Road New Construction[b]			299	230	342
Road Subtotal	$1,289	$1,351	$1,515	$1,644	$1,417
General Support	466	495	480	353	300
Operations	318	349	321	335	278
Right-of-Way Acquisition	124	130	244	174	166
Total	$2,378	$2,499	$2,825	$2,818	$2,539

	Percentage of Total				
	1998-99	2000-01	2002-03	2004-05	2006-07
Bridge Inspection	<1%	<1%	<1%	<1%	<1%
Road and Bridge Construction	62	61	63	69	71
Bridge Subtotal	7	7	9	11	15
Road Subtotal	54	54	54	58	56
Research and Support	20	20	17	13	12
Operations	13	14	11	12	11
Right-of-Way Acquisition	5	5	9	6	7
Total	100%	100%	100%	100%	100%

NOTES: Dollar amounts were adjusted for inflation using the U.S. Bureau of Economic Analysis Price Indexes for Government Consumption Expenditures and Gross Investment, State and Local Government. Subcategories may not sum to totals due to rounding. Larger construction projects can take several years to complete. For budgeting, the total cost of a project is appropriated to the first fiscal year of the project timeline; however, expenditures are made only as work is completed. This table shows spending based on the fiscal year in which the charge was recorded, not the fiscal year for which the money was appropriated to the budget.

[a] Construction spending includes construction project costs (materials and payments to contractors), as well as MnDOT staff costs associated with construction and preservation projects (e.g., planning, bridge design, and project management).

[b] Financial coding for these categories was not implemented until fiscal year 2002.

SOURCE: Office of the Legislative Auditor, analysis of Department of Transportation financial management data.

In 2007 dollars, construction spending on state trunk highway roads and bridges was $326 million higher in the 2006-07 biennium than in the 1998-99 biennium.

Construction spending on state trunk highway bridges, adjusted to 2007 dollars, more than doubled, from $176 million during the 1998-99 biennium to $374 million in the 2006-07 biennium. With this increase, bridge construction expenditures as a proportion of total spending increased from about 7 percent to 15 percent from fiscal years 1998-99 to fiscal years 2006-07. About $268 million (72 percent) of bridge construction spending in the 2006-07 biennium was for bridges associated with state trunk highway system expansion and other new construction projects.

Between fiscal years 1998 and 2007, construction spending for trunk highway roads (in 2007 dollars) was highest in the 2002-03 and 2004-05 biennia at $1.5 billion and $1.6 billion, respectively. The data reflect the impact of the 2000 transportation package and Governor's 2003 bond accelerated transportation package, which allowed earlier implementation of several large transportation projects. Overall, in the ten-year period shown in Table 2.2, pavement-related spending as a proportion of total state trunk highway spending grew slightly, from 54 percent to 56 percent.

Staffing Levels

As MnDOT's budget situation changed, its staff complement changed as well. We found that:

- **The number of MnDOT staff declined by 19 percent from fiscal year 2001 to 2007.**

As shown in Table 2.3, between fiscal years 1998 and 2007, MnDOT staffing peaked at 5,649 in fiscal year 2001 and fell to a low of 4,555 by the end of fiscal year 2007. In addition, staff counts in two key job classifications at MnDOT—engineers and transportation specialists—declined from their peak levels. The engineer group includes both paraprofessionals and licensed engineers. While MnDOT employed more engineers in fiscal year 2007 than fiscal year 1998, the total number of paraprofessional and professional engineers declined by about 16 percent from fiscal year 2002 (a staffing peak) to fiscal year 2007. Transportation specialists perform front-line maintenance and technical work, such as road repair, bridge maintenance, and snowplowing, and their number declined from 2,245 in fiscal year 2000 to 1,942 in fiscal year 2007, a 13.5 percent decrease.[9]

[9] MnDOT created the transportation specialist position series in 2000 when it combined, then eliminated, the various position classifications the workers had been in.

Table 2.3: Minnesota Department of Transportation Staffing, Total and in Selected Job Classifications, Fiscal Years 1998-2007

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007
Total Agency Staff	5,379	5,559	5,556	5,649	5,417	4,876	4,880	4,707	4,747	4,555
Transportation Specialists[a]	--	--	2,245	2,177	2,195	2,115	2,031	2,002	1,935	1,942
Paraprofessional Engineers	206	230	265	285	351	331	309	301	294	286
Licensed Engineers (Staff-level)	335	342	342	338	374	358	362	362	340	336
Licensed Engineers (Management)	81	84	85	86	103	100	90	82	80	77
Total Engineering Staff	622	656	692	709	828	789	761	745	714	699

NOTE: Staff counts are individuals employed at the end of the fiscal year.

[a] Transportation Specialists are district office personnel who deliver maintenance and operation services, such as state trunk highway road and bridge repair, snowplowing, and road striping. MnDOT created this job classification beginning in fiscal year 2000; as a result, staff counts for fiscal years 1998-99, when the affected workers were assigned to various other job classifications, are excluded from the table.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation staffing data.

The number of MnDOT professional and paraprofessional engineering staff declined by about 16 percent between fiscal years 2002 and 2007.

Some of this staff reduction is a direct result of a fiscal year 2004 reallocation of resources. Although shielded from the General Fund budget reductions resulting from the budget crisis, the Pawlenty-Molnau administration shifted $36 million from MnDOT administration and operations to “improve the efficiency of the operations of the department” and finance additional state trunk highway system construction.[10] As shown in Table 2.4, most of the savings came from reductions in central office administration and information technology spending. Actions to achieve these reductions included (1) reducing two layers of management between the Commissioner’s office and District Engineers and eliminating assistant director positions in various offices; (2) consolidating various finance, human resources, payroll, and information technology functions and reducing associated staff positions; and (3) reducing investments in information technology hardware and software. MnDOT reported in December 2004 that the $36 million spending shift resulted in about 250 layoffs and terminations.[11]

---

[10] Minnesota Department of Transportation, *Budget Base Reduction Report* (St. Paul, December 15, 2004), 1.

[11] The department also reduced its base budget for state trunk highway field operations by about $7.8 million. MnDOT made most of these reductions by (1) reducing its vehicle fleet and changing procedures for vehicle maintenance and management; (2) reducing or deferring maintenance activities, such as mowing, litter clean-up, fence repair, shoulder and drainage repairs, cleaning and shaping of ditches, and landscape and building maintenance; and (3) altering snow and ice removal procedures.

Table 2.4: Minnesota Department of Transportation Operating Budget Reductions, Fiscal Year 2004

	Reduction (in thousands)	Percentage of Fiscal Year 2004 Direct Appropriation
Central Office Administration	$15,775	
Information Technology	10,075	
Research	2,500	
Subtotal	$28,350	6.6%
Fleet and Facilities	$ 3,150	
Road Maintenance	2,350	
Snow and Ice	950	
Road Striping	800	
Landscaping	500	
Subtotal	$ 7,750	1.8%
Total	$36,100	8.4%

NOTE: MnDOT reallocated the $36.1 million in operating budget reductions to finance additional construction.

SOURCE: Minnesota Department of Transportation, *Budget Base Reduction Report* (St. Paul, December 15, 2004), 1.

PAVEMENT CONDITION

MnDOT uses several measures, listed in Table 2.5, to quantify the condition of highway pavements. Of the indices listed in the table, MnDOT uses ride quality index (RQI) and remaining service life (RSL) as its key performance measures. We focused our trend analysis on these data as well and found that:

- **Since 2002, the condition of state trunk highway pavements has generally deteriorated, and pavement conditions have not met MnDOT performance targets.**

As shown in Table 2.6, RQI rating categories (good, fair, etc.) reflect how a typical driver perceives the smoothness of the road pavement. MnDOT collects RQI data on all state trunk highway roads (in both directions) annually and has been doing so for many years.[12] In 2002, the department used historical pavement condition data to establish RQI performance targets aimed at having—by 2014—a high proportion of state trunk highway roads in good or very good condition and a small proportion of roads in poor or very poor condition. The

[12] Prior to 2005, the measure was calculated the same way but called "present serviceability rating." For the purposes of measuring and managing pavement conditions, MnDOT uses "roadway miles." One mile of undivided road equals one roadway mile, while one mile of divided road equals two roadway miles. Bridge lengths and gravel roads are generally excluded from the calculation of roadway miles.

Table 2.5: Measures of Pavement Quality

Ride Quality Index (RQI)	A measure of pavement smoothness on a scale from 0 to 5. Based on quantitative measures of pavement roughness, it reflects an average person's perception of ride quality.
Surface Rating (SR)	A measure of pavement distress that quantifies the extent of defects, such as cracks and faults.
Pavement Quality Index (PQI)	A measure of overall pavement quality based on ride quality and surface ratings.
Remaining Service Life (RSL)	Estimated time, in years, until the RQI reaches a value of 2.5, which is generally considered to be the end of a pavement's design life.

SOURCE: Minnesota Department of Transportation.

Table 2.6: Ride Quality Index Rating Categories and Performance Targets

Category	Description	Performance Targets
Very Good (4.1 – 5.0)	Only new (or nearly new), superior pavements are likely to be smooth enough and sufficiently free of cracks and patches to qualify for this category. Most pavements constructed or resurfaced during the year of data collection would be rated in this category.	70 percent or more of principal arterials and 65 percent or more of nonprincipal roads rated as very good or good
Good (3.1 – 4.0)	Pavements in this category, although not quite as smooth as those described above, give a first-class ride and exhibit few, if any, visible signs of surface deterioration.	
Fair (2.1 – 3.0)	The ride quality of these pavements is noticeably inferior to those of new pavements and may be barely tolerable for high-speed traffic.	
Poor (1.1 – 2.0)	Pavements have deteriorated to such an extent that they affect the speed of free-flowing traffic.	2 percent or less of principal arterials and 3 percent or less of nonprincipal roads rated as poor or very poor
Very Poor (0 – 1.0)	Pavements in this category are in an extremely deteriorated condition. The road is passable only at reduced speeds and with considerable ride discomfort.	

NOTE: The ride quality index is a measure of pavement smoothness on a scale of 0 to 5. It reflects an average person's perception of ride quality.

SOURCE: Minnesota Department of Transportation.

targets set higher standards for principal arterials than for nonprincipal roads, as shown in the table. (The state trunk highway system is about evenly divided between principal and nonprincipal roads.) Also in 2002 and in response to a recommendation from the Legislative Auditor, MnDOT revised the RQI values associated with rating categories; as a result, ride quality performance data published prior to 2002 are not comparable to those for later years.

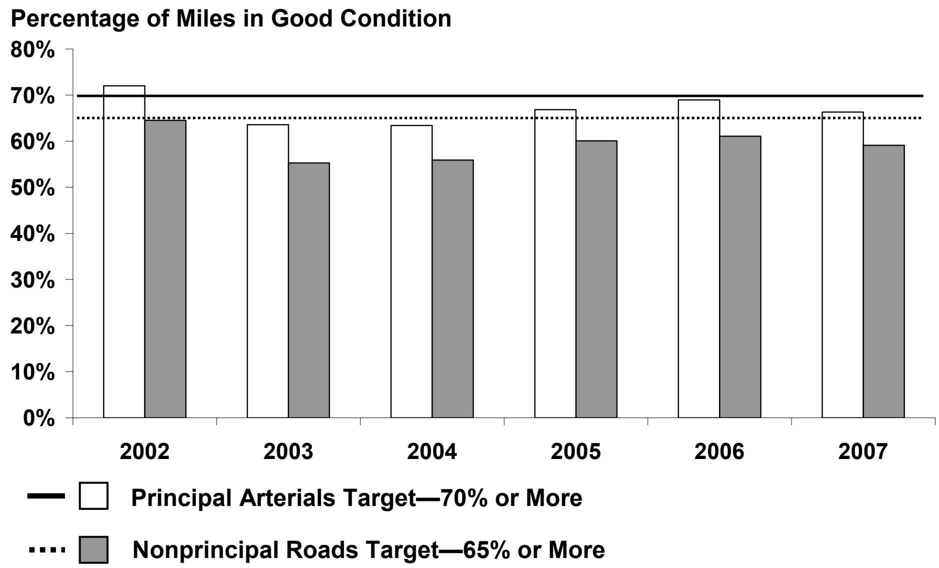
Minnesota had more miles of trunk highway pavement in poor condition in 2007 than in 2002.

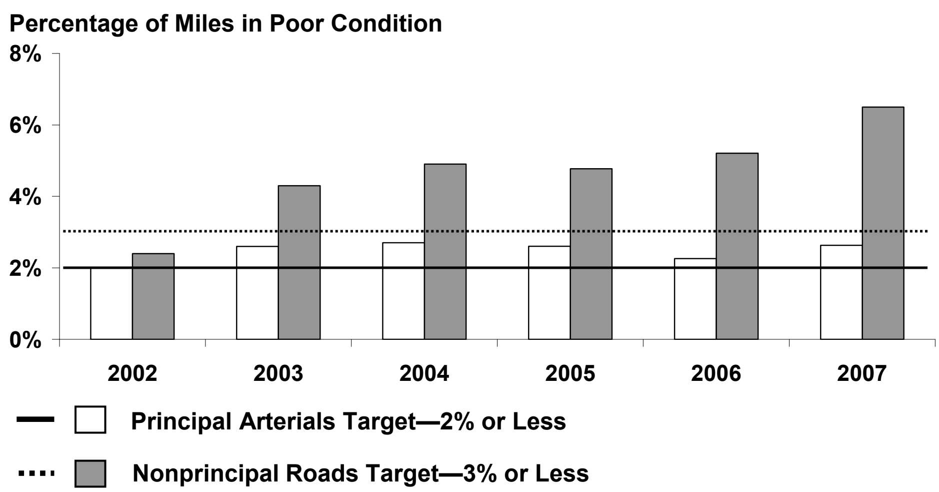
Beginning in 2003, the condition of trunk highway pavements has not met all RQI performance targets for either principal or nonprincipal roadways. As shown in Figure 2.2, 72 percent of principal arterial miles in 2002 were in good or very good condition and 2 percent were in poor or very poor condition. Through 2003 and 2004, the percentage of principal arterials in good condition declined by roughly 10 percentage points while the percentage in poor condition increased slightly. The condition of these roads improved in the two years that followed, then worsened again in 2007. The condition of nonprincipal roadways also declined and was farther from meeting performance targets. In 2007, 6.5 percent of nonprincipal roadways were in poor or very poor condition compared to 2.4 percent in 2002.

RSL measures the years remaining until a pavement segment's RQI reaches a value of 2.5. This is the point at which pavement is generally considered to be at the end of its design life and in need of some type of major rehabilitation or reconstruction. Average remaining service life (ARSL) is the mean RSL for the pavement segments in a given road system (such as principal arterials in the state trunk highway system) or geographic area (such as a MnDOT district). ARSL reflects the relative impact of opposing forces: (1) new construction and maintenance that improves roads and (2) aging and wear and tear that results in deterioration. Addition of new roads and rehabilitation of existing roads will push ARSL higher; the aging process and heavy road use that speeds deterioration will push ARSL lower. Over time, ARSL data will show the relative impact of these forces. In December 2007, MnDOT revised certain aspects of the prediction model used to calculate ARSL to reflect more recent data on the actual rate of deterioration experienced on different classifications of roadways. This revision resulted in steeper rates of decay.

As shown in Figure 2.3, ARSL for both principal and nonprincipal roads in the state trunk highway system was lower in fiscal year 2007 than in fiscal year 1997. This is true using either the old or revised prediction models in 2007. For both systems, ARSL showed a noticeable decline from 2001 through 2003, with modest improvement through 2006. Among principal roadways, the ARSL was 14 years in 1997, 14.8 years at its peak in 2001, and 9.2 years in 2007 (11.9 years using the old prediction model). The ARSL among nonprincipal roadways lagged by at least a year behind that of principal arterials, falling from 13.3 years in 1997 to 7.4 years in 2007 (10.5 years using the old prediction model). The drop in ARSL from fiscal year 2006 to 2007 reflects the impact of MnDOT's updated prediction model. According to MnDOT officials, in addition to the aging of the infrastructure, reduced levels of maintenance and preservation work, more use of shorter-term fixes, and increased traffic volumes have resulted in faster rates of decay among trunk highway pavements. We discuss these issues in more detail in Chapter 4.

Figure 2.2: Trunk Highway Pavement Ride Quality Compared to Performance Targets, 2002-07

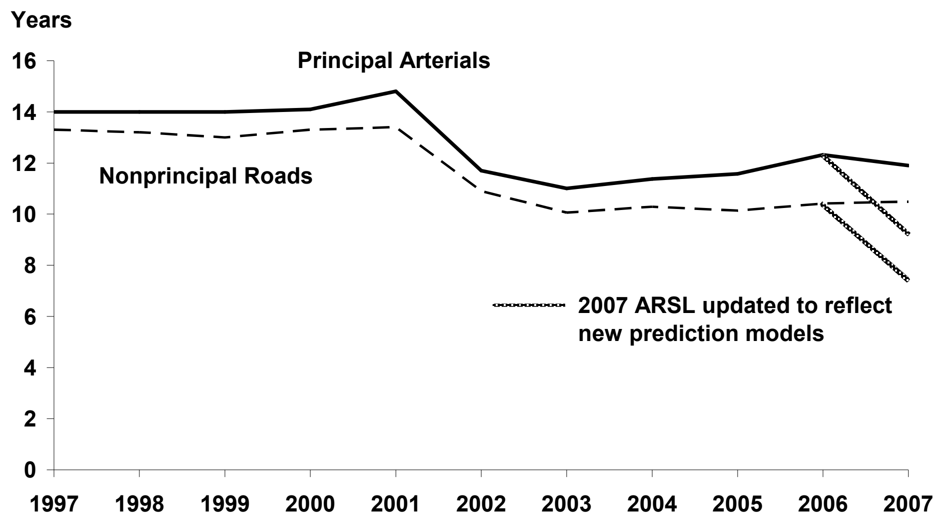




NOTES: The ride quality index (RQI) is a measure of pavement smoothness on a scale of 0 to 5. It reflects an average person's perception of ride quality. Good condition includes roadway miles with an RQI greater than 3; poor condition includes roadway miles with an RQI less than or equal to 2. A "roadway mile" is a mile of undivided road, excluding gravel roads and bridges.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

Figure 2.3: Average Remaining Service Life of State Trunk Highway Pavements, Fiscal Years 1997-2007



NOTES: Remaining service life (RSL) is the estimated time, in years, until the ride quality index (RQI) of a road segment reaches a value of 2.5 (on a scale of 0 to 5). At an RQI of 2.5, the pavement is generally considered to be at the end of its design life. Average remaining service life (ARSL) is the mean RSL for a group of roads. MnDOT updated its method for estimating remaining service life in 2007. The department revised certain aspects of its prediction models to reflect more recent data about the actual rate of deterioration on trunk highway pavements, and this revision generally resulted in steeper rates of decay.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

Pavement Condition by District

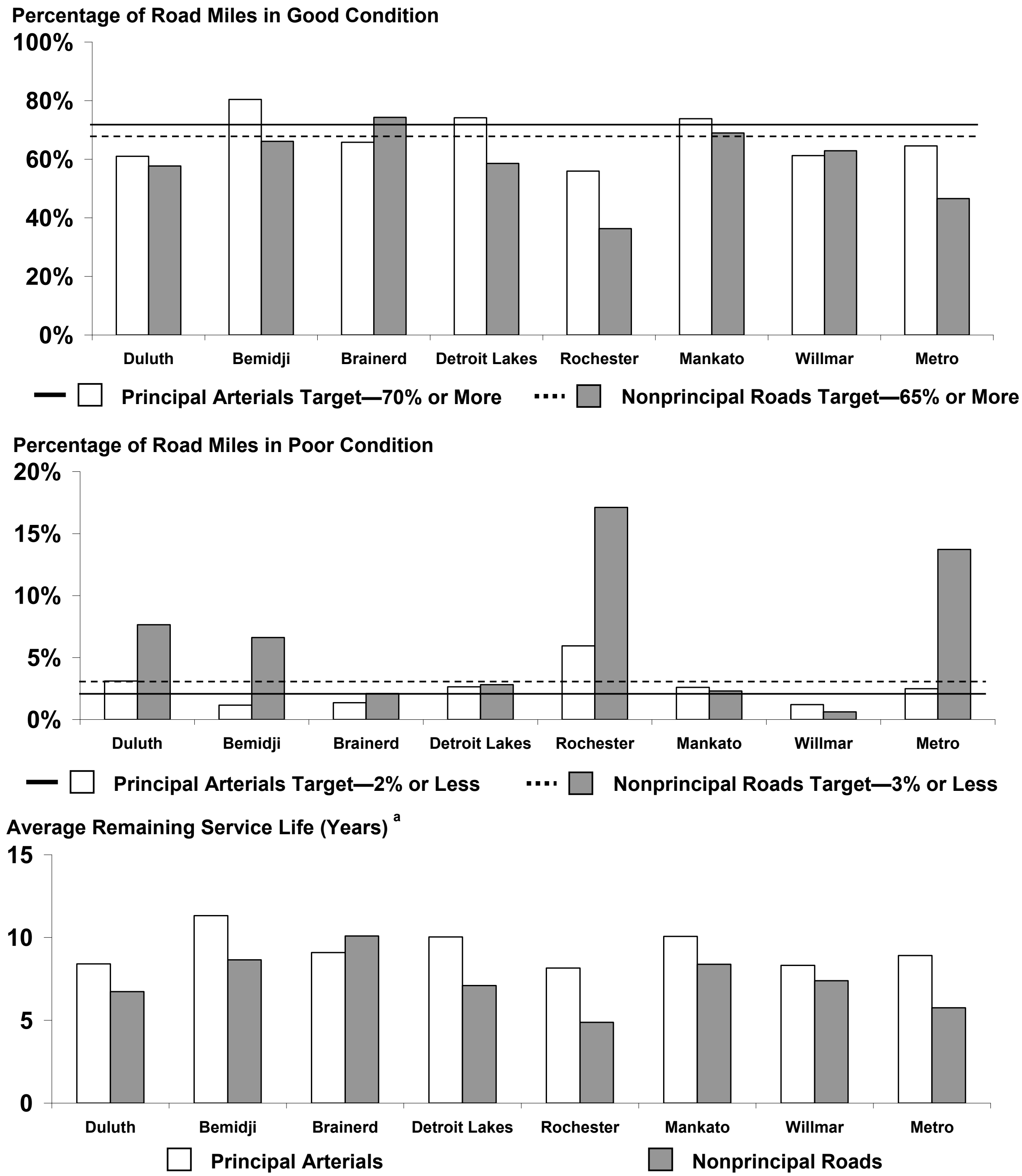
To manage transportation programs, MnDOT is organized into districts.[13] We analyzed trunk highway pavement data by district, and we found that:

- **The condition of state trunk highway roads—particularly nonprincipal roads—in some districts of the state are noticeably poorer than in other districts.**

As shown in Figure 2.4, three districts (Duluth, Metro, and Rochester) met none of the RQI performance targets in 2007. Three of eight districts (Bemidji, Detroit Lakes, and Mankato) met the state performance target to have at least 70 percent of principal arterials in good condition. State trunk highway roads in southeastern Minnesota (Rochester District) were farthest from this goal with 56

[13] In the remainder of the chapter, we use the term "district" for brevity. District information actually reflects information for Minnesota's Area Transportation Partnerships (ATPs). As part of the transportation planning process, ATPs work with MnDOT and other transportation partners to create transportation improvement programs. In some cases, ATP geographic boundaries differ from MnDOT district boundaries.

Figure 2.4: Pavement Condition by District, Fiscal Year 2007



NOTES: Figures reflect information for Minnesota's Area Transportation Partnerships (ATPs). In some cases, ATP boundaries differ from MnDOT district boundaries. The top two figures show road quality based on the ride quality index (RQI). RQI is a measure of pavement smoothness on a scale of 0 to 5. It reflects an average person's perception of ride quality. Good condition includes roadway miles with an RQI greater than 3; poor condition includes roadway miles with an RQI less than or equal to 2. A "roadway mile" is a mile of undivided road, excluding gravel roads and bridges. Remaining service life is the estimated time, in years, until the RQI of a road segment reaches a value of 2.5. At an RQI of 2.5, the pavement is generally considered to be the end of its design life.

[a] Average remaining service life data are based on revised prediction models that MnDOT implemented in late 2007.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

percent of principal arterials in good condition. According to Rochester District officials, poorer pavement conditions in the district are the direct result of investments in the highway 52 expansion project and subsequent advance construction paybacks, which diverted funds from pavement preservation. Three of eight districts (Bemidji, Brainerd, and Willmar) met state performance goals by having less than 2 percent of principal arterial miles in poor condition. In contrast, the Rochester District had triple the target amount, with 6 percent of principal arterial miles in poor condition.

Nonprincipal roadways in the Metro and Rochester districts were in significantly poorer condition than those in other areas of the state, with 17 percent and 14 percent of nonprincipal road miles in poor condition. Two other districts (Duluth and Bemidji) had 8 and 7 percent of nonprincipal road miles in poor condition. In addition, ARSL for both principal and nonprincipal state trunk highway roadways in the Rochester District lagged behind other districts.

Pavement Condition Projections

MnDOT's pavement management system models the future condition of pavement segments, taking into account historical patterns of deterioration on each segment and preservation and new construction work planned for the period of the projection. In January 2008, MnDOT applied the pavement condition model using the trunk highway road construction projects planned for 2008-11. From this analysis:

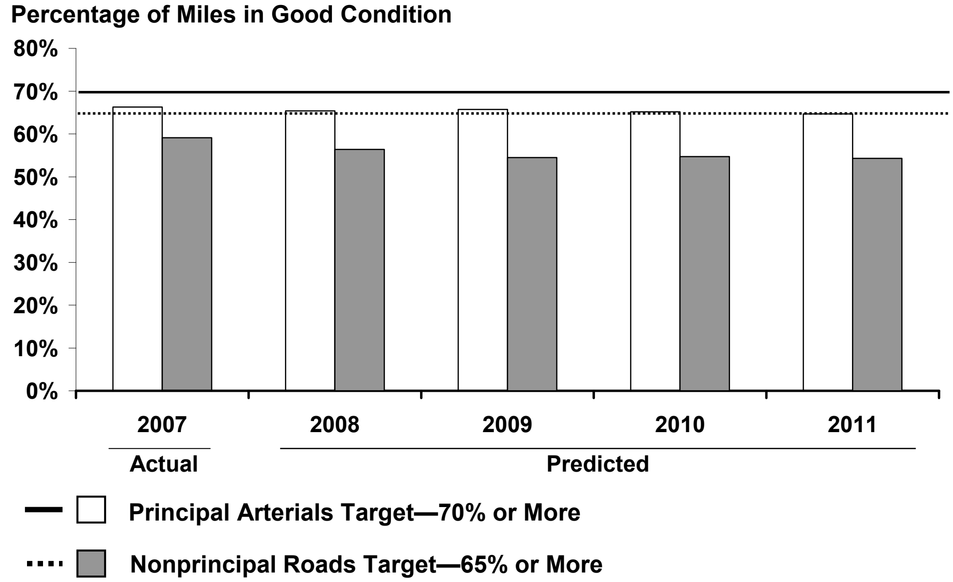
- **MnDOT predicted that by 2011, there will be twice as many trunk highway miles in poor condition as there were in 2007.**

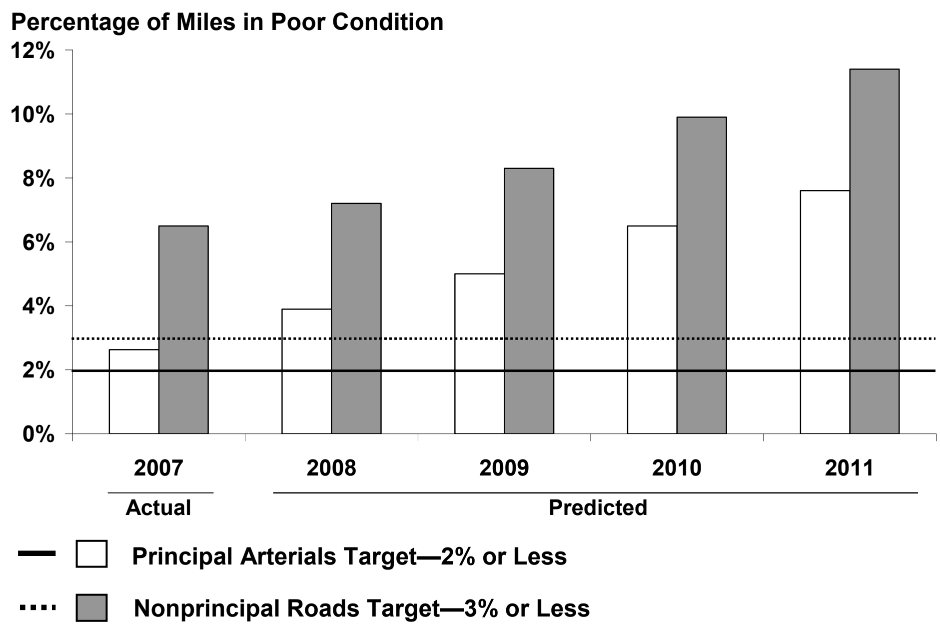
As pavement deteriorates to poor or very poor condition, the cost to repair it increases significantly.

MnDOT has estimated that its planned investments will result in a slight decline in the percentage of state trunk highway road miles in good condition by 2011. In 2007, about 66 percent of principal road miles and 59 percent of nonprincipal road miles were in good condition. For principal roads, MnDOT estimates that the percentage will slip slightly, to about 65 percent through 2011, as shown in Figure 2.5. Nonprincipal roads will show more deterioration, with the percentage of miles predicted to be in good condition slipping to 54 percent by 2011.

Of significant concern, MnDOT estimated that, by 2011, the percentage of principal arterial miles in poor condition will increase from 2.6 percent to 7.6 percent, nearly four times the target amount. As discussed above, nonprincipal roads are already in poorer condition, and MnDOT predicts they will continue to be so. In 2007, 6.5 percent of nonprincipal road miles were in poor condition, and that proportion is expected to increase to 11.4 percent in 2011. This rapid increase in the percentage of trunk highway pavements in poor condition will negatively affect the traveling public, but it also has important fiscal implications because the cost of repairing a segment of pavement rises significantly with the extent of deterioration.

Figure 2.5: Predicted Trunk Highway Pavement Ride Quality Compared to Performance Targets, 2007-11





NOTE: The ride quality index (RQI) is a measure of pavement smoothness on a scale of 0 to 5. It reflects an average person's perception of ride quality. Good condition includes roadway miles with an RQI greater than 3; poor condition includes roadway miles with an RQI less than or equal to 2.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

MnDOT predicts that, through 2011, the miles of trunk highway pavement in poor condition will increase.

BRIDGE AND CULVERT CONDITION

The state and federal governments measure the condition of bridges and culverts in several different ways.

Bridges are complex structures, and an assessment of a bridge's condition builds from evaluations of its component parts. The three major components of a bridge are the deck (riding surface), superstructure (load-carrying members such as beams or trusses that support the deck), and substructure (abutments and piers). Culverts—openings beneath an embankment with the road passing over the top—are treated as a single component.[14] The state and federal governments measure the condition of bridges and culverts in several different ways. In the sections that follow, we describe the most common measures of bridge and culvert condition and present historical data showing what the measures say about the condition of Minnesota's trunk highway structures.

Federal Condition Measures

FHWA's National Bridge Inventory (NBI) tracks the condition of bridges and culverts that carry vehicular traffic and are longer than 20 feet. Only structures longer than 20 feet are eligible for federal bridge rehabilitation and replacement funds. The FHWA uses condition and appraisal ratings to characterize the condition of structures, and it uses two other measures (deficient status and sufficiency rating) to determine eligibility for federal bridge funds. A brief description of each type of rating follows.

- **Condition Ratings.** Condition ratings describe the overall condition of the component being rated relative to its as-built condition. Each of a bridge's deck, superstructure, and substructure is assigned a condition rating, whereas culverts have a single condition rating.[15] In general, condition ratings range from 0 to 9, with 0 indicating failure and 9 indicating excellent condition.

- **Appraisal Ratings.** With one exception, appraisal ratings "evaluate a bridge in relation to the level of service which it provides on the highway system of which it is a part," relative to current construction standards and specifications.[16] The exception, approach roadway alignment, is not compared to current standards, but to the existing highway alignment. Appraisal ratings cover: (1) structural evaluation, (2) deck geometry,[17] (3) underclearance (vertical and horizontal), (4) waterway adequacy, and (5) approach roadway alignment. Like condition ratings, appraisal ratings range from 0 (closed) to 9 (superior to present desirable criteria).

---

[14] Culverts are generally constructed with structural material all around the perimeter. For example, many are made with concrete pipe.

[15] The NBI system also includes a channel and channel protection condition rating, which refers to bridge condition with respect to water flow. We did not use data on channel condition ratings in our report.

[16] Federal Highway Administration, *Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (Washington, DC, December 1995), 45.

[17] Deck geometry refers to design features such as lane and shoulder width.

- **Deficient Status.** Deficient status is one of two measures that determine a structure's eligibility for federal bridge rehabilitation and replacement funds. Based on their NBI condition and appraisal ratings, structures are placed into one of three status categories: (1) structurally deficient, (2) functionally obsolete, or (3) adequate. The criteria for being deemed structurally deficient or functionally obsolete are shown in Table 2.7.[18]

Table 2.7: Determination of Structural Deficiency or Functional Obsolescence

Structurally Deficient

A structure is structurally deficient if it meets any of the following conditions:

Deck condition rating	4 or less
Superstructure condition rating	4 or less
Substructure condition rating	4 or less
Culvert condition rating	4 or less
Structural evaluation appraisal rating	2 or less
Waterway adequacy appraisal rating	2 or less

Functionally Obsolete

A structure is functionally obsolete if it meets any of the following conditions:

Deck geometry appraisal rating	3 or less
Underclearance appraisal rating	3 or less
Approach roadway alignment appraisal rating	3 or less
Structural evaluation appraisal rating	3
Waterway adequacy appraisal rating	3

NOTE: Condition and appraisal ratings are on a scale of 0 to 9. Because a rating as structurally deficient relates to the physical integrity of a structure and is considered to be of primary importance, structures that meet the definitions of both structurally deficient and functionally obsolete are counted as structurally deficient.

SOURCE: Federal Highway Administration, Nonregulatory Supplement to *23 CFR* 650, subp. D (2007), http://www.fhwa.dot.gov/legsregs/directives/fapg/0650dsup.htm, accessed October 30, 2007.

- **Sufficiency Rating.** The sufficiency rating is the second measure that determines eligibility for federal funding. A structure's sufficiency rating indicates the structure's sufficiency to remain in service. A sufficiency rating considers three broad categories of information:

[18] By definition, a structurally deficient structure's condition has deteriorated, but it is not necessarily unsafe. Or, as one FHWA official said, structural deficiency is a "programmatic classification rather than an indication of safety." (See Tom Everett, Federal Highway Administration National Bridge Inspection Program, as quoted in "States warned to inspect bridges," http://www.cnn.com/2007/US/08/02/bridge.structure/index.html, accessed January 7, 2008.) A functionally obsolete structure is one that does not meet current design standards for a new structure. Because a rating as structurally deficient relates to the physical integrity of a structure and is considered to be of primary importance, structures that meet the definitions of both structurally deficient and functionally obsolete are counted as structurally deficient. Because of its greater relevance for safety, we focus on structurally deficient structures and present limited information about functional obsolescence.

(1) structural adequacy and safety; (2) serviceability and functional obsolescence, which considers such factors as traffic, appraisal ratings, and deck condition; and (3) essentiality for public use. Sufficiency ratings range from 0 percent to 100 percent, with 0 indicating a structure that is entirely insufficient and 100 indicating a structure that is entirely sufficient.

Structures that are deficient (structurally deficient or functionally obsolete) and have a sufficiency rating of 80 or less are eligible for federal bridge rehabilitation funding. Structures that are deficient and have a sufficiency rating less than 50 are eligible for federal bridge replacement funding.

MnDOT Performance Measures

Our analysis focuses on Minnesota's "structural condition rating," an overall measure of a bridge's or culvert's physical condition.

MnDOT collects all bridge condition information required by the FHWA, but the department has also developed three state-specific performance measures to categorize trunk highway structures. We focused on one of the measures—structural condition rating, which is a broad characterization of the structural condition of a bridge.[19] Structures are rated as good, satisfactory, fair, or poor based on a combination of NBI condition and appraisal ratings, as shown in Table 2.8.

MnDOT has set performance targets for structures over 20 feet long based on the functional class of related roadways.[20] According to the department, it set the goals so as to gain the most from the state's investment by using a bridge through its useful life and, thus, efficiently plan future investments. For structures on principal arterials, the department's goals are that at least 55 percent of deck area is associated with structures in good condition, less than 2 percent with structures in poor condition, and less than 16 percent with structures in fair or poor condition.[21] For structures on nonprincipal roads, the department's goals are that at least 50 percent of deck area is associated with structures in good condition, less than 8 percent with structures in poor condition, and less than 20 percent with structures in fair or poor condition.

---

[19] The other two measures are the geometric rating and the load carrying capacity rating. The geometric rating is a broad characterization of the geometric properties of a bridge (width, clearance, and approach). The load carrying capacity rating measures "the load carrying capacity of a bridge, and its ability to carry legal and overweight loads." Minnesota Department of Transportation, *Minnesota Bridges: Current Statistics* (St. Paul, October 2006), 5-2.

[20] When more than one road is associated with a bridge (i.e., the bridge is on one road and another is under it), MnDOT classifies the bridge based on the road with the highest functional class.

[21] When MnDOT first set structural condition targets, the target for structures in good condition on principal arterials was 65 percent. According to MnDOT, the agency reassessed the target in 2003-04. It asked the Federal Highway Administration to look at bridge conditions nationwide and learned that a much higher percentage of Minnesota's state-owned bridge inventory was in good condition than the nationwide percentage. MnDOT also determined that meeting the 65 percent target would require replacement of structures in fair condition that still have remaining useful life. Therefore, MnDOT revised the target down to 55 percent, still above the nationwide figure.

Table 2.8: Criteria for Minnesota's Structural Condition Rating

Good	NBI condition ratings for deck, superstructure, and substructure (for bridges) or culvert (for culverts) are 7 or greater *and* NBI appraisal ratings of structural evaluation and waterway adequacy are 6 or greater
Satisfactory	NBI condition rating for deck, superstructure, substructure, or culvert is 6 or appraisal rating of structural evaluation or waterway adequacy is 5
Fair	NBI condition rating for deck, superstructure, substructure, or culvert is 5 or appraisal rating of structural evaluation or waterway adequacy is 3 or 4
Poor[a]	NBI condition rating for deck, superstructure, substructure, or culvert is 4 or less or appraisal rating of structural evaluation or waterway adequacy is 2 or less

NOTES: Structures that meet the criteria for more than one rating are placed in the poorest rating. NBI condition and appraisal ratings are on a scale of 0 to 9.

[a] Minnesota's criteria for a poor condition rating are the same as the federal criteria for structurally deficient structures.

SOURCES: Minnesota Department of Transportation, *Minnesota Bridges: Current Statistics* (St. Paul, October 2006), 5-1; and telephone interview with Bridge Office staff.

The amount of information generated from bridge inspections and calculated for state and federal condition measures can be overwhelming. In the remainder of this chapter, we present historical data on the MnDOT structural condition rating and the NBI deficiency status of state trunk highway structures. We think these measures provide a good, overall picture of the condition of Minnesota's bridges and culverts. The structural condition rating is also the measure MnDOT uses to gauge its performance in maintaining the structural condition of bridges and culverts.

Although MnDOT's performance targets apply to all trunk highway structures, we show separately how the conditions of bridges and culverts compare to targets. Whereas bridge condition is weighted by deck area in our analysis, as is MnDOT's practice, deck area is not relevant for culverts. Therefore, we present information on culvert conditions in a separate section, unweighted by deck area or other indication of size. This is different from MnDOT's practice.

Bridge Condition

In 2006, Minnesota had 2,732 state trunk highway bridges with 44.1 million square feet of deck area. We obtained detailed, annual data on each of these bridges going back to 2002. From these data, we found that:

- **The overall structural condition of state trunk highway bridges improved between 2002 and 2006, and met performance targets for structures in good condition in 2006.**

The percentage of bridge deck area associated with bridges with a good structural condition rating increased between 2002 and 2006, from 52 percent to 56 percent of deck area.[22] In addition, the percentage of deck area in poor condition declined from 5 percent to 3 percent, and the percentage of deck area in fair or poor condition declined from 14 percent to 12 percent.

Bridges over 20 feet long on principal arterials met the performance target for structures in good condition in the last year of the period examined. As Figure 2.6 shows, the percentage of deck area on principal arterials associated with bridges in good condition increased from 51 to 55 percent. Over the entire period, MnDOT kept the deck area associated with bridges in "fair or poor" condition below the target maximum of 16 percent, but the percentage in poor condition remained slightly above target.

Minnesota's trunk highway bridges over 20 feet in length are in better condition than state-owned bridges nationwide.

Bridges on nonprincipal roads have met the target for structures in good condition on those roads, and exceeded the percentages in good condition on principal arterials. The percentages of deck area in poor and "fair or poor" condition were higher on nonprincipal roads than on principal arterials, but were below their targets during the time period.

Minnesota's bridges over 20 feet long compared favorably with bridges nationwide. As mentioned above, one of MnDOT's considerations when it reduced the target for structures over 20 feet long on principal arterials from 65 percent to 55 percent in good condition was that Minnesota's state-owned bridges were in better shape than bridges nationally. According to the most current available data, approximately 56 percent of the deck area of Minnesota's state-owned bridges over 20 feet long was associated with bridges in good condition. The comparable nationwide figure was 44 percent in good condition. Approximately 3 percent of the deck area of bridges over 20 feet long in Minnesota was associated with bridges in poor condition, while the nationwide figure was 9 percent.[23]

As noted earlier, deficiency status is another global indicator of bridge condition and one used to determine whether Minnesota can obtain federal funding to support bridge rehabilitation or replacement. Using this measure, we found that:

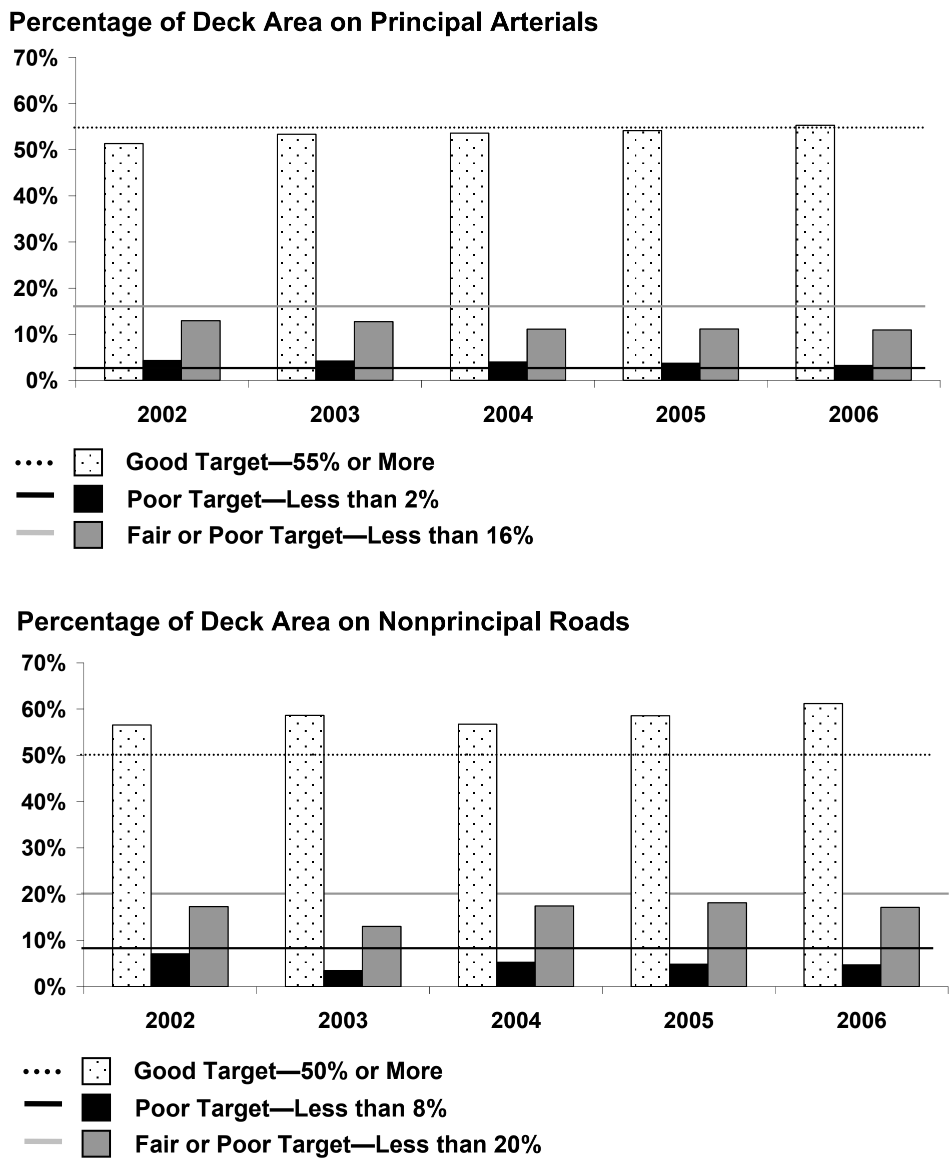
- **Between 2002 and 2006, the Minnesota Department of Transportation reduced the number of trunk highway bridges that were structurally deficient.**

---

[22] Unless specifically noted otherwise, we are reporting bridge condition information weighted by the deck area associated with the bridges. As described in the previous section, the structural condition rating is based on condition and appraisal ratings of various bridge elements, not just the bridge decks.

[23] We obtained National Bridge Inventory data corresponding to our 2006 data and determined the structural condition rating for state-owned bridges nationwide. We included "state highway agency" and "state toll authority" as state owners. We excluded bridges in Puerto Rico and bridges that carried only pedestrian and bicycle traffic.

Figure 2.6: Structural Condition Rating of Trunk Highway Bridges Over 20 Feet, 2002-06



In 2006, trunk highway bridges met MnDOT's performance target for the percentage of deck area in good condition.

NOTES: The "percentage of deck area" measure weights bridges in each condition by their deck area. The structural condition rating incorporates the National Bridge Inventory deck, superstructure, and substructure condition ratings, and structural evaluation and waterway adequacy appraisal ratings. A structure is placed in the worst category warranted by any of the individual ratings. MnDOT targets apply to all structures as a group, not just bridges.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

Table 2.9: Deficient Status of Trunk Highway Bridges, 2002-06

		Overall		Sufficiency Rating Less Than 50[a]		Sufficiency Rating Less Than or Equal to 80[b]	
	Adequate	Functionally Obsolete	Structurally Deficient	Functionally Obsolete	Structurally Deficient	Functionally Obsolete	Structurally Deficient
2002	2,360	189	121	8	59	126	111
2003	2,402	192	111	11	56	128	103
2004	2,423	184	112	8	49	123	106
2005	2,436	191	100	5	43	126	94
2006	2,444	184	94	4	39	118	85

[a] Bridges that have a sufficiency rating less than 50 and are either structurally deficient or functionally obsolete are eligible for federal bridge replacement funds.

[b] Bridges that have a sufficiency rating less than or equal to 80 and are either structurally deficient or functionally obsolete are eligible for federal bridge rehabilitation funds.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

As shown in Table 2.9, Minnesota had 121 structurally deficient trunk highway bridges in 2002. By 2006, the number had dropped to 94.[24] Considering that 38 trunk highway bridges became structurally deficient between 2003 and 2006, this is an important accomplishment. Minnesota's structurally deficient trunk highway bridges and culverts are listed in Appendix A.

Although the statewide picture of trunk highway bridge condition shows improvement, the structural condition of trunk highway bridges was not uniform throughout the state. We found that:

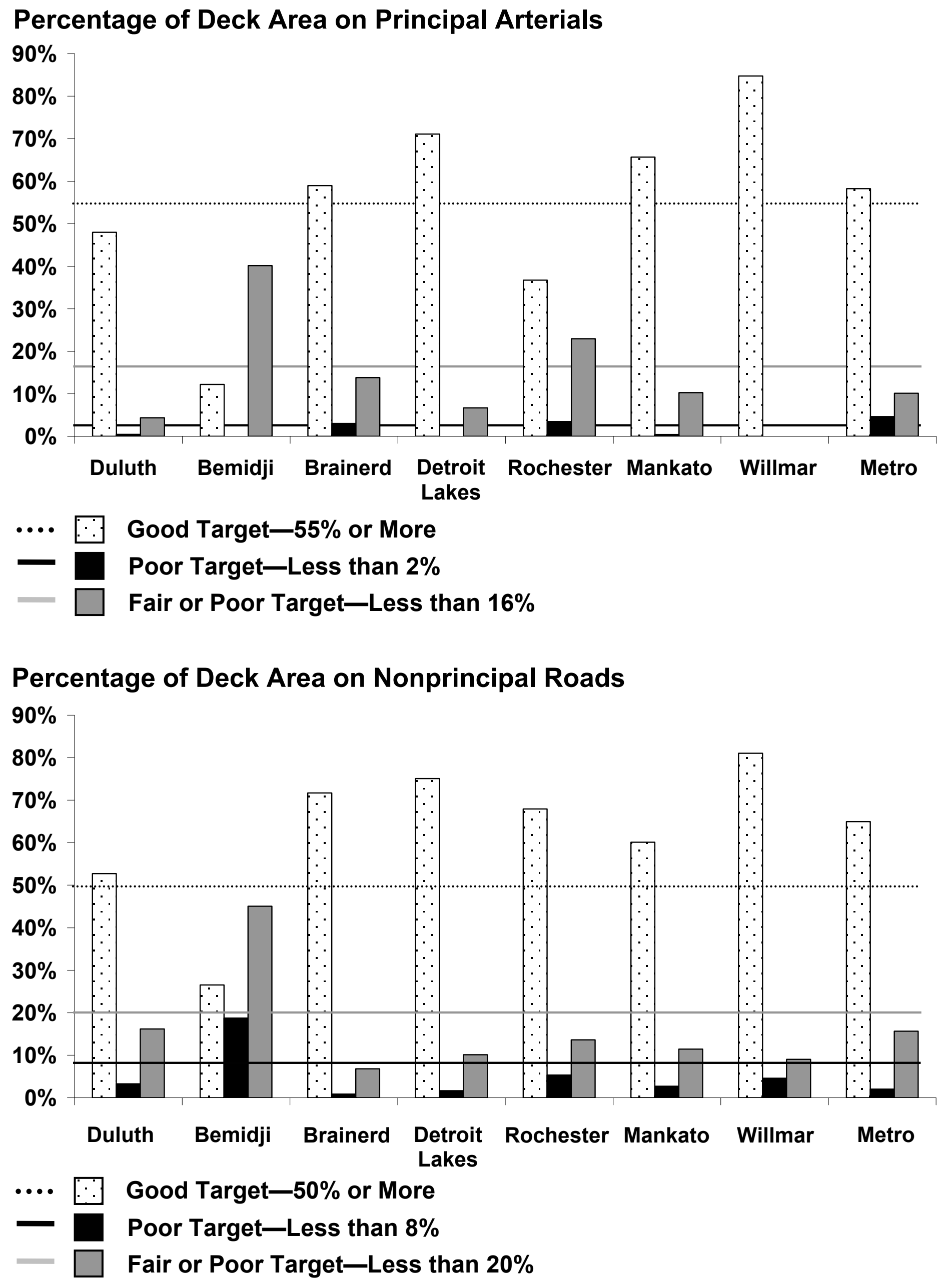
- **Bridge conditions showed that MnDOT districts had mixed success relative to the established targets for trunk highway structures.**

As shown in Figure 2.7, in 2006, bridges in five of the eight districts exceeded the target percentage for structures on principal arterials with a structural condition rating of good, and seven exceeded the target for nonprincipal routes. The Brainerd, Detroit Lakes, Mankato, Willmar, and Metro districts, together accounting for 72 percent of bridge deck area on the trunk highway system, met the target for both functional classes of roadways.

Bridges in five districts—Duluth, Bemidji, Detroit Lakes, Mankato, and Willmar—were below the target maximum percentage of trunk highway structures in poor condition on principal arterials. Although the Bemidji District had no trunk highway bridges in poor condition on principal arterials in 2006, Figure 2.7 shows that 19 percent of bridge deck area on nonprincipal routes was associated with trunk highway bridges in poor condition, far exceeding MnDOT's target of less than 8 percent. This is primarily due to the condition of

[24] Table 2.7 listed the criteria that define structurally deficient bridges.

Figure 2.7: Structural Condition Rating of Trunk Highway Bridges by District, 2006



NOTES: Figures reflect information for Minnesota's Area Transportation Partnerships (ATPs). In some cases, ATP boundaries differ from MnDOT district boundaries. The "percentage of deck area" measure weights bridges in each condition by their deck area. The structural condition rating incorporates the National Bridge Inventory deck, superstructure, and substructure condition ratings, and structural evaluation and waterway adequacy appraisal ratings. A structure is placed in the worst category warranted by any of the individual ratings. MnDOT targets apply to all structures as a group, not just bridges.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

one bridge that carries trunk highway 171 over the Red River at the North Dakota state line. The department has reported this anomaly for a number of years and has determined that accelerating replacement of the bridge is not a wise investment.

Since the deficient status of bridges is based, at least in part, on the same measures from which MnDOT's structural condition rating is derived, it is not surprising that districts performed differently on these measures, too. As Table 2.10 shows, most districts showed an increase in the percentage of deck area associated with bridges in adequate condition between 2002 and 2006. The percentage of deck area in adequate condition dropped in the Bemidji District, and also decreased slightly in the Mankato District. Although the number of structurally deficient bridges in the Bemidji District decreased between 2002 and 2006, the changed condition of the single bridge mentioned above caused the percentage of deck area associated with bridges labeled structurally deficient to increase over the time period, from around 6 percent to roughly 11 percent. The percentage of deck area associated with structurally deficient bridges increased slightly in the Brainerd District also.

Table 2.10: Deficient Status of Trunk Highway Bridges by District, 2002 and 2006

	Districts[a]							
	Duluth	Bemidji	Brainerd	Detroit Lakes	Rochester	Mankato	Willmar	Metro
2002								
Percentage of Deck Area								
Adequate	86.3%	89.7%	94.8%	89.2%	89.8%	89.0%	95.5%	84.6%
Functionally Obsolete	12.9	4.0	3.4	10.5	6.3	9.5	2.2	8.5
Structurally Deficient	0.8	6.3	1.8	0.2	3.9	1.5	2.2	6.8
Number of Bridges								
Adequate	300	114	223	142	357	221	124	879
Functionally Obsolete	17	2	10	5	31	4	4	116
Structurally Deficient	13	8	9	1	25	10	5	50
2006								
Percentage of Deck Area								
Adequate	86.7%	84.8%	95.1%	92.9%	92.4%	87.5%	97.4%	87.0%
Functionally Obsolete	12.6	4.7	2.4	6.9	3.8	11.7	1.0	8.7
Structurally Deficient	0.7	10.6	2.5	0.2	3.8	0.7	1.7	4.4
Number of Bridges								
Adequate	310	112	232	146	377	223	124	920
Functionally Obsolete	15	3	7	3	21	6	2	127
Structurally Deficient	8	6	7	1	25	7	5	35

[a] Table reflects information for Minnesota's Area Transportation Partnerships (ATPs). In some cases, ATP boundaries differ from MnDOT district boundaries.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

Fracture Critical Bridges

"Fracture critical" bridges are bridges of certain designs, typically with a steel superstructure, that are at risk of collapse if any one of their load carrying components fails. These bridges were not constructed with redundant components that can bear the load in the event that a component fails. In 2006, Minnesota had 70 fracture critical bridges in the state trunk highway system, accounting for 4.5 million square feet of deck area. As of January 2008, 68 of the bridges were open; bridge 9340 (I-35W over the Mississippi River in Minneapolis) collapsed on August 1, 2007, and bridge 6535 (in Brown County) was damaged and will remain closed until repairs can be completed in the spring. Minnesota's fracture critical trunk highway bridges are listed in Appendix B.

Minnesota had 70 fracture critical bridges in the state trunk highway system in 2006, but not all of these bridges need to be replaced in the near term.

Figure 2.8 shows the location of the fracture critical bridges in the state and their structural condition ratings for 2006. The Duluth and Metro districts included the largest number of fracture critical bridges, numbering 20 and 28 respectively. Fracture critical bridges accounted for 28 percent of the deck area in the Duluth District. The longest fracture critical bridge (bridge 69100) is over 8,300 feet long and carries U.S. Highway 2 from St. Louis County to Wisconsin. The fracture critical bridge with the highest average daily traffic is the Lafayette Bridge in Ramsey County, which carries trunk highway 52 over the Mississippi River in St. Paul. This bridge had an average daily traffic count of around 81,000.

MnDOT officials said that Minnesota has not built a bridge with a fracture critical design since the 1980s, and not all fracture critical bridges need to be scheduled for near-term replacement. Fracture critical bridges built in the 1980s were designed and fabricated differently than fracture critical bridges built in earlier decades. For example, bridges with fracture critical designs built in the 1980s were constructed with stronger steel less prone to fatigue cracking, better welding methods, and steel connections specifically designed to withstand fatigue loads.

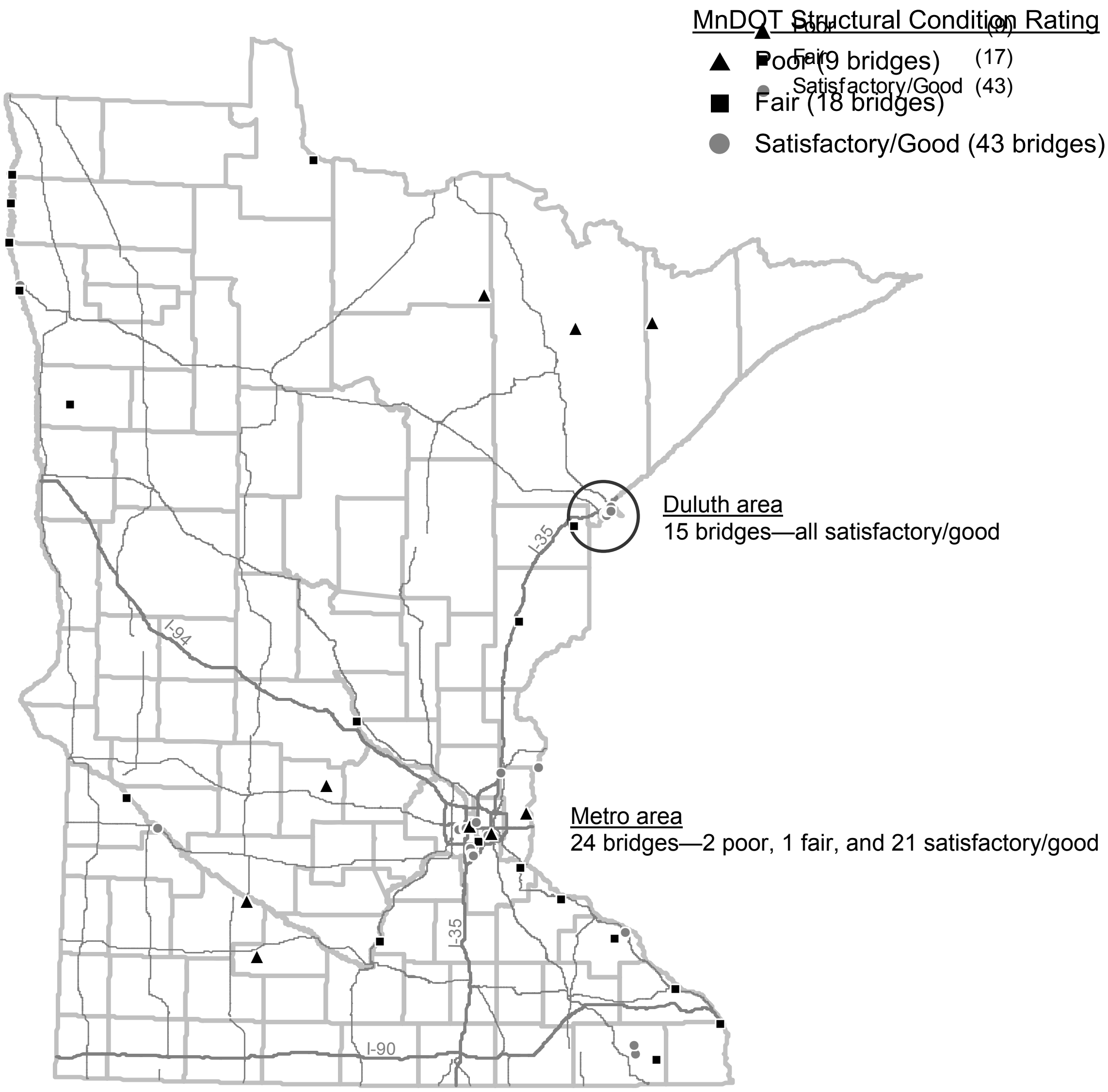
Because fracture critical bridges do not have built-in redundancies, we looked more closely at the condition of these bridges. We found that:

- **The percentage of fracture critical bridges with a good structural condition rating was significantly lower than the overall percentage of bridges with a good rating.**

Among fracture critical bridges in 2006, about 26 percent of deck area was associated with bridges in good condition. As mentioned above, overall, 56 percent of bridge deck area was associated with bridges in good condition. More than 11 percent of fracture critical bridge deck area was associated with structurally deficient bridges, compared to around 3 percent for all bridges.

In 2005, MnDOT established a special funding mechanism—the Statewide Bridge Preservation Fund—to support the replacement of Minnesota's largest bridges. Capitalized with $40 million in federal funding annually, the preservation fund will cover half the cost of replacing selected bridges, with MnDOT districts funding the remainder from their trunk highway construction

Figure 2.8: Fracture Critical Bridges on Minnesota's State Trunk Highway System, 2006



NOTES: Only bridges that carry vehicle traffic are included. Bridge 9340 (in Minneapolis) collapsed August 1, 2007. Bridge 6535 (Brown County) was closed as of this writing, but is expected to re-open in the spring of 2008 after necessary repairs. The fracture critical bridges on the state trunk highway system are listed individually in Appendix B.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation bridge inventory.

budgets. Currently, five of the six bridges slated for replacement using Statewide Bridge Preservation Fund resources are fracture critical.[25] According to MnDOT, because these bridges are so large, replacing them will result in a significant improvement in performance indicators for fracture critical bridges as a group.

Culvert Condition

There were over 1,700 culverts that were at least 10 feet long on Minnesota's trunk highway system in 2006. Most were located on nonprincipal roads, and less than half were over 20 feet long (and thus eligible for federal funding assistance).

When we examined condition ratings for trunk highway system culverts, we found that:

- **Overall, the condition of trunk highway culverts was similar to bridge conditions in 2006, but culvert conditions had shown less improvement since 2002.**

Most of Minnesota's 1,700 trunk highway culverts— openings beneath an embankment— are on nonprincipal roads.

Just over 54 percent of culverts had a good structural condition rating in 2006, close to the 56 percent figure cited above for bridges. Similarly, 2.6 percent of culverts were in poor condition; the figure for bridges was 3.4 percent. However, the percentage of culverts in good condition did not show much improvement between 2002 and 2006. Around 53 percent of culverts were in good condition in 2002. This declined to 52 percent in 2004 before increasing to its 2006 level.[26]

Overall, culverts on principal arterials met the performance target of at least 55 percent in good structural condition between 2002 and 2006, while culverts on other routes met their target of at least 50 percent in good condition three of the five years. However, MnDOT's targets apply to structures over 20 feet long. When only these culverts are assessed, culverts on principal arterials fell short of the target for good condition, as Figure 2.9 shows. At the same time, the figure shows that culverts on principal arterials were below the target maximums for structures in poor condition and structures in "fair or poor" condition. Culverts over 20 feet on other routes met performance targets throughout the 2002 to 2006 period.

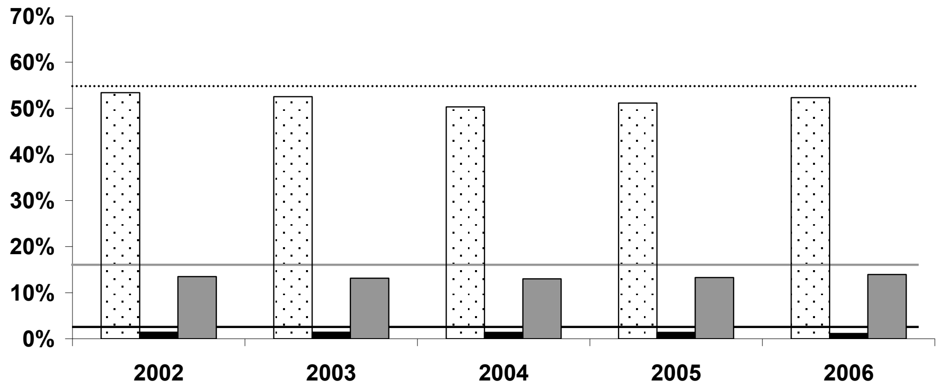
---

[25] The six bridges are: Lafayette (TH 52 over the Mississippi River in St. Paul), Hastings (U.S. 61 over the Mississippi River), Dresbach (I-90 to LaCrosse, Wisconsin), Winona (TH 43 over the Mississippi River), Desoto (TH 23 over the Mississippi River in St. Cloud), and Cayuga (I-35E north of downtown St. Paul). Cayuga is not fracture critical. All are slated for replacement by 2018, with preliminary replacement costs estimated to be $787 million.

[26] MnDOT is very concerned that smaller drainage culverts (from 15 inches to 9 feet) that are not covered in the audit are in very poor condition, potentially affecting roadway substructure.

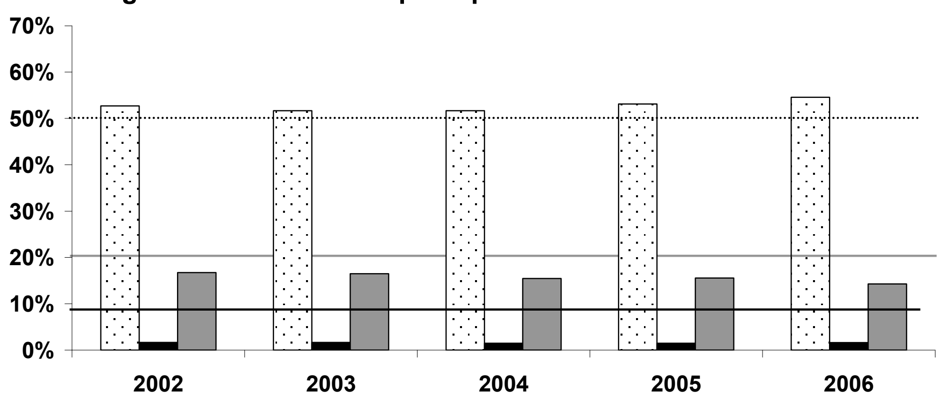
Figure 2.9: Structural Condition Rating of Trunk Highway Culverts Over 20 Feet, 2002-06

Percentage of Culverts on Principal Arterials



Good Target—55% or More
Poor Target—Less than 2%
Fair or Poor Target—Less than 16%

Percentage of Culverts on Nonprincipal Roads



Good Target—50% or More
Poor Target—Less than 8%
Fair or Poor Target—Less than 20%

NOTES: A culvert's structural condition rating is based on its National Bridge Inventory culvert condition rating and structural evaluation and waterway adequacy appraisal ratings. A structure is placed in the worst category warranted by any of the individual ratings. MnDOT targets apply to all structures as a group, not just culverts.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

Similar to the case with bridges, we found that:

- **Between 2002 and 2006, the Minnesota Department of Transportation reduced the number of state culverts that were structurally deficient by more than one-quarter.**

Even more so than with bridges, most state culverts were in adequate condition. In 2006, 1,706 culverts were adequate, or 96.8 percent of rated culverts. In 2006 there were 45 structurally deficient trunk highway culverts, down from 63 in 2002.[27]

Looking at individual districts, we found that:

- **MnDOT districts have had mixed success maintaining their culverts in good condition.**

In 2006, the percentage of culverts in good condition ranged from a high of over 80 percent in the Detroit Lakes District to a low of about 30 percent in the Rochester District. Rochester contains the most culverts of any district. Over 60 percent of the culverts in the Bemidji, Brainerd, and Willmar districts had a good structural condition rating in 2006. Just over half of the culverts in the Duluth, Metro, and Mankato districts were in good condition that year.

Age

The replacement age for trunk highway bridges is about 55 years in the Twin Cities area and 68 years elsewhere in the state.

The median age of structures on the state trunk highway system in 2006 was 30 years old.[28] Overall, culverts are older than bridges, and structures in Greater Minnesota are older than those in the metropolitan area. As shown in Figure 2.10, the bulk of the bridges on today's trunk highway system were built after the mid-1950s and are currently under 50 years old. About 500 of the bridges on the 2006 trunk highway system were built in the five-year period from 1965 to 1969. Information on the age distribution of state trunk highway structures by district is in Appendix C.

According to MnDOT, the replacement cycle for trunk highway bridges in the metropolitan area is about 55 years, while the cycle for bridges in Greater Minnesota is 68 years. In the metropolitan area, where many bridge replacements are driven by a need to widen bridges, high levels of car and truck traffic also contribute to a shorter replacement cycle.[29]

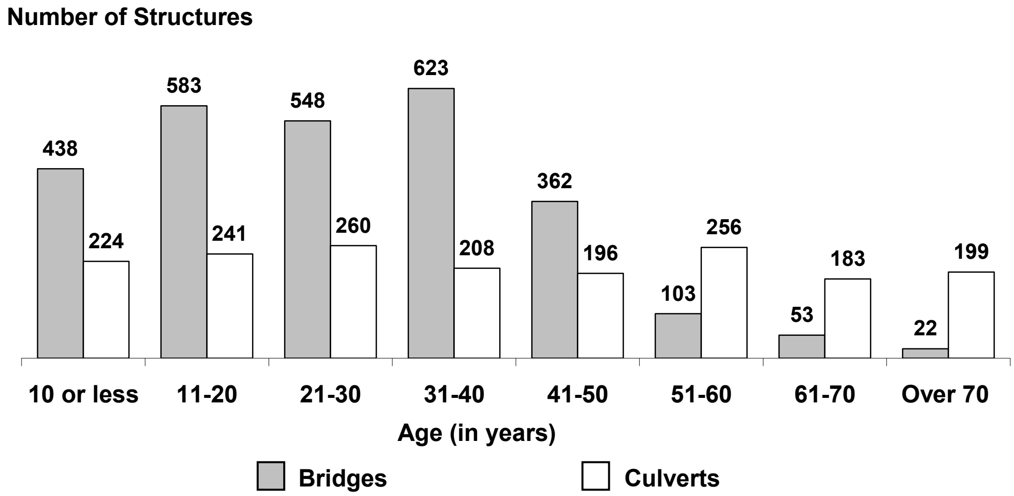
---

[27] Minnesota's structurally deficient trunk highway bridges and culverts are listed in Appendix A.

[28] Age is calculated as 2006 minus the year built or year rehabilitated.

[29] Current standards require bridges to be designed for a minimum useful life of 75 years. However, a structure might be replaced due to functional obsolescence, even though it has remaining useful life.

Figure 2.10: Age Distribution of Trunk Highway Structures, 2006



NOTE: Age is calculated as 2006 minus the year built or year rehabilitated.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

Using 68 years as the expected replacement cycle of bridges outside the metropolitan area and 55 years as the expectation in the Twin Cities metropolitan area, we found that:

- **Between now and 2026, over 500 state trunk highway bridges will reach or exceed the end of their replacement cycle.**

In 2006, 521 trunk highway bridges were within 20 years of the end of their replacement cycle. In the Twin Cities metropolitan area, 307 bridges were 35 years old or older in 2006.[30] In Greater Minnesota, 214 bridges were 48 years old or older. Statewide, this amounts to 19 percent of trunk highway bridges—an average of 26 bridges per year—reaching the end of their replacement cycle. Over the past five years, MnDOT averaged about 23 bridge replacements each year.

[30] We defined the metropolitan area to correspond to the counties in the Metro District. It includes the seven-county metropolitan area and Chisago County.

3

Bridge and Culvert Inspection

SUMMARY

Authority for routine bridge and culvert inspections is delegated to Minnesota Department of Transportation (MnDOT) district offices, counties, and cities, while certain specialized inspections are done centrally. There does not appear to be a shortage of certified inspectors to conduct routine bridge inspections, but MnDOT needs additional resources to increase the frequency of fracture critical bridge inspections. Most state trunk highway and local structures are on a two-year inspection cycle, and we found that they were generally inspected on time. MnDOT policy directs field inspectors to take immediate action if an inspection reveals a problem that compromises the safety of a bridge, and MnDOT inspectors told us they do not hesitate to use that authority. District bridge officials reported that they are not keeping up with routine bridge maintenance needs or getting to lower-priority maintenance work suggested by bridge inspectors.

Minnesota has over 19,000 bridges and culverts, and 4,500 of them are in the state trunk highway system. Bridges are complex structures, and an assessment of a bridge's condition builds from evaluations of its component parts, primarily the deck, superstructure, and substructure. Culverts—openings beneath an embankment with the road passing over the top—are treated as a single component.[1] Ensuring the structural integrity of both bridges and culverts is essential to the safety of the traveling public. The safety of these structures rests on a number of factors, including proper design and construction, ongoing maintenance, and inspection.

This chapter addresses the following question:

- **What are Minnesota's bridge and culvert inspection practices, and how do they compare to state and federal requirements?**

To answer this question, we reviewed state and national standards for inspector training and qualifications, inspection procedures, and inspection program quality control; MnDOT inspection manuals and other technical guidance; and Federal Highway Administration (FHWA) reports of its quality control reviews of

[1] Culverts are generally constructed with structural material all around the perimeter. For example, many are made with concrete pipe. A culvert can allow passage of a stream, a drainage path, a pedestrian path, or another road. The data we used in our analysis of bridge and culvert inspections include culverts ten feet or longer. However, MnDOT is very concerned that smaller drainage culverts (from 15 inches to 9 feet) are in very poor condition, potentially affecting roadway substructures.

Minnesota's inspection program.[2] We interviewed officials from the MnDOT Bridge Office who are responsible for the statewide bridge inspection program as well as inspection program and bridge maintenance officials at four district offices (Brainerd, Metro, Rochester, and Mankato). In addition, we selected four trunk highway bridges and conducted in-depth interviews with the lead inspector on the most recent inspection of each bridge.[3]

This evaluation was never designed to determine why the I-35W bridge collapsed on August 1, 2007. However, the I-35W bridge was one of the four bridges that we used as the basis for detailed discussions of MnDOT's bridge inspection program. We examined MnDOT's most recent inspection report for the bridge and interviewed several MnDOT employees directly involved with inspections and/or maintenance of the bridge. We used information gleaned from interviews and documents related to the I-35W bridge throughout this chapter, but for interested readers, Appendix D includes excerpts related to the I-35W bridge from an interview with the director of MnDOT's Bridge Office.

OVERVIEW

Inspections serve two main purposes—ensuring the safety of a structure and identifying maintenance needs.

Bridge and culvert inspections serve two general purposes—ensuring the safety of the structure and identifying maintenance needs. An inspection includes evaluating the physical condition of the structure and reporting observations and evaluations in an inspection report. In Minnesota, day-to-day responsibility for conducting most bridge and culvert inspections is delegated to the structures' owners—MnDOT district offices, counties, and cities. The MnDOT Bridge Office has overall responsibility for the state inspection program, including establishing inspection policies and procedures, maintaining statewide inspection data, certifying inspectors, and conducting specialized inspections.

The elements of Minnesota's inspection program are established primarily in federal laws and regulations, but are supplemented by state law, rule, and policy. According to MnDOT officials, the federal regulations—the National Bridge Inspection Standards—constitute the minimum requirements;[4] those set forth in Minnesota law and policy add to this base. The requirements cover (1) the type

[2] In its program guidance and conversation, MnDOT often refers to its highway structure inspection program inclusively as a "bridge inspection program," with it implicitly understood that inspections include all structures under the department's jurisdiction, including traditional bridges, culverts, pedestrian bridges, railroad bridges, and other types of structures. Our evaluation focused on inspection of bridges and culverts, and for ease of reading, we often use "bridge inspection" to be inclusive of both bridges and culverts.

[3] The bridges were (1) the old I-35W bridge in Minneapolis (bridge 9340); (2) the U.S. 169 bridge over Nine Mile Creek in Edina (bridge 27568); (3) the trunk highway 23 bridge over the Mississippi River in St. Cloud (bridge 6748, which is fracture critical); and (4) the U.S. 61 bridge over Hay Creek in Red Wing (bridge 6483). The first two are located in the Metro District, the third in the Brainerd District, and the fourth in the Rochester District. All four are highly traveled and were not scheduled for replacement before 2015.

[4] National Bridge Inspection Standards, *23 CFR* 650, subp. C (2007).

The type and frequency of inspections required, inspector qualifications, and inspection procedures are largely governed by federal standards.

and frequency of required inspections, (2) inspector qualifications, and (3) inspection procedures. National Bridge Inspection Standards apply to bridges and culverts over 20 feet in length. By policy, MnDOT inspects structures ten feet and longer.

As shown in Table 3.1, National Bridge Inspection Standards establish different types of bridge inspections, distinguished by the circumstances under which they are performed or the types of techniques used. Every bridge and culvert in Minnesota is subject to an annual "routine" inspection unless the MnDOT Bridge Office authorizes a two-year inspection cycle.[5] In general, structures with National Bridge Inspection condition ratings of fair or higher are eligible for two-year inspection intervals.[6] Some bridges, by the nature of their design, are subject to additional inspections. For example, the components of fracture critical bridges must be inspected using special techniques at least every two years, and underwater components of bridges that can only be accessed using diving equipment must be inspected at least every five years.[7]

In the remainder of this chapter, we focus on several aspects of Minnesota's inspection program, including (1) the actual frequency of bridge and culvert inspections; (2) the number of certified inspectors in the state and the process for certifying them; (3) protocols for conducting routine inspections and MnDOT procedures for acting on inspection results; and (4) MnDOT's quality assurance efforts and the results of FHWA quality reviews. In some cases, we were able to obtain and analyze information relating to both state trunk highway and local structures. In other cases, as noted, our work was limited to MnDOT district offices and trunk highway bridges.

---

[5] *Minnesota Statutes* 2007, 165.03, subd. 2, requires routine inspections at regular intervals not to exceed two years. Minnesota rules establish a presumptive requirement for annual routine inspections but allow the Commissioner to authorize inspections every two years under certain conditions. Authority for determining the frequency of routine inspections has been delegated to the MnDOT Bridge Office.

[6] More specifically, to be eligible for a two-year inspection interval, a bridge must have (1) condition ratings for deck, superstructure, and substructure all of 5 (fair) or higher and (2) an overall structural evaluation rating of 5 or higher. However, fracture critical bridges must have annual routine inspections, regardless of condition ratings. District, county, and city agencies with bridges meeting the requirements for two-year inspections must submit a request for approval by the Bridge Office, and bridge owners are responsible for returning to a one-year schedule as bridge conditions warrant. Minnesota Department of Transportation, *Guidelines for Bridge Inspection Frequency*, Technical Memorandum 04-08-B-01 (May 21, 2004).

[7] "Fracture critical" bridges are bridges of certain designs, typically with a steel superstructure, that are at risk of collapse if any one of their load carrying components fails. These bridges were not constructed with redundant components that can bear the load in the event that a component fails.

Table 3.1: Types of Bridge Inspections and Requirements for Frequency of Inspections

Routine Inspection	Regularly scheduled inspection consisting of observations and/or measurements needed to determine the physical and functional condition of the bridge, to identify any changes from initial or previously recorded conditions, and to ensure that the structure continues to satisfy present service requirements. Required annually, unless a longer interval not to exceed two years is authorized by the commissioner of Transportation.[a]
Fracture Critical Inspection	A hands-on[b] inspection of fracture critical members or member components that may include visual and other nondestructive evaluation. Required every two years.[c]
Underwater Inspection	Inspection of the underwater portion of a bridge substructure and the surrounding channel that cannot be inspected visually at low water by wading or probing. Generally requires diving or other appropriate techniques. Required every five years.
Damage Inspection	An unscheduled inspection to assess structural damage resulting from environmental factors or human actions. Conducted as needed.
Special Inspection	An inspection scheduled at the discretion of the bridge owner, used to monitor a particular known or suspected deficiency. Conducted as needed.
In-depth Inspection	A close-up inspection of one or more members above or below the water level to identify any deficiencies not readily detectable using routine inspection procedures; hands-on inspection may be necessary at some locations. Frequency is discretionary. Until 2006, Minnesota used this technique to meet fracture critical inspection requirements.

[a] State law and federal regulation require routine inspections at regular intervals not to exceed 24 months. Minnesota rules establish a presumptive requirement for annual routine inspections but allow the commissioner to authorize inspections every two years under certain conditions. Authority for determining the frequency of routine inspections has been delegated to the MnDOT Bridge Office.

[b] "Hands-on" means inspection within arms length of the component. Hands-on inspection may be supplemented by nondestructive testing (such as the use of ultrasound).

[c] Prior to 2005, federal regulations did not specify a frequency.

SOURCES: Office of the Legislative Auditor; National Bridge Inspection Standards, *23 CFR* 650, subp. C (2007); *Minnesota Statutes* 2007, 165.03, subd. 2; *Minnesota Rules* 2007, 8810.9400, subp.1; and Minnesota Department of Transportation, *Guidelines for Bridge Inspection Frequency*, Technical Memorandum 04-08-B-01 (May 21, 2004).

INSPECTION FREQUENCY

Our evaluation focused on the extent to which state and local bridge inspections met standards for the frequency of routine bridge inspections. We found that:

- **Most Minnesota bridges and culverts are assigned a two-year inspection cycle; the remaining bridges are to be inspected annually by virtue of their fracture critical status or poor condition.**

In addition, based on a more detailed review of recorded inspection dates for state trunk highway structures (rather than simply the assigned inspection interval), we found that:

- **Roughly 85 percent of state structures were inspected within the 24-month interval required under federal standards.**

Bridge inventory data maintained by the Bridge Office include an assigned inspection interval—6, 12, or 24 months—for each bridge and culvert in the state. Based on data from October 2007 for structures 10 feet and longer, 87 percent of state trunk highway structures and 68 percent of local structures were assigned two-year inspection intervals, as shown in Table 3.2. The remaining bridges—including all state and local fracture critical bridges—were assigned inspection intervals of 6 or 12 months.

Table 3.2: Assigned Routine Inspection Intervals for Bridges and Culverts, March 2007

		Assigned Inspection Interval					
		6 Months		12 Months		24 Months	
	Number of Structures	Number	Percent of Row	Number	Percent of Row	Number	Percent of Row
State							
Fracture Critical Bridges[a]	70	0	0%	70	100%	0	0%
Other Bridges	2,663	0	0	312	12	2,351	88
Culverts	1,767	2	<1	186	11	1,579	89
Total	4,500	2	<1%	568	13%	3,930	87%
County and Municipal							
Fracture Critical Bridges[a]	142	0	0%	142	100%	0	0%
Other Bridges	5,457	2	<1	2,277	42	3,178	58
Culverts	9,056	0	0	2,295	25	6,761	75
Total	14,655	2	<1%	4,714	32%	9,939	68%

NOTES: This analysis is based on an indicator contained in the department's database (as of April 2007) that shows whether the structure was assigned a 6-, 12-, or 24-month inspection schedule, not actual dates of inspection. Data include all structures ten feet and longer.

[a] Bridge owners (MnDOT, counties, and cities) are required to conduct annual routine inspections of fracture critical bridges. In addition, fracture critical bridge components are subject to specialized inspection at least every two years. The data presented in the table refer to the routine inspection frequency recorded in the MnDOT bridge database.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

When we analyzed actual inspection dates recorded in the data system, inspection intervals did not always match federal and state requirements. To confirm that MnDOT has complied with federal standards requiring routine inspections at intervals not to exceed 24 months, we analyzed inspection dates recorded for state trunk highway bridges and culverts between 2002 and 2006.[8] Each year, between 83 and 86 percent of state structures were inspected in compliance with 24-month inspection intervals. In its reviews of Minnesota's bridge inspection program, the FHWA allows a 90-day grace period to complete inspections. Using this more generous standard, 96 to 97 percent of structures were in compliance.

We also assessed whether inspection practices complied with state statutes and rules specifying that structures meeting specific indicators of poor condition and structures designated as fracture critical be inspected annually.[9] We identified 208 bridges and culverts that, based on their 2005 bridge inventory data, met these criteria. We then determined the number of months that elapsed between each structure's 2006 inspection and the inspection preceding it. Of the 208 structures, about 52 percent had been inspected within a 12-month interval and, cumulatively, 88 percent had been inspected within an 18-month interval. According to MnDOT officials, the "annual" inspection requirement in Minnesota rule was always intended to mean "once per calendar year" rather than a strict 12-month interval. This allows MnDOT districts and local agencies flexibility in scheduling annual inspections, for example, to better manage inspection resources or to allow inspection of a structure in different seasons. We agree that some flexibility in scheduling annual inspections is warranted, but we encourage MnDOT to keep annual inspection intervals in the range of 12 to 14 months.

INSPECTION STAFF

Responsibility for routine bridge and culvert inspections is delegated to MnDOT districts and local governments.

With over 19,000 structures to be inspected and a decentralized bridge inspection program, Minnesota has a significant demand for certified bridge inspectors. We assessed the extent to which Minnesota's certification procedures follow federal standards, the number of inspectors certified in Minnesota and how they are allocated among state and local offices, and district inspection officials' views on the sufficiency of resources available to inspect state trunk highway bridges. We found that:

- **Minnesota's inspector certification requirements exceed federal standards, and there does not appear to be a shortage of inspectors to conduct routine bridge inspections.**

Bridge inspectors in Minnesota can be certified at one of two levels—inspection team leader or assistant inspector. Team leaders conduct inspections of in-service bridges and culverts on state and local highways. To be certified as a

---

[8] We did not obtain historical inspection data for local bridges, so we limited this analysis to state structures.

[9] *Minnesota Rules* 2007, 8810.9400, subp. 1.

team leader, candidates must (1) either be a registered professional engineer in the state of Minnesota or have five years of bridge inspection experience;[10] (2) successfully complete a two-week, FHWA-approved comprehensive bridge inspection training course; and (3) pass a field proficiency test administered by the MnDOT Bridge Office. Assistant inspectors can only assist in bridge inspections, and an inspection team leader must be present at the bridge site. Assistant inspector certification is automatically assigned to those who successfully complete a one-week training course ("Engineering Concepts for Bridge Inspectors").

MnDOT requires inspection team leaders to pass a field proficiency test, a requirement that exceeds National Bridge Inspection Standards. MnDOT has required it of newly-certified team leaders employed by MnDOT districts since at least 2001; in 2006, MnDOT began requiring it of local government team leaders as well. The test consists of a routine inspection of an in-service bridge, including taking notes, determining the condition ratings, and completing the bridge inspection form. Test evaluators compare the candidate's inspection results with the most recent inspection findings and assign a final score ranging from 0 to 100. A passing score is 70 or above. Since 2001, 55 individuals have passed the proficiency test (1 individual passed on a second try) and 1 individual failed.

Inspection team leaders in Minnesota have to pass a field proficiency test.

In Minnesota, being a bridge inspector is generally not a full-time position. Rather, most inspectors are maintenance staff employed by MnDOT district offices, counties, and cities. MnDOT certifies other types of individuals as inspectors as well, including private consultants and staff from other federal and state agencies. As shown in Table 3.3, Minnesota had 329 certified team leaders and 354 certified assistant inspectors as of October 2007. Among them, 73 team leaders and 149 assistant inspectors are employed by MnDOT districts and responsible for the inspection of structures in the state trunk highway system. We were not able to obtain historical data on the number of certified inspectors in Minnesota. The Bridge Office maintains a database with information about certified inspectors, but the database is updated continuously, overwriting old data and deleting records for inactive inspectors. Consequently, we were not able to analyze changes in the number of certified bridge inspectors over time.

Because inspecting bridges is a part-time responsibility of many staff, it is difficult to determine inspection workloads. According to Bridge Office staff, inspectors employed by MnDOT district offices conduct all routine inspections of the 4,500 bridges and culverts in the state trunk highway system.[11] Bridge

[10] A professional engineer is an individual who has completed education, experience, and testing requirements that, under Minnesota licensing laws, allow the individual to offer engineering services to the public. Federal regulations allow individuals with certain other combinations of training and experience to qualify as team leaders, but very few individuals in Minnesota use these qualification terms.

[11] There is an exception to this right now, however. Because the Governor ordered immediate inspections of many state bridges following the I-35W bridge collapse on August 1, 2007, MnDOT has had to contract for some inspection services.

Table 3.3: Minnesota-Certified Bridge Inspection Team Leaders and Assistant Inspectors, October 2007

Employer	Inspection Team Leaders	Assistant Inspectors
MnDOT District Office	73	149
MnDOT Central Office	6	2
County	181	154
City	34	26
Subtotal	294	331
Consultant	30	19
Other[a]	5	4
Total	329	354

NOTE: MnDOT district offices and their 73 inspection team leaders are responsible for routine inspections of the 4,500 bridges and culverts in the state trunk highway system. Cities and counties are responsible for routine inspection of the remaining 14,655 bridges and culverts in the state. MnDOT central office inspectors conduct fracture critical and other specialized inspections.

[a] Other employers include the Minnesota Department of Natural Resources, the U.S. Bureau of Indian Affairs, the U.S. Forest Service, and a railroad company.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation data.

MnDOT districts told us they have sufficient resources to conduct routine inspections of trunk highway bridges and culverts.

Office staff also told us that certified county and city employees inspect a large majority of the state's 14,655 local bridges and culverts, with the remainder inspected by consultants or through arrangements with MnDOT. To get a rough estimate of inspection workloads in different areas of the state, we calculated for each MnDOT district the number of state trunk highway structures that must be inspected per team leader.[12] Inspections per team leader ranged from 39 in Bemidji, Brainerd, and Mankato districts to 79 in the Rochester District. The Metro District is responsible for inspecting 1,153 structures and has 26 staff certified as team leaders, resulting in a workload of 44 trunk highway bridge inspections per team leader. These are only rough estimates and should be interpreted carefully. For example, some districts inspect local bridges on behalf of local governments, which could significantly affect workloads. Rochester District officials told us that district staff inspect about 300 county structures under agreements with county governments. As a result of the inspection workload, the district's three primary inspectors conduct inspections nearly full time.

At the three districts we visited to discuss bridge inspection in detail, officials responsible for the bridge inspection program told us that their districts have sufficient resources—people, time, and equipment—to conduct thorough, timely routine inspections. In all three districts, bridge district officials said that

[12] Federal law requires inspections of all structures over 20 feet long, so we used counts of these structures to calculate the number of mandatory inspections per team leader.

conducting bridge inspections is their top priority. Most bridge inspectors also work either on a bridge maintenance crew or in a district bridge engineering group. If the inspection workload demands are higher than expected, additional time for inspections is granted. District officials also noted, however, that at current staff levels, their commitment to bridge inspection results in decreased ability to accomplish routine maintenance.

Changes to the National Bridge Inspection Standards made in 2005 presented states with additional resource demands for fracture critical bridge inspections. Beginning in 2006, federal regulations required fracture critical inspections to be done at least every two years. Prior to that, the regulations did not specify an interval, but MnDOT conducted in-depth fracture critical bridge inspections every four to five years (with routine inspections continuing to take place in the interim). According to agency officials:

- **MnDOT will need additional resources to fully implement new federal fracture critical inspection requirements.**

In the late 1990s, MnDOT consolidated responsibility for fracture critical inspections with specially trained inspectors in the Bridge Office, Metro District, and Rochester District. These state employees conducted inspections of state trunk highway and locally owned fracture critical bridges. MnDOT's policy had been to do a full, in-depth inspection of the entire fracture critical bridge, not simply a special inspection of the fracture critical elements only. Continuing this practice on a two-year schedule will require adding staff, hiring a consultant to do the additional inspections, or a combination of the two. MnDOT could choose to do narrowly focused inspections of fracture critical elements rather than in-depth inspections of the full bridge. Doing so would require fewer resources and still meet federal requirements. However, following the collapse of the I-35W bridge, Bridge Office officials think it prudent to follow past practice and continue using the in-depth inspection methods.

Inspections of fracture critical bridge components require specialized expertise.

The Bridge Office would prefer to retain its practice of establishing centralized expertise for fracture critical inspections and using MnDOT employees (rather than consultants) to perform fracture critical inspections. According to the Bridge Office, local transportation agencies and some MnDOT district offices do not have staff trained in specialized "nondestructive" inspection techniques used on fracture critical bridges. These nondestructive inspection techniques include ultrasonic testing, dye penetration testing, and magnetic particle testing.[13] It

[13] In ultrasonic testing, very short ultrasonic pulse-waves are launched into materials and the behavior of the waves is displayed by the diagnostic machine. Wave patterns can reveal internal flaws or characterize materials. This technique is commonly used to determine the thickness of the test object, for example, to monitor steel beam corrosion. Dye penetration testing is similar. A penetrating dye is applied to the bridge component. After adequate penetration time, the excess dye is removed and a developer is applied. The developer draws penetrant out of any flaws, similar to the action of blotting paper, leaving a visible indication of the flaw for the inspector. In magnetic particle testing, magnetic particles suspended in a liquid are sprayed or painted over an area of the bridge that has been magnetized with a direct current or an electromagnet. Because the magnetic resistance of defects is different than surrounding metal, the defect is revealed through the build up of magnetic particles. Magnetic particle testing is commonly used to find fatigue cracks.

would be feasible to train more inspectors on the latter two techniques, but according to the Bridge Office, unless the techniques are used frequently, quality suffers. In addition, ultrasonic testing requires separate certification and highly trained staff to obtain credible measurements and interpret the results accurately. Thus, in the opinion of Bridge Office officials, centralizing additional inspection resources in the Bridge Office and districts that currently perform fracture critical inspections would be the best way to (1) build and maintain specialized inspection expertise and (2) provide consistent fracture critical bridge inspections over time. They added that statewide oversight of the fracture critical inspection program should continue to be a Bridge Office function.

Hiring and retaining engineers as specialized bridge inspectors could be a challenge.

In spite of their preference to hire more specially-trained inspectors in the Bridge Office, managers identified several barriers to doing so. MnDOT would like at least half of its fracture critical inspectors to be at the senior engineer level (the remaining would be at the engineering specialist level). Because of the relatively low pay compared to the private sector, however, turnover among senior engineers is fairly high. The benefits to be gained from employing additional bridge inspectors would be diminished by high turnover. Other considerations associated with using in-house staff are (1) added costs associated with doing more fracture critical inspections in-house, particularly equipment costs; and (2) determining how additional inspectors would be used in the off season. On the latter issue, Bridge Office officials said that new engineers could be assigned to assist with the large in-house bridge design workload.

RECOMMENDATION

The Minnesota Department of Transportation should provide the operating funds necessary to meet inspection frequency requirements for fracture critical bridges.

Having completed inspections of all fracture critical bridges in Minnesota following the collapse of the I-35W bridge, MnDOT will be in compliance into 2009 with federal frequency requirements for fracture critical bridges. In the meantime, MnDOT needs to retain and train the staff and/or consultant resources necessary to complete fracture critical inspections at two-year intervals. MnDOT may also need to seek additional resources in the 2010-11 budget proposal it submits to the Legislature during the 2009 session.

INSPECTION PROCESS

A bridge inspection includes examining the structure, evaluating its physical condition, and reporting the observations and evaluations on the bridge inspection report. Bridge inspections serve two purposes—to ensure the safety of the structure and to identify maintenance needs. Our evaluation focused on the protocols for conducting routine inspections and MnDOT procedures for acting on inspection results, particularly communication of maintenance recommendations and follow-through to ensure that recommended bridge maintenance gets done.

Inspection Procedures

Regarding the general conduct of routine inspections, we found that:

- **The inspection process is highly structured to ensure thorough inspections.**

In addition, we found that:

- **MnDOT policy directs field inspectors and their supervisors to take immediate action if an inspection reveals a problem that compromises the safety of a bridge, and inspectors told us they do not hesitate to use that authority.**

There is a substantial body of written guidance that establishes detailed inspection procedures and criteria for evaluating what the inspector sees on each element of the bridge. For example, MnDOT uses two separate condition rating systems for bridges and culverts—the NBI condition ratings, which describe the overall condition of the bridge, and the Pontis element condition ratings, which divide a bridge into separate elements that are then rated individually based upon the severity and extent of deterioration.[14] Standards and criteria for both rating systems are documented in manuals.[15] MnDOT has its own inspection manual as well that helps ensure consistent application of standards.[16] It includes pictures and descriptions showing the condition ratings that should be applied to a given state of deterioration for a particular component.

Routine inspections rely on visual examinations of bridges and culverts.

For routine inspections, inspectors rely on visual examinations of bridges and culverts, and thus, focus on the exterior of the structure's components. Inspectors generally use the prior inspection report as their starting point. It delineates the elements present on the bridge and notes particular elements that have been singled out for special monitoring. As needed, inspectors use ladders, boats, or specialized lift trucks to see less accessible parts of the structure. When inspectors see deterioration of a structural element, they measure its extent—for example, the length of a crack or square feet of corrosion. They also use photographs to document bridge condition. After the field inspection is

[14] An "element" refers to structural members (beams, pier columns, decks) or any other components (railings, expansion joints, approach panels, etc.) commonly found on a bridge. Inspectors assign each element a "condition state" on a scale of one to five, with condition state one representing as-new condition.

[15] The NBI rating system was developed by the FHWA and is described in: Federal Highway Administration*, Recording and Coding Guide for the Structure Inventory and Appraisal of the Nation's Bridges* (Washington, DC, December 1995). NBI condition ratings were described in Chapter 2. The Pontis rating system was developed by the American Association of State Highway and Transportation Officials (AASHTO), and is outlined in: American Association of State Highway and Transportation Officials, *AASHTO Guide for Commonly Recognized (CoRe) Structural Elements* (Washington, DC, December 1997).

[16] Minnesota Department of Transportation, *Bridge Inspection Manual, Version 1.4* (St. Paul, May 2007).

completed, inspectors enter condition ratings and inspection notes into MnDOT's bridge management system.

Inspectors are authorized to take immediate action—including closing a bridge—if an inspection reveals a deficiency that compromises safety.

MnDOT policy authorizes inspection team leaders to take immediate action if the inspection reveals a deficiency that compromises the bridge's structural integrity or otherwise presents an immediate safety hazard to the traveling public. A "critical deficiency" is a deficiency that, if not promptly corrected, could result in collapse or partial collapse of a bridge. MnDOT has a written policy outlining the steps that are to be taken if an inspector finds a critical deficiency.[17] As shown in Table 3.4, responsibility for initiating an emergency bridge closure rests with the team leader, although the supervising engineer and Bridge Office have immediate responsibilities as well. In policy and practice, the decision to close a bridge rests with inspectors and engineers in the field, although they may ask for input from Bridge Office engineers before taking action. Other than the Bridge Office, MnDOT's central office is not involved in bridge closure decisions.

Inspectors rarely encounter critical deficiencies. For example, among the approximately 3,900 state trunk highway and 10,500 local inspections of bridges and culverts completed during the 2007 inspection season, inspectors identified 17 critical deficiencies.[18] (For reference, the 2007 critical deficiencies are listed in Appendix E.) More often, inspectors may find "hazardous deficiencies," which are conditions that may be hazardous to the public but are not expected to lead to collapse or partial collapse of the bridge. An example would be water damage loosening a chunk of concrete that could fall from the underside of a bridge to the road below. As with critical deficiencies, inspectors who find hazardous deficiencies are charged with ensuring the immediate safety of the public and initiating actions to promptly resolve the problem.

Inspectors and supervising engineers that we interviewed stated that they do not hesitate to follow these procedures if they find a serious deficiency. For example, inspectors for the trunk highway 23 bridge over the Mississippi River in St. Cloud found during their 2006 inspection that the bridge approach roadway had pushed the bridge superstructure two inches to the west. While this finding did not warrant closure of the bridge, district officials contacted the Bridge Office for assistance. A Bridge Office engineer visited the site and designed a solution, and the district completed the necessary repair within six weeks of the finding. Inspectors and bridge engineers in the other districts we visited provided similar examples and asserted that bridge inspection teams and district bridge engineers have the authority necessary and resources available to ensure that significant, safety-related bridge deficiencies are addressed promptly.

---

[17] Minnesota Department of Transportation, *"Critical Deficiencies" Found During Bridge Inspections,* Technical Memorandum 05-02-B-02 (July 20, 2005).

[18] In 2006, state and local inspectors reported a total of 23 critical deficiencies, although Bridge Office officials said that not all of the reported findings rose to the level of critical deficiency.

Table 3.4: Critical Deficiency Procedures

Responsibilities of the Bridge Inspection Team Leader

1. **Emergency Bridge Closure**: If the observed condition is severe enough to warrant immediate closure of the bridge (or immediate restriction of traffic above or below the bridge), the inspector shall immediately take any actions necessary to ensure public safety.
2. **Prompt Notification of the Engineer**:[a] Upon discovery of a critical deficiency, the inspector shall promptly notify the Engineer, identifying the bridge number and location and clearly describing the critical condition.
3. **Inspection Report**: In addition to making prompt verbal notification of the finding, the inspector must document the finding in writing.

Responsibilities of the Engineer [a]

1. **Rapid Evaluation**: The Engineer is required to quickly assess the situation to confirm or refute the finding and to initiate necessary traffic restrictions to safeguard the public. If in doubt, the Engineer should temporarily close or restrict traffic on the bridge and request assistance.
2. **Traffic Control and Public Notification**: The Engineer shall coordinate all necessary traffic control (such as load restrictions, lane or bridge closures, or detours) and notify the public of any traffic restrictions.
3. **Rapid Implementation of Corrective Action**: The Engineer is responsible for promptly scheduling repairs to the bridge and, if the bridge remains open to traffic, determining and posting the proper load rating for the bridge.
4. **Notification and Documentation**: When the deficiency is discovered and as it is resolved, the Engineer has various responsibilities for notifying bridge owners and the MnDOT Bridge Office, documenting the finding in the inspection report, and documenting resolution of the critical deficiency.

Responsibilities of the MnDOT Bridge Office

1. **Immediate Assistance**: The MnDOT Bridge Inspection Engineer will give priority to requests for assistance evaluating and resolving a critical deficiency.
2. **Recording of the Critical Finding**: Upon receipt of a written or oral report of a critical deficiency, the Bridge Office will enter the deficiency in a Critical Deficiency Log, create a file to track resolution of the problem, and ensure that the finding is promptly entered into the Bridge Management System.
3. **Follow Up**: The Bridge Office shall monitor the situation as necessary until the situation has been resolved and ensure that written notification of corrective action is received within 30 days.
4. **Follow-up Documentation**: The Bridge Office will record resolution of the deficiency in the Critical Deficiency Log, file related documents, and update the Bridge Management System. Annually, the MnDOT Bridge Inspection Engineer will report to the State Bridge Engineer on the status of all critical deficiencies found during the year.

NOTE: A critical deficiency is any condition discovered during a bridge inspection that threatens public safety and, if not promptly corrected, could result in collapse or partial collapse of a bridge.

[a] The "Engineer" is the supervisory, registered Professional Engineer with reporting jurisdiction for the bridge. In most cases, this is the MnDOT District Bridge Engineer, the County Engineer, or the City Engineer.

SOURCES: Office of the Legislative Auditor; and Minnesota Department of Transportation, *"Critical Deficiencies" Found During Bridge Inspections,* Technical Memorandum 05-02-B-02 (July 20, 2005).

Postinspection Activities

Most inspections result in a list of maintenance needs. Some of these needs are added to work lists for district bridge crews; others may be consolidated into construction projects done by contract. We talked with district bridge officials about (1) procedures for communicating to maintenance and bridge program officials maintenance needs identified during the inspection, (2) follow-up to ensure that critical deficiencies are resolved, and (3) the extent to which district bridge maintenance crews were able to address work items generated from bridge inspections. Because we conducted this evaluation under tight time constraints, we did not review districts' maintenance records to cross-reference maintenance work performed to inspection findings.

Communicating Maintenance Needs

We found that:

- **MnDOT does not have formal, standardized procedures for communicating to maintenance crews recommendations from bridge inspectors or for documenting decisions on the maintenance work to be performed.**

Inspection reports document a structure's condition, not maintenance work needed or performed.

Inspection reports alone are not a reliable source of information on decisions about bridge maintenance. The primary purpose of an inspection report is to fully document the condition of the bridge; while it facilitates a discussion of maintenance needs, its purpose is not to communicate specific maintenance recommendations or serve as a record of maintenance performed. Inspection reports are organized around a list of bridge elements, with space for the assigned condition rating and narrative comments to explain any findings of condition other than "as new." According to the inspectors we interviewed, the narrative comments describing a deficiency can remain in the report for years, sometimes with indications of maintenance actions taken, but sometimes not. It is a routine practice for inspectors to leave the comments in the report as a flag for future inspections, because once deterioration is noted, future inspectors should monitor the element to note any changes in condition regardless of whether maintenance was completed in the interim.

For example, fracture critical inspection reports for the I-35W bridge from fiscal years 2000 to 2006 contained references to broken bolts under a report header for recommendations. According to MnDOT, Metro District staff evaluated this inspection finding when it was first noted and determined that immediate maintenance was not required because the element was fully secured by the remaining bolts. Nevertheless, inspectors left the notation in the report from year to year so that inspectors would know if conditions changed further. Metro District officials told us that in retrospect, and with the needs of an external audience in mind, it would have made more sense to label these and similar notes in the inspection reports "elements to monitor."

MnDOT does not have standard requirements for the process districts should use to make and document decisions on inspectors' maintenance recommendations, and the districts we visited varied in the extent to which they developed formal procedures of their own. Inspectors told us there is direct, frequent communication between inspectors and maintenance staff about work that should be performed. In the three districts where we interviewed inspectors, bridge inspectors are either members of bridge crews (the case in the Metro and Brainerd districts) or are in the same organizational unit as bridge maintenance crews (the case in the Rochester District).

MnDOT districts use various informal and formal methods for documenting what maintenance work should be performed following an inspection.

Districts varied in the means and extent to which they formally documented decisions made about the bridge maintenance to be performed as a result of inspection findings. For example, District 3B (encompassing the southern half of the Brainerd District) maintains a database that contains historical maintenance records on all of District 3B structures.[19] A maintenance supervisor enters inspection findings into the database along with notations of work that needs to be done to address these findings. With this information, the maintenance supervisor creates a maintenance plan for each bridge. In the Rochester District, at the end of each inspection season, bridge maintenance officials compile a list of maintenance needs from inspection reports in a spreadsheet. Using this list and other information, the district identifies high, medium, and low priority maintenance lists that go to bridge maintenance crews.

Metro District officials stated that they were confident that bridge maintenance staff discuss inspection results and make appropriate decisions about what work should be referred to maintenance crews. Nevertheless, Metro District officials said that they learned in the aftermath of the I-35W bridge collapse that the district's recordkeeping of this process was not sufficient. The district was not able to document that the right people were at the table to discuss an inspection report, the substance of the discussion that took place, or the maintenance work orders that resulted. Metro District officials also acknowledged that they could have been more rigorous in keeping track of deferred maintenance items so that they could be included if the district were to let a contract for bridge maintenance.

The Metro District developed new postinspection documentation procedures in late 2007 and started pilot implementation in January 2008. Under the new process, the inspector, bridge maintenance staff, and, as needed, Bridge Office staff meet after an inspection takes place. The meeting is documented using a newly-developed form that shows who attends the meeting, inspection findings (cross-referenced to the inspection report), notes on the discussion, the follow-up action required (e.g., repair, monitor, no action), and the functional group or individual responsible.

Eventually, the Metro District would like to expand its postinspection procedures to track actual completion of planned maintenance activities. As we discuss later in the chapter, districts told us that bridge maintenance resources are tight and that planned maintenance activities often get deferred because higher priorities

---

[19] MnDOT's bridge management system contains data from the most recent inspection only; the system overwrites past data when the new inspection is entered.

arise. We agree that it would be a good idea for districts to document not only the postinspection maintenance they plan to do, but what they actually accomplish.

RECOMMENDATION

The Minnesota Department of Transportation should evaluate districts' procedures for documenting postinspection bridge maintenance decisions and implement standard practices across districts.

The number of bridges and culverts in each of MnDOT's districts varies considerably. It would be reasonable for MnDOT to build some flexibility into its postinspection documentation procedures to accommodate the districts with smaller inspection workloads as well as the Metro, Rochester, and Duluth districts that include most of the state's bridges and culverts.

Follow Up on Critical Deficiencies

As discussed earlier in the chapter, the National Bridge Inspection Standards require states to have specific procedures for handling critical deficiencies, including follow-up procedures to ensure that appropriate maintenance has been performed and documentation of the finding is complete. MnDOT included a follow-up requirement in its critical deficiencies policy (see Table 3.4) and also revised its bridge inspection information system to include a field prompting inspectors to report any critical deficiencies in their inspection reports. Nevertheless, we found that:

- **MnDOT has had problems effectively implementing its guidelines for follow up on critical deficiencies.**

In 2006, the Federal Highway Administration identified weaknesses in Minnesota's process for ensuring that critical inspection findings are fully addressed.

According to Bridge Office officials, the department provided training during its annual refresher training seminars on the process for reporting critical deficiencies and on the use of the critical deficiency flag in the inspection report system. However, in 2006, the FHWA found instances of noncompliance with the reporting process, particularly among local agencies. Inspectors had been reporting critical deficiencies, but reviewing officials—particularly county engineers—were not following up on reports of critical deficiencies in accordance with the documented process.[20] As a result, it was not clear that critical deficiencies were being fully addressed and resolved. To correct this problem, the Bridge Office now has a procedure in place to annually search bridge inventory data for bridges with a critical deficiency indicator, and the Bridge Office follows up with the bridge owner to review the critical deficiency and follow the next steps in the reporting process. According to Bridge Office officials, compliance with critical-deficiency follow-up procedures increased

[20] A separate issue was that inspectors were erroneously reporting findings as critical deficiencies that did not, in fact, rise to that level.

significantly in 2007. The Bridge Office also plans to continue providing refresher training on critical deficiency procedures.

Sufficiency of Bridge Maintenance Resources

Bridge maintenance staff are assigned to crews that work as a team, with crews generally having five to seven members who work year-round. Districts may also supplement bridge crew staff with seasonal help. We discussed with district inspectors and bridge maintenance staff the extent to which bridge maintenance crews were able to address work items generated from bridge inspections and keep up with routine bridge maintenance activities. We found that:

- **District officials reported that they are performing the high priority work recommended by bridge inspectors, but are not keeping up with routine and preventive bridge maintenance activities or inspectors' lower-priority maintenance recommendations.**

As discussed earlier, district officials assured us that they are promptly addressing safety-related and other high-priority bridge maintenance needs. But they also reported that, overall, their districts are not keeping up with routine maintenance the way they were five to ten years ago. For example, one maintenance supervisor reported stretching the interval between applications of deck sealant and delaying maintenance on secondary bridge elements (those elements not part of the bridge's main support structure).

MnDOT districts reported having an insufficient number of workers on their bridge crews to complete the amount of maintenance work that is needed.

In the three districts we visited to discuss bridge inspection in depth, bridge maintenance officials reported having an insufficient number of workers on their bridge crews to complete the amount of maintenance work that is needed. For example, in the mid-1990s, the Brainerd District had three bridge crews with a total of 12 staff and 2 supervisors. The southern portion of the district ("District 3B") ran two crews with eight bridge workers and a supervisor. Currently, District 3B has one crew of five members and a supervisor.

The situation in the Rochester District is similar. Bridge crew permanent staffing has remained fairly stable for the past 20 years, with the district running three bridge crews with 16 bridge workers in total. The district has seen the biggest change in its use of seasonal help. In the past, the Rochester District hired up to 20 seasonal staff and used these staff to run a fourth bridge crew that performed routine bridge maintenance work, such as crack sealing and painting. Over the last five years, the district has averaged four seasonal employees. According to the district, this has dramatically affected the amount of bridge maintenance and improvement work the district can accomplish in a season.

In the Metro District, budget limitations have resulted in similar staffing adjustments, but on a larger scale given the number of bridges in the district. Prior to 2001, the district operated six bridge crews with a total complement of 32 bridge workers. During the construction season, the district normally hired two to three seasonal workers to assist each crew. In 2001, the Metro District retained the complement of 32 workers, but dropped to five crews. The district stopped filling bridge worker vacancies in 2004, and it currently has seven vacant bridge worker positions. In effect, the district is operating one crew short. In

Bridge maintenance crews also perform an ongoing inspection function, the impact of which diminished as bridge crew staffing declined.

addition, the Metro District no longer hires seasonal staff to assist bridge crews. This has had significant impact on the crews' workloads. With about 1,300 structures in the district, a complement of six bridge crews (as there was prior to 2001) resulted in a workload of roughly 200 structures per crew. With five crews, that grows to about 260 and with four crews, to 325. A district manager reported that, overall, the Metro District's bridge work is more reactive than in the past, and the district has a substantial backlog of preventive maintenance needs.

Having fewer bridge crews and staff on the job has another important, indirect impact on bridge maintenance—as they go about their daily work, bridge crews perform an ongoing inspection function as well. To the extent that MnDOT reduces the presence of bridge crews in the field, the depth of the department's inspection presence is also reduced.

Although facing resource challenges, district staff said that between technology and process improvements, bridge crews are working more productively. For example, districts reported efficiency improvements from changes in the way maintenance work is assigned. One change included assigning specialized tasks to fewer crews and having these crews then work over a larger geographic region. Changes in technology have helped also. For instance, districts are using a new machine for sealing cracks on bridge decks. A maintenance manager at one district told us that the machine is about five times faster than the old process MnDOT used to seal cracks.

RECOMMENDATION

The Minnesota Department of Transportation should assess the sufficiency of districts' bridge maintenance staffing and make additional resources available, as needed, to ensure that inspection findings and other maintenance needs are effectively addressed.

MnDOT central office and district staff clearly stated their concerns regarding the sufficiency of bridge maintenance staffing in the districts we visited, but in the short time allotted for this evaluation, we did not complete a sufficient amount of supporting analysis to make specific recommendations on the number of additional bridge maintenance staff needed or the source of additional budgetary resources. Nevertheless, MnDOT officials have identified a critical need in this regard and should act to address it.

QUALITY ASSURANCE

Federal regulations require states to use systematic quality control and quality assurance procedures to maintain accuracy and consistency in the inspection program. The procedures are required to include periodic field review of inspection teams, periodic bridge inspection refresher training for program managers and team leaders, and independent review of inspection reports and computations. MnDOT's Bridge Office Inspection Unit leads Minnesota's inspection quality assurance program, which applies to state and local inspections. We found that:

- **Minnesota uses reasonable strategies to ensure a quality bridge inspection program, and the FHWA has consistently found that Minnesota complies with federal bridge inspection requirements.**

Minnesota uses three primary strategies to ensure inspection consistency and quality: (1) inspector training and certification, (2) inspection program reviews at MnDOT district offices and local transportation agencies, and (3) use of the Minnesota, federal, and professional association manuals. In addition, the FHWA does an annual compliance review of Minnesota's bridge inspection program. Earlier in the chapter, we discussed Minnesota's procedures for certifying bridge inspectors and inspectors' reliance on various inspection manuals to ensure consistency in how inspections are conducted and the way deficient conditions are interpreted. In this section, we focus on how the Bridge Office conducts quality control reviews of state and local offices and the FHWA's recent reviews of Minnesota's bridge inspection program.

MnDOT's Bridge Office reviews the quality of bridge inspection activities by its district offices and local jurisdictions on a five-year, rotating basis.

MnDOT's policy is for the Bridge Office to conduct quality reviews of 20 percent of state and local jurisdictions each year (a five-year rotating schedule). The process begins with an office review of the selected jurisdictions. For each agency, the Bridge Office compiles information from the bridge management system, such as dates of specialized inspections, critical deficiencies, and maximum inspections completed per day. The Bridge Office also sends a questionnaire, which requires the inspecting agency to verify inspector training records, describe its compliance with various inspection program requirements, and confirm the accuracy of data from the bridge management system. The Bridge Office reviews this information, looking, for example, for up-to-date training, evidence of too many inspections being conducted in a day, or bridges that need updated load ratings.

From the jurisdictions subject to office reviews, the Bridge Office then selects 8 to 12 agencies for field visits, focusing on those where the document review revealed possible compliance problems. Field visits include the review of inspections on two to three bridges and meetings with agency officials.[21] Frequently, a representative from the FHWA participates in some of the field visits as part of the FHWA quality review of the state. At the close of office and field reviews, the Bridge Office sends letters to all agencies noting any deficiencies found, making suggestions for improvement, and specifying compliance or noncompliance with National Bridge Inspection Standards.

We reviewed Bridge Office letters sent to the local agencies participating in the quality assurance reviews completed in 2002 through 2006. Over this five-year period, MnDOT found five local agencies to be out of compliance with National Bridge Inspection Standards. Most often, noncompliance was related to

[21] Bridge Office reviewers inspect the selected bridges, then compare their results with the original inspection results. The purpose is to identify missed findings or inconsistent application of inspection standards.

inspectors not meeting education and training requirements. Other findings included missing action plans for bridges at risk from high-water events, inspections being conducted during the winter when snow cover may prevent thorough inspections, and load ratings that need to be updated.

We also reviewed FHWA reports summarizing federal quality reviews of Minnesota's bridge inspection program. In its annual program review, the FHWA evaluates the policies, procedures, and operating practices used by MnDOT to fulfill the requirements of the National Bridge Inspection Standards. The FHWA review includes Bridge Office, MnDOT district, and local bridge inspection activities, and the review is generally conducted at the MnDOT Bridge Office, one or two district offices, and one or more counties.

The Federal Highway Administration has found Minnesota to be in substantial compliance with National Bridge Inspection Standards.

We reviewed the FHWA reports for fiscal years 2003-06, and in all years, the FHWA found Minnesota to be in substantial compliance with National Bridge Inspection Standards. In each of the reports, the FHWA reviewer noted that Minnesota's quality assurance program is excellent, and noted in particular that the state's inspector certification and training program is outstanding. Nonetheless, as shown in Table 3.5, the FHWA noted several critical findings and made recommendations to address them. Some of the recommendations were repeated in several years.

Table 3.5: Recommendations from Federal Highway Administration Reviews of Minnesota's Inspection Program, 2003 to 2006

Recommendations	Years Appearing in Federal Highway Administration Report
Ensure follow-up action on critical recommendations.	2003, 2004, 2005, 2006
Obtain confirmation that recommendations resulting from underwater inspections are being acknowledged and resolved by MnDOT districts and local agencies.	2006
Minimize the number of bridges being inspected by local agencies in the middle of winter and, if inspections must be done at this time, ensure that the agency does a supplemental inspection later to ensure that all parts of the bridge are inspected.	2003, 2004, 2005, 2006
Address missing scour action plans and out-of-date channel cross-sections for relevant bridges.	2003, 2004, 2005
Ensure that inspectors use more descriptive notes in inspection reports.	2003, 2004, 2005

SOURCE: Office of the Legislative Auditor, analysis of Federal Highway Administration reports on Minnesota's bridge inspection program.

RECOMMENDATION

The Minnesota Department of Transportation should ensure timely resolution of recommendations from Federal Highway Administration reviews of Minnesota's bridge inspection program.

The Bridge Office has initiated actions to address FHWA recommendations, but the repeating of some recommendations indicates that further action is necessary. As discussed above, the Bridge Office has provided additional training and oversight to improve compliance with critical deficiency follow-up procedures, and it has taken similar actions to address the FHWA recommendation regarding underwater inspections. The Bridge Office plans to address problems with scour action plan requirements in its 2008 inspector certification classes. According to the Bridge Office, issues with winter inspections occur most often with local jurisdictions. In response, for the last four years, Bridge Office staff have visited counties with high numbers of winter inspections to discourage the practice. They also remind local jurisdictions that if they do winter inspections, follow up may be required to complete inspection of any bridge components that were snow covered during the winter inspection.

4 Program Decision Making

SUMMARY

Following the Legislative Auditor's recommendations in 1997, the Minnesota Department of Transportation (MnDOT) implemented a program planning system that links decisions about state trunk highway projects to system performance targets. The department's policy is to place a priority on traveler safety and preservation of existing highways and bridges, but from 2002 to 2007, more state trunk highway funding went to system expansion projects than preservation. In addition, revenue forecasts and projections of highway and bridge conditions show that MnDOT will be hard-pressed to meet system preservation goals in the coming years. The department needs to be more realistic about the number of state trunk highway projects it commits to, and it needs to work with the Legislature to establish fiscal management policies to guide decisions on how trunk highway projects will be financed.

The collapse of the I-35W bridge raised many questions about how MnDOT allocates resources and chooses among transportation projects. Accordingly, this chapter addresses the following questions:

- **What priorities and criteria guide MnDOT's allocation of state trunk highway resources?**

- **How has actual trunk highway spending aligned with MnDOT's stated priorities?**

To answer these questions, we interviewed MnDOT officials about (1) the agency's overall approach to strategic planning for the state trunk highway system, (2) the process it uses to develop long-range and near-term program plans for highway and bridge projects, and (3) the methods it uses to measure progress toward its performance goals. We also interviewed former officials from MnDOT's central office and current executives, managers, and staff from the central office and districts about the sufficiency of state trunk highway resources and how, in practice, decisions about the allocation of resources have been made over the last five to ten years. We reviewed a variety of planning documents and performance reports, and we analyzed fiscal year 2002 to 2007 data from MnDOT's project management systems on contracts let for trunk highway road and bridge projects.

Our evaluation focused on several aspects of the process MnDOT uses to decide which trunk highway projects it should do and when they can be accomplished. We started by assessing the overall framework that MnDOT uses to develop the state trunk highway program, including the department's strategic priorities, long-range planning process, and performance measurement. We then evaluated how, over the past five to six years, actual project investments have lined up with the department's stated goals, and whether the department has been realistic about the number of projects it can deliver in its four-year project cycle. And finally, we reviewed MnDOT's projections of state trunk highway preservation needs and expected revenues as well as the fiscal management policies it has in place to guide decisions about trunk highway financing.

DECISION-MAKING FRAMEWORK

As shown in Figure 4.1, MnDOT uses a multi-step process to plan state transportation investments, moving from a strategic plan to a four-year schedule of projects approved by the Federal Highway Administration for federal funding. In 1997, the Legislative Auditor recommended that MnDOT take several steps to improve its process for selecting state trunk highway projects. For example, we said MnDOT should report on the funding needs of the trunk highway system and define needs in terms of what investments would be necessary to meet specific performance targets. We evaluated MnDOT's response to these recommendations and found that:

- **MnDOT acted on the Legislative Auditor's 1997 recommendations and established performance-based criteria for deciding which state trunk highway projects it should undertake.**

MnDOT laid the groundwork for its new investment strategy and process with the release of the 2003 statewide transportation plan.[1] The plan was built on three long-standing strategic priorities: (1) preserving the existing transportation system, (2) improving traffic safety and mobility, and (3) operating the department efficiently and effectively. The plan also presented ten policies to support the strategies. The policy priorities that MnDOT weighs when allocating resources for the state trunk highway system are to preserve the existing infrastructure, effectively manage state trunk highway operations, improve mobility between regional centers, improve mobility in major metropolitan areas, and ensure safety.

MnDOT says its top priority is to maintain and preserve the existing infrastructure.

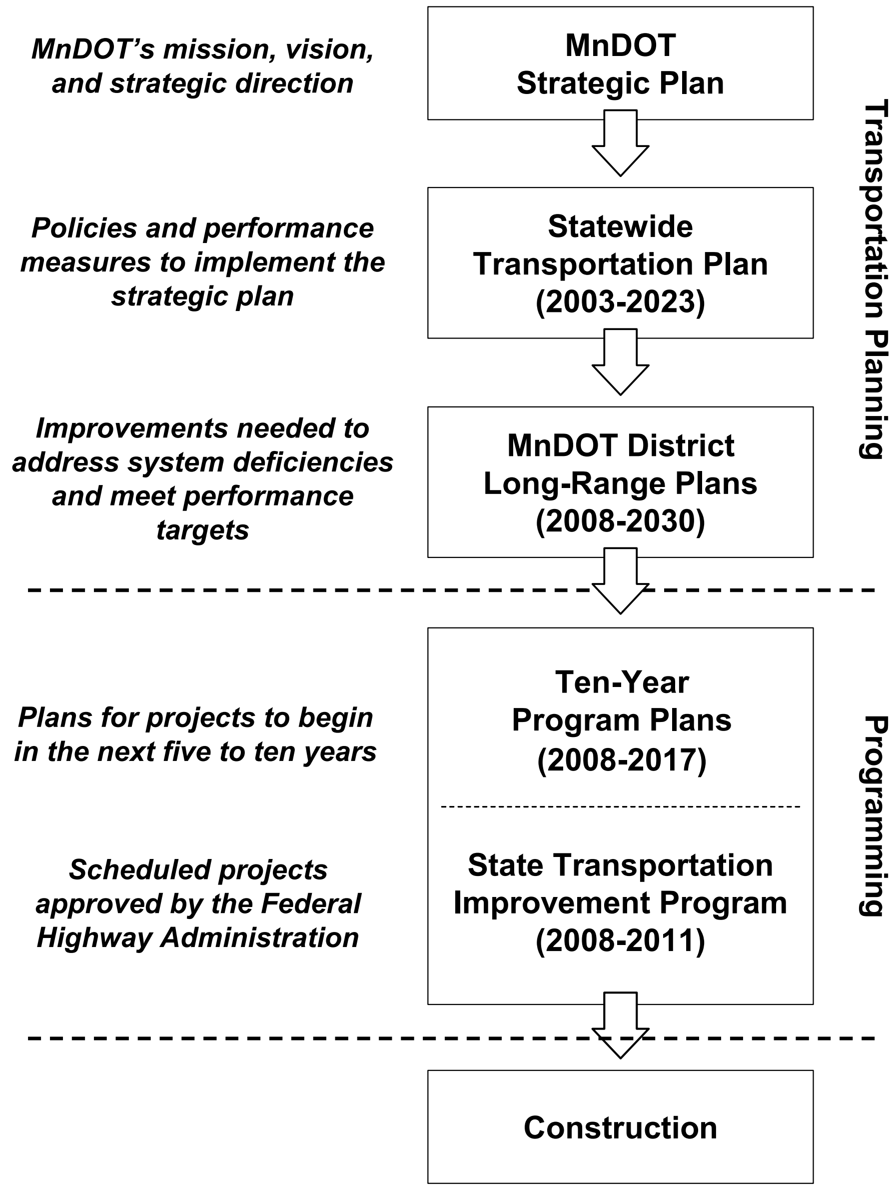
Among these, the statewide transportation plan states that "MnDOT's top priority is to maintain transportation assets in sound physical condition and to meet system preservation targets. Resources will be directed to meeting other performance objectives (such as Interregional Corridor performance and bottleneck removal) after the physical condition of the system has been considered."[2] MnDOT has established this policy in order to reduce the long-term cost to Minnesotans of maintaining its transportation infrastructure. Failing to invest in the "right" preservation fixes at the "right" time could result in conditions requiring more expensive fixes, ultimately diverting resources from needed safety and mobility investments. As stated in our 1997 report, we support MnDOT's preservation first policy as sound financial and asset management policy.

---

[1] Minnesota Department of Transportation, *Minnesota Statewide Transportation Plan: Moving People and Freight from 2003 to 2023* (St. Paul, August 2003).

[2] *Ibid.*, 6-13.

Figure 4.1: Program Planning for the State Trunk Highway System



NOTES: Date ranges shown are for the transportation plans in place in September 2007. As of January 2008, MnDOT was in the process of updating its statewide transportation plan and district long-range plans. The State Transportation Improvement Program (STIP) is a rolling four-year plan that is updated and submitted to the Federal Highway Administration annually.

SOURCES: Minnesota Department of Transportation, *Minnesota Statewide Transportation Plan: Moving People and Freight from 2003 to 2023, Executive Summary* (St. Paul, August 2003), 4; and Minnesota Department of Transportation, *Summary of the District Long-Range Plans 2008-2030* (St. Paul, November 2005), 2.

The district long-range plans for 2008-2030, which were completed in 2005, represent MnDOT's first attempt at performance-based investment planning on a statewide basis. These plans are the link between the policies in the statewide transportation plan and specific projects to preserve and improve the state trunk highway system. Also implementing a 1997 recommendation from the Legislative Auditor, the statewide transportation plan set performance goals for preservation of state trunk highways and bridges (along with goals related to safety and mobility), and the district planning process assessed what investments would be needed to meet those performance goals. The plans also include a "fiscally constrained" scenario that established investment priorities within a fixed amount of projected available resources. Districts select from among the projects in these long-range plans when placing projects in the State Transportation Improvement Program (STIP), which is the four-year schedule of projects.

To better direct resources to priority areas, the department also revised the formula it uses to allocate federal funds among Area Transportation Partnerships (ATPs), with more resources going to those with highway conditions demonstrating the greatest performance needs.[3] The new formula, which will take effect in fiscal year 2009, allocates 60 percent of funds based on preservation needs, 30 percent based on mobility-related factors, and 10 percent based on safety needs. Under the old formula, federal funds were allocated largely on the basis of system size and use. To compensate ATPs that would have received fewer funds under the new formula, MnDOT increased the total amount of money distributed through the formula and agreed to a "hold harmless" policy. Under this agreement, all ATPs received federal fund allocations for fiscal year 2009 that were no less than what they would have received under the old formula.[4] State trunk highway funds are allocated using a similar formula.

MnDOT also initiated use of district "check-in" meetings to present and discuss districts' activities and progress toward performance goals. The meetings, held about twice a year, bring together MnDOT senior managers, the heads of the districts, and various central office experts. Districts provide a common array of information, including district construction funds available, anticipated expenditures by strategic policy area, major projects, road and bridge conditions, expenditure versus need comparisons, and data on safety-related indicators. From the central office perspective, these meetings are another means of linking long-range plans to project selection and promoting implementation of the department's investment priorities.

Overall, we think MnDOT has made significant progress in establishing criteria for identifying state trunk highway needs, determining which construction and preservation investments will move the department towards its goals, and

---

[3] Federal transportation aid is directed to several purposes in addition to the state trunk highway system. The target formula applies broadly to the federal aid system, not only trunk highways.

[4] Funding the hold harmless policy was possible because the 2005 Federal Transportation Act provided an increase in federal funds to Minnesota.

directing funding accordingly. MnDOT officials said their efforts to revamp these processes were a direct result of the Legislative Auditor's 1997 recommendations, and we think the changes made respond to the weaknesses that we identified in the 1997 report.

ALIGNMENT OF INVESTMENTS WITH STRATEGIC PRIORITIES

Changes to the program planning process were an important, positive step at MnDOT, but ensuring that project investments conform to the principles directed in the plan is essential as well. Given MnDOT's priority on safety and "preservation first" and data showing that highway and bridge conditions are (or soon will be) falling short of performance targets, the department's construction program spending should be skewed toward preservation and safety. However, detailed, complete data on investments by project type were not available. MnDOT's financial management systems do not accurately track expenditures to this level of detail. The department's project management systems use the categories outlined in Table 4.1, but the cost data are incomplete. They include the cost of construction contracts at the time the contracts are let but exclude any cost overruns, supplemental agreements, incentive payments, and MnDOT staff costs.[5]

In spite of these omissions, MnDOT's project management systems remain the best available source of information on the allocation of resources among various types of system expansion and preservation projects. We used these data to evaluate the extent to which MnDOT's spending decisions aligned with stated priorities and found that:

In fiscal years 2002 to 2007, over half of MnDOT's spending on trunk highway construction was allocated to expansion projects.

- **Overall, state trunk highway project investments have not aligned with the department's stated policy of "preservation first," and important preservation needs have been left unmet.**

As shown in Table 4.2, for the past six fiscal years (2002 through 2007), over half of MnDOT's spending on trunk highway construction contracts was allocated to system expansion rather than preservation. In contrast, 25 percent of trunk highway contract spending was allocated to expansion projects in fiscal year 2001. According to MnDOT officials, this pattern of spending reflects the commitments MnDOT made in two significant system expansion initiatives, Governor Ventura's "Moving Minnesota" program in 2000 and Governor Pawlenty's "Bond Accelerated Program" (BAP) of 2003. The impact of the BAP projects is most pronounced in fiscal years 2004 and 2005, when many of the initiative's multi-year contracts were let, and preservation contract awards fell to

[5] Financial management and project management systems also differ in the timing used to record costs for multi-year projects. The program management system records the full contract amount in the year the contract is let. This is different than the financial management data that we presented in Chapter 2. The financial management system records spending in the year expenditures are actually made.

Table 4.1: Minnesota Department of Transportation Program Categories

Major Construction/Expansion	Improvements such as adding lanes or building a new roadway that decrease congestion, increase operating speed, or reduce accidents. Projects consist of grading and surfacing and may include bridges, signals, lighting, and landscaping.
Pavement Preservation	
Reconstruction	Improvements that bring grades (deficient horizontal or vertical sight distances) and cross section (steep slopes and narrow shoulders) up to an acceptable standard.
Reconditioning	Improvements intended to correct conditions that have been identified as critically deficient, usually consisting of widening, resurfacing, recycling, drainage correction, or shouldering.
Resurfacing	Improvements that restore the roadway surface or shoulders, including removing and replacing the top layer of the roadway or placing an additional layer on the existing roadway or shoulder.
Road Repair	Minor preservation work that is more extensive than ordinary maintenance and necessary to obtain the normal life expectancy of the roadway.
Preventive Maintenance	Projects that preserve the surface of the roadway.
Bridge and Culvert Preservation	
Replacement	Elimination or correction of bridges that have been identified as inadequate or hazardous because of horizontal and vertical clearances, load restrictions, or deterioration. Work may include full replacement of the bridge or culvert or major rehabilitation.
Improvement and Repair	Investments to maintain, protect, and improve the safety of existing bridges. The work may consist of deck and substructure repair, deck overlay, slope protection repair, bridge approach repair, painting, or minor widening.

SOURCES: Office of the Legislative Auditor; and Minnesota Department of Transportation, *State Transportation Improvement Program Guidance* (St. Paul, 2001), Appendix F.

12 and 36 percent of the total, respectively. Investments in resurfacing contracts fell from 35 percent of total investments in 2001, to 4 percent in 2003, and back to 15 and 16 percent for 2005 to 2007. According to MnDOT officials, in addition to reducing resurfacing investments, the department also used thinner overlays, which have shorter life. MnDOT staff think this lesser investment in resurfacing relates directly to overall declines in the remaining service life of trunk highways and difficulties meeting ride quality performance targets (as discussed in Chapter 2).

Table 4.2: Contracts Let for State Trunk Highway Pavement Projects, Fiscal Years 2001-07

	2001	2002	2003	2004	2005	2006	2007
Dollars (in millions)							
Expansion	$ 83	$256	$761	$299	$329	$278	$414
Preservation							
Reconstruction	$ 70	$ 64	$ 26	$ 38	$ 67	$ 27	$ 77
Reconditioning	44	54	10	43	42	68	10
Resurfacing	116	87	38	43	86	80	95
Road Repair	19	26	23	17	20	28	17
Preventive Maintenance	0	3	6	30	25	11	10
Subtotal	$249	$234	$103	$171	$241	$214	$208
Total	$331	$490	$864	$470	$570	$492	$622
Percentage of Total							
Expansion	25%	52%	88%	64%	58%	57%	66%
Preservation							
Reconstruction	21%	13%	3%	8%	12%	5%	12%
Reconditioning	13	11	1	9	7	14	2
Resurfacing	35	18	4	9	15	16	15
Road Repair	6	5	3	4	4	6	3
Preventive Maintenance	0	1	1	6	4	2	2
Subtotal	75%	48%	12%	36%	42%	43%	34%
Total	100%	100%	100%	100%	100%	100%	100%

NOTES: Dollar amounts are not adjusted for inflation. For multi-year projects, the full project cost was recorded in the year the contract was let. See Table 4.1 for category descriptions. Amounts may not sum to totals due to rounding.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation project management data.

In contrast to highway pavement spending, spending on bridge and culvert construction contracts has leaned more heavily toward system preservation due to steady investments in bridge replacement, as shown in Table 4.3. Between fiscal years 2001 and 2007, roughly 50 to 60 percent of bridge investments were for bridge replacement, with the exception of fiscal year 2005, when bridge replacement accounted for 24 percent of contract amounts awarded. Investments in other improvements and repairs intended to preserve existing bridges and culverts—such as painting, deck repair, and joint repair—remained fairly steady at about $13 million to $14 million per year between fiscal years 2001 and 2006, increasing to $26 million in 2007. Increased funding made available with the transportation bonding initiatives in 2000 and 2003 reduced the relative proportion of total program spending that was dedicated to preservation. Together, preservation activities accounted for about 30 percent of contract awards in fiscal year 2001, and ranged from 8 to 17 percent through fiscal year 2007.

Table 4.3: Contracts Let for State Trunk Highway Bridge and Culvert Projects, Fiscal Years 2001-07

	2001	2002	2003	2004	2005	2006	2007
Dollars (in millions)							
Expansion	$ 8.3	$ 41.1	$ 71.1	$21.9	$ 72.5	$ 29.7	$ 53.9
Preservation							
Bridge Replacement	23.6	77.5	85.7	39.0	26.6	59.1	89.9
Culvert Replacement	0.4	0.5	3.4	1.2	2.2	2.6	1.9
Other Improvements and Repairs	12.5	13.4	13.9	12.3	11.7	13.7	26.3
Subtotal	$36.5	$ 91.3	$103.1	$52.6	$ 40.5	$ 75.4	$118.2
Total	$44.9	$132.4	$174.2	$74.5	$113.0	$105.0	$172.1
Percentage of Total							
Expansion	19%	31%	41%	29%	64%	28%	31%
Preservation							
Bridge Replacement	53	59	49	52	24	56	52
Culvert Replacement	1	<1	2	2	2	2	1
Other Improvements and Repairs	28	10	8	17	10	13	15
Subtotal	81%	69%	59%	71%	36%	72%	69%
Total	100%	100%	100%	100%	100%	100%	100%

NOTES: Dollar amounts are not adjusted for inflation. For multi-year projects, the full project cost was recorded in the year the contract was let. Amounts may not sum to totals due to rounding.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation project management data.

MnDOT managers and executives acknowledged that aligning project investments with state priorities has not come quickly or easily, particularly with regard to state trunk highway pavements. As noted earlier, MnDOT phased in its revamped framework for program decision making over a number of years, issuing its statewide transportation plan in 2003 and district long-range plans in 2005. Before the districts could focus exclusively on activities tied to the performance targets, they had to complete work on expensive, multi-year projects that were already underway or to which the department was firmly committed under the 2003 BAP legislation. Rather than demand an immediate shift, MnDOT's leadership team allowed these projects to continue, with the understanding that future projects would be tied to the performance targets. In 2002 and 2003 when the central office and district officials discussed the shift to performance-based decision making, they felt the balance of expansion and preservation commitments was "about right" because revenues were expected to grow and pavement conditions were at an acceptable level. At the time, postponing some pavement preservation activities in order to wrap up prior commitments seemed like a reasonable course of action. The 2005 district plans, for example, showed that needed preservation investments would require about 60 percent of projected available resources, leaving 40 percent for other purposes.

However, MnDOT's optimism that preservation investments were on track to meet performance targets was short lived. We found that:

- **MnDOT realized by 2004 that it needed to shift trunk highway investments toward additional preservation, but it has had a limited ability to do so.**

By 2004, state trunk highway pavement conditions were worsening, but higher-than-expected financial commitments for major expansion projects, decreasing state resources, and delayed passage of federal transportation legislation limited MnDOT's ability to respond. MnDOT realized that pavement condition was highly responsive to the changes in investments. MnDOT officials told us that they were surprised to learn that even one year of postponing pavement preservation led to marked decreases in road conditions, which also required more costly fixes than if the preservation had been undertaken on time.

Cost overruns on the 2003 bonding initiative and highway 52 project in Rochester limited MnDOT's ability to reallocate funds toward pavement preservation.

In addition, the 2003 BAP projects had a larger-than-expected impact on district construction budgets, reducing funds available for (1) ongoing preservation needs and (2) any expansion projects that had been committed to as part of the regular construction program. The BAP initiative originally included 13 projects. One was later dropped and a second was significantly reduced in scope because of cost overruns on other projects and federal delays in appropriating transportation funding. Among the remaining 11 projects, shown in the top portion of Table 4.4, construction costs (as of January 2007) were $106.9 million higher than originally estimated. The 2003 BAP stipulated that if project costs exceeded available funding from bond and federal advance construction revenues, the difference would come from district budgets. Districts were also responsible for right-of-way acquisition costs associated with the projects, because right-of-way could not be purchased with bond revenues. These costs totaled $86 million.

As of January 2007, total BAP program costs (construction and right-of-way) totaled about $916 million, and MnDOT had obtained $830 million in bond and federal advance construction revenues. This left approximately $86 million to be covered from districts' budgets.[6] In addition, in 2003 and 2004, MnDOT encountered cash management complications associated with the use of federal advance construction funds for the trunk highway 52 project in Rochester. To counter the resulting impact on trunk highway fund balances, MnDOT reduced districts' spending authority for trunk highway construction by $100 million. Ultimately then, the BAP initiative and trunk highway 52 project consumed roughly $186 million in excess of bond and federal revenues that otherwise could have been directed to trunk highway preservation. Had the projects been better scoped in 2003 with more accurate cost estimates attached, MnDOT would have included fewer projects in the initiative from the start. We discuss problems with project scoping and cost estimates later in the chapter, along with MnDOT's policies for managing the risks associated with federal advance construction.

[6] Comprehensive BAP program costs in January 2008 may differ somewhat from those included in our analysis. For our analysis, MnDOT provided right-of-way cost estimates from 2003, and these costs may have changed. In addition, MnDOT may have incurred costs after January 2007, the date of the published construction cost estimates included in our analysis.

Table 4.4: Costs Associated with the Bond Accelerated Program, 2004 and 2007

District	Trunk Highway	Project	January 2004	January 2007		
			Construction Cost Estimates (in millions)	Increase in Construction Costs (in millions)	Right-of-Way Acquisition (in millions)	Total Including Right-of-Way (in millions)
Metro and Willmar	212	Construct four lane expressway—Hennepin CSAH 4 to CR 147	$225.4	$ 18.0	$55.3	$298.7
Metro	494	I-394 to TH 212/5	80.3	68.0	5.0	153.3
Rochester	52	Reconstruction—Oronoco	26.0	14.9	7.5	48.4
Metro	Various	Improvements to support "Transit Advantages"	36.0	10.0	0.0	46.0
Metro	694/35E	Reconstruction—35E/694 interchange	118.6	9.5	1.0	129.1
Brainerd	101	Interchanges and Bridges—Crow River to Mississippi River	53.6	8.2	7.0	68.8
Bemidji	34	Reconstruction—in Park Rapids	9.4	2.4	0.8	12.6
Detroit Lakes	10	Reconstruction—in Detroit Lakes	40.7	2.3	2.5	45.5
Duluth	53	Reconstruction—Piedmont Avenue to TH 194 in Duluth	14.6	(0.1)	4.1	18.6
Brainerd	371	Construct four lane expressway—TH 10 to CSAH 48	30.1	(9.6)	3.0	23.5
Mankato	14	Construct four lane expressway—Janesville to Waseca	64.9	(16.7)	0.0	48.2
		Subtotal	$699.6	$106.9	$86.2	$892.7
Projects Canceled or Substantially Reduced in Scope						
Metro	169	Interchanges and bridges	$105.3	($ 81.6)	$ 0.0	$ 23.7
Brainerd	94	Bridges and roadway realignment—Monticello	20.0	(20.0)	0.0	0.0
		Subtotal	$125.3	($101.6)	$ 0.0	$ 23.7
		NET TOTAL	$824.9	$ 5.3	$86.2	$916.4

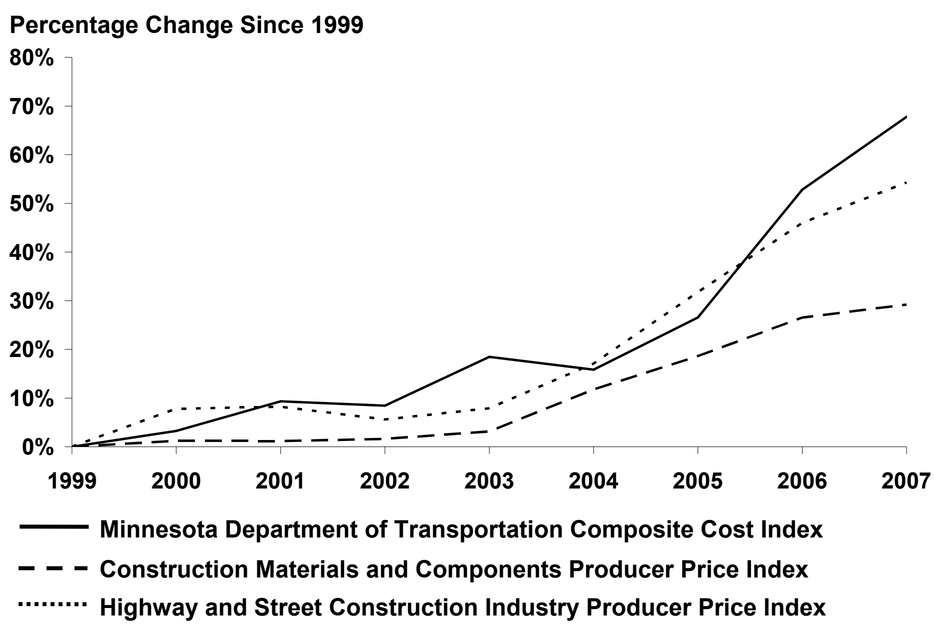
NOTE: The original cost estimates used to select projects for the Bond Accelerated Program did not include right-of-way acquisition. Revised cost estimates from 2007 include construction cost increases and right-of-way acquisition costs.

SOURCES: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation, *Bond Accelerated Program: Report to Legislature on Trunk Highway Bonding*, January 2004; report of same title dated January 2007; and Office of Investment Management data.

Inflation in highway construction materials and services reduced MnDOT's purchasing power and narrowed the scope of preservation investments it could make.

Finally, inflation in highway construction materials and services reduced MnDOT's purchasing power and narrowed the scope of preservation investments it could make. According to MnDOT's Office of Investment Management, after many years of stable or decreasing material costs, the price of staple construction goods increased significantly over the past five or so years. To better understand these trends, we selected several construction-related price indicators and calculated inflation rates since 1999. As shown in Figure 4.2, prices increased dramatically after 2002. For example, prices in the highway and street construction industry were 6 percent higher in 2002 than in 1999, but 54 percent higher in 2007 than 1999. According to MnDOT's highway and bridge specialists and district engineers, inflation of this magnitude has had a significant impact on preservation efforts. Even setting aside concerns about the overall level of funding for trunk highway preservation, preservation dollars were not going as far. In response, most districts chose to focus on lower cost fixes (like thinner overlays for road resurfacing) and the state's most traveled roads and bridges. As the state gets farther behind, the cost to recover gets higher and higher.

Figure 4.2: Cumulative Change in Construction Price Indexes, 1999-2007



SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation (composite cost index) and Bureau of Labor Statistics (producer price indexes).

MnDOT has taken several actions to shift resources toward trunk highway preservation, but these efforts will begin taking effect in fiscal year 2009. For example, the revised formula for allocating state and federal trunk highway funds discussed earlier in the chapter will take effect beginning in fiscal year 2009 and will direct funds toward those districts with greater preservation needs. In addition, the department has directed about $80 million in federal funds toward bridge replacement and rehabilitation beginning in 2009, and for 2011, shifted another $30 million in federal funding from statewide mobility improvements to critical statewide pavement needs on Interstate highways.

TRUNK HIGHWAY PROJECT COMMITMENTS

Considering the number of constituencies that manage, use, or are affected by the state trunk highway system, it is not surprising that there is immense demand for trunk highway improvement projects or that views on the priorities among them differ. In this section of the report, we address the extent to which MnDOT has created realistic expectations for itself and among outside stakeholders about the number of projects the department can undertake at any given time. We found that:

- **The Department of Transportation has consistently included more projects in the state trunk highway program than it could deliver.**

MnDOT executives, managers, and staff acknowledged to us that the department has had a long-standing problem in this regard, and that the consequences of it—project cancellations and delays—have hurt the public's perception of the agency. There are several factors underlying the mismatch between the state trunk highway construction program the department says it will deliver in a given time period and the projects that it actually starts.

MnDOT faces immense pressure—from the public, local communities, and state and local public officials—to complete trunk highway expansion and improvement projects.

MnDOT faces immense pressure—from the public, local communities, and state and local public officials—to complete trunk highway expansion and improvement projects that meet their particular needs. MnDOT executives told us that department staff do their best to act as gatekeepers, but too often, the agency agrees to put projects on a planning list and devote resources to initial development. MnDOT staff told us that they try to be clear with external partners that doing some planning around a particular project idea is not the same thing as a commitment to fund the full project. Nevertheless, these stakeholders generally expect that once a project is in a district plan, it will be delivered within a reasonable amount of time. MnDOT's leaders acknowledged that the department needs to do a better job managing public expectations, letting fewer projects into the planning process, and ensuring that those entering the process fit with MnDOT's strategic priorities.

MnDOT has had problems managing its trunk highway construction program because projects move from the planning concept phase into the programming phase with ill-defined scopes and underestimated project costs. Entering the final stages of project development with a poorly defined scope requires additional work by designers and engineers, results in cost increases over original estimates, and contributes to contract delays. Poorly defined scope is a key contributor to underestimates of project cost, but there are others as well. MnDOT lacks a standardized process for preparing cost estimates, and districts vary in the methods, assumptions, and documentation used. The BAP projects discussed earlier in the chapter are a large-scale example of this problem and its consequences, but MnDOT officials said it is a systemic issue with smaller expansion and preservation projects as well.

MnDOT has had a long-standing problem with underestimating project costs during project development; as project costs later increased, other projects had to be delayed or canceled.

As the scope and cost of projects increase, other projects must be delayed or canceled completely. This presents not only a public relations problem for the agency, but also creates substantial consequences for stakeholders. Local governments, for example, may have community development projects linked to trunk highway capacity or access improvements or local preservation projects, such as sewer upgrades, linked to trunk highway pavement work.

A recent internal audit conducted by MnDOT also illustrated the need for the department to improve its estimates of project scope and cost.[7] The audit included a review of 193 supplemental agreements totaling $89 million, and covered, among other things, management controls over contract changes and the cost impact of the supplemental agreements. The audit found that contract changes are a significant percentage of total construction costs and most often resulted from inadequate designs or plans, new understanding of soil conditions, and add-ons to project scope. All of these are factors that could be addressed in early scoping of the project. In response to the audit, MnDOT launched a task force to examine the contract change process. As of December 2007, that task force had not completed its work.

In addition, MnDOT launched two other initiatives to address the issues with project scoping and cost-estimating. The first initiative established a standard project scoping process to be implemented statewide. The process established expectations that project managers conduct comprehensive scoping before placing a project in the STIP (four-year schedule of projects), allow enough time for functional experts to make their contributions, and thoroughly document scoping decisions. The department also provided new tools to assist in the scoping process, including planning needs lists, detailed worksheets, and a scope report template. Implementation of the new scoping process began in 2007 for projects scheduled for fiscal year 2012.

A second MnDOT initiative is focused on better estimating project costs. Designed in four phases from needs analysis to training, the project's purpose is to design a standardized cost-estimating process and integrate it into the organization. The department finished the first phase of the project in May 2007 and identified numerous areas of needed improvement, including the need for a structured, systematic approach to estimate costs and greater focus on cost management, not simply project delivery. The next phase of the project, underway now, is to develop an actual cost-estimating process, including management support strategies, policies, and performance measures. MnDOT estimates that implementation of the new process is 6 to 12 months away.

---

[7] Minnesota Department of Transportation Office of Audit, *Audit of Construction Contract Changes*, Report No. 07-900-105, March 26, 2007.

RECOMMENDATION

The Minnesota Department of Transportation should improve its process for developing state trunk highway projects to better ensure that projects included in its program plans (1) align with the department's priorities and (2) can realistically be delivered within the funds projected to be available.

We think the department's initiatives relative to project scope and cost are an important step to improve the efficiency and effectiveness of the state trunk highway construction program. But MnDOT will also need to be more conservative in putting projects into its long-range plan, ten-year plan, and STIP, ensuring that the projects selected align with performance needs, providing adequate resources for project development, and holding managers and staff accountable for staying on schedule and on budget.

TRUNK HIGHWAY PRESERVATION NEEDS

Minnesota has many well-established transportation needs. In this section of the report, we focus on MnDOT's most recent estimates of preservation needs for trunk highway pavements and bridges as well as the department's assessment of how those needs align with forecasted revenues. According to MnDOT projections:

- **If MnDOT is to meet its commitment to a "preservation first" policy in the coming years, it will need to direct virtually all available trunk highway construction funds to preservation projects.**

MnDOT significantly increased its estimate of what the state needs to spend on pavement preservation for fiscal years 2012 to 2018.

According to MnDOT, staff in the districts, Bridge Office, and Office of Materials have been updating projections of the preservation investments that the department should be making annually in order to achieve highway and bridge condition goals. Based on these estimates and revised revenue forecasts, MnDOT's leadership team has concluded that (1) the cost of meeting existing preservation needs through 2018 exceeds current plans for spending on preservation; and (2) as a result, meeting preservation needs through 2018 will require the department to devote virtually all of the state trunk highway construction budget to preservation, leaving little or no funds available to meet other system goals, including enhanced mobility.

As shown in Table 4.5, from fiscal years 2012 to 2018, MnDOT planned to spend an average of $322 million per year on state trunk highway preservation projects. However, in 2008, the department estimated that, for fiscal years 2012 to 2018, the state should invest about $672 million per year (an increase of $350 million per year) if it wants to meet performance targets for trunk highway pavements, bridges, and culverts.[8] Much of this increase comes from pavement

[8] Because of the long time horizon, planned spending amounts and estimates of preservation needs should be considered rough estimates.

Table 4.5: Planned State Trunk Highway Preservation Spending Compared to Estimates of Need, Fiscal Years 2012-18

	Planned Average Annual Spending for Preservation, as Estimated in February 2007 (in millions)	Annual Spending Needed to Meet Performance Targets, as Estimated in January 2008 (in millions)	Difference (in millions)
Pavements	$230[a]	$440[b]	$210
Bridges and Culverts	92	232	140
Major Bridge Replacement[c]		112	112
Other Structures		120[d]	28
Total	$322	$672	$350

[a] Planned preservation spending estimates are based on the fiscal year 2008 to 2017 District Highway Investment Plans developed in February 2007.

[b] Pavement preservation needs were estimated in January 2008 and reflect the amount of annual preservation spending needed from 2012 to 2018 to bring pavements to performance targets by 2014 and keep them there.

[c] For its 2008 assessment of preservation needs, MnDOT accounted separately for the replacement of six major bridges scheduled between 2012 and 2018. Preliminary estimates to replace the six bridges total $787 million, or an average of $112 million per year for 2012 through 2018. The six bridges are: Lafayette (TH 52 over the Mississippi River in St. Paul), Hastings (U.S. 61 over the Mississippi River), Dresbach (I-90 to LaCrosse, Wisconsin), Winona (TH 43 over the Mississippi River), Desoto (TH 23 over the Mississippi River in St. Cloud), and Cayuga (I-35E north of downtown St. Paul).

[d] Other bridge and culvert preservation needs were estimated in 2008 and reflect amount of annual preservation spending needed from 2012 to 2018 to meet performance targets by 2023.

SOURCE: Office of the Legislative Auditor, analysis of Minnesota Department of Transportation planning estimates.

preservation needs. As shown in the table, MnDOT estimated that to meet pavement condition targets, the state should spend about $440 million per year in fiscal years 2012 through 2018, or about $210 million more per year than is currently planned.[9] A significant gap between planned pavement spending and need is projected for all districts. To meet condition targets for trunk highway bridges and culverts, MnDOT estimates that the state should be spending about

[9] The need for increased annual spending is due to several factors: an increasing number of roadway miles in poor condition, increasing construction costs, and the impact of earlier decisions to defer maintenance activities, resulting in more costly fixes being required now.

State and federal revenues for trunk highway construction are projected to be $635–700 million per year in fiscal years 2012 to 2018.

$232 million per year between fiscal years 2012 and 2018.[10] This is roughly $140 million more per year than is currently planned for bridge and culvert preservation spending.

For fiscal years 2012 to 2018, the estimated cost of meeting state trunk highway preservation needs roughly matches estimates of available funding for state trunk highway construction. As of January 2008, MnDOT estimated that projected state and federal revenues for trunk highway construction will range from $635 million to $700 million between fiscal years 2012 and 2018.[11] As stated above, MnDOT projects that average spending for pavement and bridge preservation should be $672 million per year during the same time period.

RECOMMENDATION

Early in the 2008 legislative session, MnDOT should clearly present the implications of its current financial projections, particularly its projected inability to both preserve existing infrastructure and fund infrastructure enhancements.

Based on these analyses of future needs and projected revenues, meeting its "preservation first" commitment will, in effect, require a "preservation only" investment policy in the coming years. MnDOT senior managers told us that without the addition of new revenue, Minnesota is facing direct trade-offs between preservation of the existing infrastructure and other priorities, including mobility and safety. Decisions in the coming years to initiate trunk highway mobility or safety improvement projects—by the Legislature, Governor, or MnDOT—will have an offsetting impact that reduces trunk highway preservation. As the legislature addresses transportation financing issues this session, we think it important for legislators to understand and evaluate the implications of MnDOT's recent projections.

FINANCIAL MANAGEMENT POLICY

Historically, Minnesota has financed construction of transportation improvement projects on a pay-as-you-go basis. But in 2003, the state initiated an $800 million package of state trunk highway projects funded through a combination of state trunk highway bonds and use of federal advance construction authority (also a form of debt financing). To better understand the risks associated with these financing techniques and the state's policies regarding their use, we wanted to

[10] Of the $232 million, $112 million is for the scheduled replacement of six major bridges. Preliminary estimates to replace the six bridges total $787 million, or an average of $112 million per year for 2012 through 2018. The six bridges are: Lafayette (TH 52 over the Mississippi River in St. Paul), Hastings (U.S. 61 over the Mississippi River), Dresbach (I-90 to LaCrosse, Wisconsin), Winona (TH 43 over the Mississippi River), Desoto (TH 23 over the Mississippi River in St. Cloud), and Cayuga (I-35E north of downtown St. Paul).

[11] This revenue forecast assumes (1) no changes in current laws affecting state revenues, (2) modest growth in state revenues between 2012 and 2018, and (3) federal funding at the level currently authorized through 2014 with modest growth in federal funding from 2015 through 2018.

compare the terms of the 2003 funding package to MnDOT's debt management policies. However, we found that:

- **MnDOT has not formally adopted up-to-date financial management policies to guide decisions related to federal advance construction authority, debt management, and State Trunk Highway Fund balances.**

MnDOT has a policy governing issuance of trunk highway bonds dated May 1983. However, after the department's experience managing the 2003 BAP initiative, MnDOT officials thought it prudent to update and expand the department's financial management policies. Their purpose was to ensure that MnDOT effectively manages State Trunk Highway Fund balances and mitigates the substantial risks associated with debt financing. Some of these risks are listed in Table 4.6.

There are benefits to using debt financing for certain trunk highway projects, but MnDOT should have formal policies in place to manage related risks.

We did not analyze the specific terms of the proposed policies on debt management, advance construction, or State Trunk Highway Fund balances as part of this evaluation. But in general, they establish limits on the cumulative amount of debt the state should incur at a given time; the terms of repayment, particularly in the context of ensuring adequate cash balances in the State Trunk Highway Fund; and sources of revenue for repayment. In addition, the policies include expectations regarding the types of projects suitable for debt financing.

To date, the Commissioner and senior management team have not adopted the proposed financial management policies. They gave us various reasons for not having done so, but generally emphasized a desire to have more experience with the use of debt financing before formalizing any specific constraints or terms of its use. They also suggested that MnDOT needed to consult with the Legislature.

RECOMMENDATION

In consultation with the Legislature and Minnesota Department of Finance, MnDOT should adopt financial management policies to guide the use of debt financing and federal advance construction for state trunk highway investments.

Given the magnitude of state investments and the risks associated with debt financing, we think having policies in place regarding debt management, advance construction, and State Trunk Highway Fund balances is both reasonable and prudent. MnDOT should work with the Legislature to establish a reasonable set of parameters that outline, for example, the types of projects suitable for debt financing, the terms of debt service, and limits on the cumulative amount of trunk highway debt incurred.

Table 4.6: Costs and Risks Associated with Use of Debt Financing and Federal Advance Construction

Debt Financing

- Interest must be paid to bond purchasers over the life of the bond. Over 20 years at current interest rates, interest costs can add as much as 50 percent to the original value of the bond, although the real cost of the interest paid is mitigated by inflation.
- Debt financing does not create a new source of revenue. Without additional funding streams to pay the debt service, annual principal and interest payments will have to be made with funds currently planned for other purposes.
- Unfavorable future events may negatively affect the state's ability to repay the debt, and state law requires bond holders to be repaid before State Trunk Highway Fund resources can be spent for other purposes. This may result in reduction in funds available for construction projects and other departmental operations.
- Debt financing requires careful fiscal management to ensure that sufficient cash exists to pay debt service when it becomes due and that debt financing does not have unexpected impacts on the department's operating budget. The risk of cash flow problems increases with any subsequent rounds of debt financing.

Federal Advance Construction

- Use of advance construction (AC) is based on an expectation of future federal funds, rather than currently available appropriations. Once the commitment of AC is made to encumber a project, the department is committing to payments and assuming the risk that future appropriated federal revenues will be sufficient to meet these obligations. If future appropriations are below estimates, adjustments in spending levels will be required and options will be more limited since substantial portions of the federal appropriation will have been committed in earlier years.
- When federal funds are not available to reimburse eligible project costs, another revenue source must be used to cover payments. State and local resources are required for 100 percent of the cash outlays, rather than receiving federal funds for (usually) 80 percent of these costs. This reduces the overall cash balances and results in lower investment income.
- If cumulative AC commitments are very large compared to revenues dedicated to support other operations, there is significant potential that unexpected developments in the use of AC could limit spending in other areas of the department's operations.
- Plans for the use of AC financing are based largely on estimated federal revenue for a full fiscal year, but federal funds are regularly provided in partial-year appropriations. Thus, there is a greater risk that the amount of federal funds available for conversion will not be sufficient to pay eligible project costs at the time they are paid by the department.
- AC is not a new source of revenue. It allows one-time advancement of projects that would have been built later by committing future federal funds to AC conversion. Therefore, those federal funds are not available for additional projects in the future, reducing the construction program in future years.

NOTE: Two common sources of transportation debt financing are trunk highway bonds and the Transportation Revolving Loan Fund.

SOURCE: Minnesota Department of Transportation Finance Division.

List of Recommendations

- The Minnesota Department of Transportation should provide the operating funds necessary to meet inspection frequency requirements for fracture critical bridges (p. 54).

- The Minnesota Department of Transportation should evaluate districts' procedures for documenting postinspection bridge maintenance decisions and implement standard practices across districts (p. 60).

- The Minnesota Department of Transportation should assess the sufficiency of districts' bridge maintenance staffing and make additional resources available, as needed, to ensure that inspection findings and other maintenance needs are effectively addressed (p. 62).

- The Minnesota Department of Transportation should ensure timely resolution of recommendations from Federal Highway Administration reviews of Minnesota's bridge inspection program (p. 65).

- The Minnesota Department of Transportation should improve its process for developing state trunk highway projects to better ensure that projects included in its program plans (1) align with the department's priorities and (2) can realistically be delivered within the funds projected to be available (p. 80).

- Early in the 2008 legislative session, MnDOT should clearly present the implications of its current financial projections, particularly its projected inability to both preserve existing infrastructure and fund infrastructure enhancements (p. 82).

- In consultation with the Legislature and Minnesota Department of Finance, MnDOT should adopt financial management policies to guide the use of debt financing and federal advance construction for state trunk highway investments (p. 83).

Minnesota's Structurally Deficient State Trunk Highway Bridges and Culverts, 2006
APPENDIX A

County	Bridge Number	Bridge or Culvert	Fracture Critical	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Federal Highway Administration Status[a]
Aitkin	91049	Culvert		27	1964		US 169	Ripple River	3,950	Open
Beltrami	4561	Bridge		25	1926	1935	TH 1	Ditch	55	Posted-Other
Brown[b]	6535	Bridge	✓	163	1949		TH 258	Cottonwood River	700	Closed
Brown	6749	Bridge		98	1951		TH 4	Little Cottonwood River	1,250	Open
Carlton	8501	Culvert		12	1939	1943	TH 23	Deer Creek	550	Open
Carlton	4651	Culvert		12	1930		TH 210	Kettle River	3,450	Open
Carver	6654	Bridge		160	1952		TH 5	Recreation Trail	16,000	Open
Carver	9010	Bridge		530	1959		TH 41	Minnesota River	15,800	Open
Chippewa	6816	Bridge		29	1952		TH 277	Co Ditch #22	310	Temp Shoring
Clearwater	5581	Bridge		49	1936		TH 1	Sandy River	3,000	Open
Cook	8288	Culvert		12	1931		TH 61	Onion River	3,100	Open
Cook	8298	Culvert		12	1933		TH 61	Stream	2,250	Open
Cook	8301	Culvert		12	1933		TH 61	Carlson Creek	1,550	Open
Cottonwood	5834	Bridge		32	1939		TH 30	Branch of Watonwan River	740	Open
Cottonwood	6889	Bridge		143	1956		US 71	Des Moines River	2,350	Open
Dodge	6036	Culvert		22	1930	1982	US 14	Stream	7,400	Open
Fillmore	8163	Culvert		13	1923	1941	TH 44	Stream	2,300	Open
Fillmore	4148	Culvert		23	1923	1941	TH 44	Stream	2,300	Open
Fillmore	4149	Culvert		23	1923	1941	TH 44	Riceford Creek	2,300	Open
Fillmore	4150	Culvert		23	1923	1941	TH 44	Stream	2,100	Open
Fillmore	4151	Culvert		23	1923	1941	TH 44	Stream	2,100	Open
Fillmore	5803	Bridge		96	1937		TH 30	Trout Run Creek	340	Posted-Load
Fillmore	6119	Culvert		32	1930		US 52 (Old)	Stream	1	Open
Fillmore	3693	Culvert		12	1922	1931	US 52	Stream	3,850	Open
Fillmore	6123	Culvert		10	1931		US 52	Stream	6,200	Open
Fillmore	23006	Bridge		148	1978		US 63	South branch Root River	3,100	Open
Freeborn	3843	Culvert		18	1923	1946	TH 13	Ditch	3,100	Open
Goodhue	5188	Bridge		113	1932		TH 58	North fork Zumbro River	6,700	Open
Goodhue	97287	Culvert		13	1960	1991	US 52	Stream	25,000	Open
Goodhue	6773	Bridge		114	1954		US 61	Gilbert Creek	7,500	Open
Hennepin	5598	Bridge		164	1939		Minnetonka Blvd	TH 100	19,100	Open
Hennepin	9053	Bridge		199	1957		W 94th St	I 35W	12,800	Open
Hennepin	9796	Bridge		187	1959		W 76th St	I 35W	23,800	Open
Hennepin	27930	Bridge		307	1964		TH 121 Northbound	I 35W Southbound	6,000	Open
Hennepin	5462	Bridge		190	1939		TH 7 (CSAH 25)	TH 100	36,000	Open
Hennepin[c]	9340	Bridge	✓	1907	1967		I 35W	RR, Mississippi River, 2nd St & Rd	141,000	Closed
Hennepin	27842	Bridge		534	1966		I 94 Westbound on ramp	I 94 & TH 65	20,000	Open
Hennepin	27861	Bridge		268	1968		I 94 Westbound off ramp	CP Rail & City St	11,000	Open
Hennepin	27871	Bridge		363	1967		I 35W Southbound	TH 65 Northbound	48,500	Open
Hennepin	27932	Bridge		376	1964		TH 62 Eastbound	I 35W	50,000	Open

Minnesota's Structurally Deficient State Trunk Highway Bridges and Culverts, 2006 (continued)

County	Bridge Number	Bridge or Culvert	Fracture Critical	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Federal Highway Administration Status[a]
Hennepin	27937	Bridge		224	1964		TH 62 Westbound	I 35W Northbound	49,000	Open
Hennepin	27938	Bridge		290	1964		I 35W Southbound off ramp	I 35W Northbound	22,750	Open
Hennepin	27939	Bridge		127	1963		I 35W Southbound	E 60th St	85,000	Open
Hennepin	27940	Bridge		127	1963		I 35W Northbound	E 60th St	85,000	Open
Hennepin	27941	Bridge		244	1964		I 35W Southbound off ramp	TH 62 Westbound	22,750	Open
Hennepin	94277	Culvert		20	1939		TH 55	Bassett Creek	27,500	Open
Hennepin	9611	Bridge		214	1961		Diamond Lake Rd	I 35W	12,600	Open
Houston	8158	Culvert		12	1935		TH 44	Stream	4,300	Open
Houston	8399	Culvert		11	1900	1946	TH 44	Stream	4,850	Open
Houston	8917	Culvert		20	1946		TH 26	Stream	1,500	Open
Houston	8842	Culvert		27	1956		TH 26	Stream	2,550	Open
Houston	5475	Bridge		252	1940		US 61	I&M Rail & Street	15,600	Open
Itasca	6736	Bridge		128	1950		TH 65	Swan River	880	Open
Kanabec	5747	Bridge		107	1938		TH 65	Ann River	7,400	Open
Kanabec	6412	Bridge		53	1942		TH 65	Groundhouse River	6,900	Open
Kittson	35007	Bridge		2080	1982		TH 171	Red River of the North	800	Open
Koochiching	91272	Culvert		18	1958		TH 65	Cross River	90	NA[d]
Koochiching	5721	Bridge	✓	378	1890	1937	TH 65	Little Fork River	30	Posted-Other
Koochiching	6767	Bridge		27	1951		TH 65	Hay Creek	90	Open
Lake	5610	Bridge	✓	234	1936		TH 1	Kawishiwi River	530	Posted-Load
Lake	8286	Culvert		12	1923	1955	TH 61	Stream	4,250	Open
Lake of the Woods	5557	Bridge		216	1950		TH 11	Rapid River	760	Open
Meeker	90992	Culvert		12	1959		TH 4	Ditch	1,150	Open
Meeker	5388	Bridge	✓	105	1935		TH 24	North fork Crow River	1,650	Posted-Load
Mower	5905	Bridge		38	1940		TH 56 Farm Ent	North branch Upper Iowa River	5	Open
Mower	6470	Bridge		43	1948		TH 56	Stream	2,950	Open
Mower	6808	Bridge		243	1959	1979	I 90 Eastbound	Twp Rd & Turtle Creek	7,700	Open
Mower	8929	Culvert		31	1957		I 90	Dobbins Creek	18,800	Open
Nicollet	4014	Culvert		23	1923	1951	TH 22	Robarts Creek	1,200	Open
Norman	6730	Bridge		22	1949		US 75	Ditch	1,050	Posted-Load
Norman	6734	Bridge		225	1951		US 75	Marsh River	1,050	Open
Olmsted	8831	Culvert		14	1954		US 63	Stream	6,000	Open
Ramsey	6630	Bridge		97	1954		Hennepin Avenue	Minnesota Transfer Rail	16,000	Open
Ramsey	6688	Bridge		180	1952		US 61	BNSF RR	24,500	Open
Ramsey	6513	Bridge		199	1958	1973	Maryland (CSAH 31)	I 35E	22,500	Open
Ramsey	6738	Bridge		150	1954		Larpenteur (CSAH 30)	TH 280	13,500	Open
Ramsey	9570	Bridge		214	1964		Co Rd E2 (CSAH 73)	I 35W	5,700	Open

Minnesota's Structurally Deficient State Trunk Highway Bridges and Culverts, 2006 (continued)

County	Bridge Number	Bridge or Culvert	Fracture Critical	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Federal Highway Administration Status[a]
Ramsey	5723	Bridge		64	1938		TH 36	Lexington Ave (CSAH 51)	85,000	Open
Ramsey	6515	Bridge		1285	1965			Cayuga St & BNSF RR	148,000	Open
Ramsey	6517	Bridge		298	1963		I 35E	BNSF RR	148,000	Open
Ramsey	9096	Bridge		532	1959		I 35E Northbound off ramp	I 35E Southbound	23,000	Open
Ramsey	9197	Bridge		123	1960	1969	I 694 Westbound	BNSF RR	51,500	Open
Ramsey	9265	Bridge		165	1964		I 35E	Pennsylvania Ave	144,000	Open
Ramsey	9800	Bridge	✓	3366	1968	1992	US 52 (Lafayette)	Mississippi River, RR & Streets	81,000	Open
Ramsey	62026	Bridge		580	1965	1980	Lafayette (US 52)	UP RR & Eaton St	74,000	Open
Redwood	4667	Bridge	✓	122	1927		TH 19 Access Rd	Sulpher Lake	50	Open
Redwood	6962	Bridge		26	1900	1950	TH 68	Ditch	1,350	Temp Shoring
Rice	5337	Bridge		296	1940		TH 3	UP RR	7,300	Open
Rice	6770	Bridge		95	1952		TH 60	Cannon River	5,050	Open
Rice	6771	Bridge		115	1952		TH 60	Cannon River	6,300	Open
Rice	6842	Bridge		176	1955		TH 3	Cannon River	7,300	Open
Rice	5370	Bridge		951	1937		TH 60	Straight River, RR, Street	10,500	Open
Rock	6821	Bridge		38	1953		TH 270	Mud Creek	740	Open
Rock	6245	Culvert		23	1932	1956	US 75	Poplar Creek	9,500	Open
Rock	67807	Bridge		112	1965		I 90 Westbound	CSAH 9	5,400	Open
Scott	8844	Culvert		12	1949	1955	TH 19	Stream	5,400	Open
Sibley	91422	Culvert		14	1976		TH 19	Co Ditch # 42	4,500	Open
St. Louis	69848	Bridge		132	1964		I 35 Northbound	US 2 Eastbound	14,500	Open
St. Louis	8904	Culvert		14	1952		TH 37	Stream	6,300	Open
St. Louis	2182	Bridge	✓	69	1924		TH 1	Pike River	570	NA[d]
St. Louis	8204	Culvert		12	1927	1939	US 53	Miller Creek	18,300	Open
St. Louis	88544	Culvert		12	1930	1969	TH 23	Kingsbury Creek	13,200	Open
St. Louis	88545	Culvert		12	1930	1969	TH 23	Keene Creek	15,800	Open
St. Louis	69004	Bridge		140	1961		TH 135	US 53 Northbound, Southbound on ramp	8,300	Open
St. Louis	69003			198	1961		US 169	BN RR (Aban) & Trail	14,400	Open
Stearns	5790	Bridge		55	1937		US 71	North fork Crow River	2,100	Open
Stearns	9086	Bridge		189	1958		TH 23	10th Ave	29,000	Open
Steele	74820	Bridge		202	1965		US 14 Eastbound	I 35	6,050	Open
Swift	6552	Bridge		92	1948		TH 29	Ditch	1,200	Open
Wabasha	8355	Culvert		17	1942		TH 74	Stream	90	Open
Wabasha	5968	Bridge		96	1941		TH 42	North fork Whitewater River	3,000	Open
Wabasha	9166	Bridge		106	1959		US 63	Miller Creek	2,900	Open
Wabasha	9167	Bridge		106	1959		US 63	Miller Creek	2,800	Open
Wabasha	9798	Bridge		94	1961		TH 60	Stream	630	Open
Wabasha	6461	Bridge		102	1945	1973	US 61 Northbound	East Indian Creek	2,075	Open
Wabasha	79009	Bridge		483	1969		US 61 Southbound	Zumbro River	3,050	Open

Minnesota's Structurally Deficient State Trunk Highway Bridges and Culverts, 2006 (continued)

County	Bridge Number	Bridge or Culvert	Fracture Critical	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Federal Highway Administration Status[a]
Waseca	88497	Culvert		13	1925	1979	US 14	Stream	8,000	Open
Washington	4654	Bridge	✓	1053	1930		TH 36	St. Croix River	18,000	Posted-Load
Washington	9115	Bridge		401	1959		TH 36 Eastbound	TH 95	9,750	Open
Washington	82805	Bridge		145	1967		I 694 Southbound	UP RR	35,000	Open
Washington	82806	Bridge		145	1967		I 694 Northbound	UP RR	35,000	Open
Watonwan	6762	Bridge		56	1951		TH 4	Watonwan River	970	Open
Winona	5836	Culvert		12	1941		TH 74	Stream	1,350	Open
Winona	8049	Culvert		13	1932		US 14	Stream	4,500	Open
Winona	8592	Culvert		14	1941		TH 74	Stream	1,350	Open
Winona	8593	Culvert		14	1941		TH 74	Stream	1,350	Open
Winona	8594	Culvert		14	1941		TH 74	Stream	1,350	Open
Winona	8595	Culvert		14	1941		TH 74	Stream	1,350	Open
Winona	91121	Culvert		11	1933		TH 43	Stream	3,250	Open
Winona	5234	Bridge		46	1932		US 14	Stream	4,500	Open
Winona	85807	Bridge		119	1963		I 90 Westbound	Twp 323	10,600	Open
Winona	85808	Bridge		119	1963		I 90 Eastbound	Twp 323	10,600	Open
Winona	85809	Bridge		95	1963		I 90 Westbound	Twp 312	10,600	Open
Winona	85810	Bridge		95	1963		I 90 Eastbound	Twp 312	10,600	Open
Wright	3622	Bridge		178	1922	1929	US 12	South fork Crow River	15,500	Open
Wright	86813	Bridge		480	1971		I 94 Westbound	CSAH 75 & RR	25,500	Open
Wright	86814	Bridge		493	1972		I 94 Eastbound	CSAH 75 & RR	25,500	Open
Yellow Medicine	87005	Bridge		187	1968		TH 274	Yellow Medicine River	920	Temp Shoring
Yellow Medicine	91795	Culvert		13	1978		TH 23	Stream	5,300	Open

NOTES: "Structurally deficient" is a status used to describe a structure that has one or more structural defects that require attention. This status does not indicate the severity of the defect but rather that a defect is present. Table includes structures that carry vehicle traffic.

[a] "Posted-Other" means that the bridge is open, but signs have been posted for other-than-weight restrictions, such as slow speed or number of vehicles allowed on the bridge. "Temp Shoring" means that temporary support has been put in place to allow the structure to remain open to unrestricted traffic. "Posted-Load" means that the bridge is open, but signs have been posted indicating vehicle weight restrictions on the bridge.

[b] Bridge 6535 was damaged by a towed farm implement and will remain closed until it can be repaired in the spring.

[c] Bridge 9340 collapsed on August 1, 2007.

[d] The Federal Highway Administration status was not available.

SOURCE: Minnesota Department of Transportation bridge inventory as of April 2007, except for the updated Federal Highway Administration statuses of bridges 6535 and 9340.

Minnesota's Fracture Critical State Trunk Highway Bridges, 2006
APPENDIX B

County	Bridge Number	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Structural Condition Rating	Steel Truss Bridge	Federal Highway Administration Status[a]	Deficient Status[b]
Brown[c]	6535	163	1949		TH 258	Cottonwood River	700	Poor	✓	Closed	Structurally deficient
Carlton	09001	223	1961		TH 210	St. Louis River	1,350	Fair	✓	Open	Adequate
Chippewa	5380	221	1938		TH 40	Lac Qui Parle Lake	610	Fair		Open	Adequate
Chippewa	9114	182	1932	1958	TH 7	Chippewa River	1,850	Satisfactory	✓	Open	Adequate
Chisago	6347	674	1953	1980	TH 243 (Osceola)	St. Croix River	7,600	Satisfactory	✓	Open	Adequate
Dakota	5895	1857	1950		US 61	Mississippi River, RR, Street	32,500	Fair	✓	Posted-Load	Functionally obsolete
Fillmore	23004	78	1931	1971	TH 43	South fork Root River	540	Fair		Open	Adequate
Fillmore	6975	104	1931	1960	TH 250	South branch Root River	840	Satisfactory	✓	Posted-Load	Functionally obsolete
Fillmore	6977	144	1924	1962	TH 250	North branch Root River	380	Satisfactory	✓	Posted-Load	Functionally obsolete
Goodhue	9040	1631	1958		US 63	Mississippi River & CP Rail	11,500	Fair	✓	Open	Adequate
Hennepin	9600N	5159	1978		TH 77 Northbound	Minnesota River & Black Dog	47,000	Satisfactory		Open	Adequate
Hennepin	9600S	5185	1978		TH 77 Southbound	Minnesota River & Black Dog	47,000	Satisfactory		Open	Adequate
Hennepin	27046	505	1988		TH 77 Southbound Collector Rd	Killebrew Drive	5,000	Satisfactory		Open	Adequate
Hennepin	27048	526	1988		TH 77 Southbound off ramp	81st Street	3,450	Good		Open	Adequate
Hennepin	27052C	603	1989		TH 77 Northbound Collector Rd	79th St & Eastbound 494/5 ramps	10,000	Good		Open	Adequate
Hennepin	27728	1475	1978		I 94 Northbound on ramp	Glenwood Ave & RR	7,100	Satisfactory		Open	Adequate
Hennepin	27753	520	1989		I 394R ramp	Northbound TH 100 to 394 HOV Eastbound	7,600	Good		Open	Adequate
Hennepin	27753A	360	1989		I 394R ramp	394 HOV Westbound to Northbound TH 100	3,800	Good		Open	Adequate
Hennepin	27776A	2738	1987		I 394R	I 394 Westbound, Dunwoody Blvd	7,600	Good		Open	Adequate
Hennepin	27776B	538	1987		I 394R Eastbound	I 394 & downtown ramps	2,175	Good		Open	Adequate
Hennepin	27776C	626	1987		I 394R Westbound	I 394 Westbound on ramp	2,175	Good		Open	Adequate
Hennepin	27776F	1200	1987		394R Eastbound ramp	I 94 Eastbound (St. Paul)	1,087	Good		Open	Adequate

Minnesota's Fracture Critical State Trunk Highway Bridges, 2006 (continued)

County	Bridge Number	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Structural Condition Rating	Steel Truss Bridge	Federal Highway Administration Status[a]	Deficient Status[b]
Hennepin	27788	289	1989		I 394 Eastbound on ramp	TH 100 Northbound on ramp	4,500	Good		Open	Adequate
Hennepin	27789	967	1989		TH 100 Southbound collector distributor	Southbound collector distributor ramp & Frontage Rd	2,000	Satisfactory		Open	Adequate
Hennepin	27789A	67	1989		I 394 Eastbound off ramp	Southbound TH 100	6,000	Good		Open	Adequate
Hennepin	27791	495	1989		TH 100 Southbound on ramp	Glenwood Ave to Southbound 100	2,000	Good		Open	Adequate
Hennepin	27799R	784	1969	1987	I 94 Eastbound on ramp	Lyndale Avenue Southbound	25,400	Satisfactory		Open	Adequate
Hennepin	27726B	1100	1979		I 94 Southbound off ramp	Lyndale Ave N & RR	10,900	Satisfactory		Open	Functionally obsolete
Hennepin	27727B	1869	1978		I 94 Southbound on ramp	Glenwood Ave & RRs	8,000	Satisfactory		Open	Functionally obsolete
Hennepin[d]	9340	1907	1967		I 35W	RR, Mississippi River, 2nd St & Rd	141,000	Poor		Closed	Structurally deficient
Kittson	6690	1058	1954		TH 11	Red River of the North	1,400	Fair		Open	Adequate
Koochiching	5721	378	1890	1937	TH 65	Little Fork River	30	Poor		Posted-Other	Structurally deficient
Lake	5610	234	1936		TH 1	Kawishiwi River	530	Poor		Posted-Load	Structurally deficient
Lake of the Woods	9412	1285	1959		TH 72	Rainy River	2,100	Fair	✓	Open	Functionally obsolete
Le Sueur	4930	402	1931		TH 99	Minnesota River	7,000	Fair		Open	Adequate
Marshall	5872	412	1939		TH 317	Red River of the North	320	Fair	✓	Open	Adequate
Marshall	9100	792	1959		TH 1	Red River of the North	1,400	Fair		Open	Adequate
Meeker	5388	105	1935		TH 24	North fork Crow River	1,650	Poor		Posted-Load	Structurally deficient
Norman	6522	41	1924	1945	TH 200 Frontage Rd	Marsh River	4	Fair		Open	Adequate
Pine	5718	403	1948	1984	TH 123	Kettle River & St	2,050	Fair	✓	Open	Adequate
Polk	9090	1261	1963		US 2	Red River & City St	21,500	Satisfactory	✓	Open	Adequate
Polk	4700	603	1929	1986	US 2B (Business)	Red River	12,700	Fair	✓	Open	Functionally obsolete
Ramsey	9300	1199	1961	1986	TH 5 West 7th St	Mississippi River	56,000	Fair		Open	Adequate
Ramsey	62090	2770	1986		TH 149 (Smith Ave)	Mississippi River & Railroad	18,000	Satisfactory		Open	Adequate
Ramsey	62853	294	1970		I 35W Ramp to TH 36 Eastbound	TH 280 Northbound	10,000	Satisfactory		Open	Functionally obsolete

Minnesota's Fracture Critical State Trunk Highway Bridges, 2006 (continued)

County	Bridge Number	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Structural Condition Rating	Steel Truss Bridge	Federal Highway Administration Status[a]	Deficient Status[b]
Ramsey	9800	3366	1968	1992	US 52 (Lafayette)	Mississippi River, RR & Streets	81,000	Poor		Open	Structurally deficient
Redwood	4667	122	1927		TH 19 Access Rd	Sulpher Lake	50	Poor	✓	Open	Structurally deficient
St. Louis	2182	69	1924		TH 1	Pike River	570	Poor		NA[e]	Structurally deficient
St. Louis	69839	318	1969		Northbound Michigan St	TH 194 Southbound	4,200	Satisfactory		Open	Functionally obsolete
St. Louis	69100	8320	1982		US 2	St. Louis River, TH 35, & RR	19,400	Satisfactory		Open	Adequate
St. Louis	69102	2642	1983		US 2 Eastbound on ramp	TH 35, RR, Lake	4,500	Good		Open	Adequate
St. Louis	69801C	666	1969		I 535 Southbound on ramp	Railroad & Fill	3,300	Satisfactory		Open	Adequate
St. Louis	69801F	576	1969		I 535 Southbound Segment 1	I 35 & Ramp to I 35 Southbound	6,625	Satisfactory		Open	Adequate
St. Louis	69801J	489	1969		I 535 Northbound Segment 1	I 35 Northbound & Southbound off ramp	6,625	Good		Open	Adequate
St. Louis	69801K	597	1969		I 535 Northbound off ramp	I 35 Southbound	3,300	Satisfactory		Open	Adequate
St. Louis	69801N	296	1969		I 535 Northbound Segment 3	CP Rail	4,400	Good		Open	Adequate
St. Louis	69825	877	1969		I 535 Northbound off ramp	BNSF Railroad	5,625	Satisfactory		Open	Adequate
St. Louis	69831	1105	1967		I 35 Southbound	DM&IR RY & BNSF RR	21,500	Satisfactory		Open	Adequate
St. Louis	69832	1171	1967		I 35 Northbound	DM&IR RY & BNSF RR	21,500	Satisfactory		Open	Adequate
St. Louis	69880	1163	1968		I 35	50th Ave & Oneta St. Connector	44,000	Satisfactory		Open	Adequate
St. Louis	9030	7980	1961	1993	I 535	St. Louis River; RR, Street	28,000	Good	✓	Open	Functionally obsolete
St. Louis	69824	1430	1969		I 535 Southbound on ramp	I 535 Northbound & I 35 Northbound	5,625	Good		Open	Functionally obsolete
St. Louis	69840	300	1968		TH 194 Northbound	Superior St (MSAS 171)	9,250	Satisfactory		Open	Functionally obsolete
Stearns	6748	890	1957		TH 23	Mississippi River & Riverside Dr	31,000	Fair	✓	Open	Adequate
Wabasha	5397	67	1935		TH 60	Trout Brook	630	Fair		Posted-Load	Adequate
Wabasha	79000	2462	1987		TH 60	Mississippi River, RR, & Sts	4,750	Good	✓	Open	Adequate
Washington	82815	356	1967		US 8 Westbound	I 35	10,500	Good		Open	Adequate

Minnesota's Fracture Critical State Trunk Highway Bridges, 2006 (continued)

County	Bridge Number	Length (in feet)	Year Built	Year Re-constructed	Facility Carried	Feature Over	Average Daily Traffic	Structural Condition Rating	Steel Truss Bridge	Federal Highway Administration Status[a]	Deficient Status[b]
Washington	4654	1053	1930		TH 36	St. Croix River	18,000	Poor		Posted-Load	Structurally deficient
Winona	5900	2289	1941	1985	TH 43	Mississippi River, RR, Streets	11,900	Fair	✓	Open	Adequate
Winona	9320	2490	1967		I 90	Mississippi River	26,000	Fair		Open	Adequate

NOTE: Includes bridges that carry vehicle traffic.

[a] "Posted-Load" means that the bridge is open, but signs have been posted indicating vehicle weight restrictions on the bridge. "Posted-Other" means that the bridge is open, but signs have been posted for other-than-weight restrictions, such as slow speed or number of vehicles allowed on the bridge.

[b] "Structurally deficient" is a status used to describe a bridge that has one or more structural defects that require attention. This status does not indicate the severity of the defect but rather that a defect is present. A "functionally obsolete" structure is one that does not meet current design standards for a new structure.

[c] Bridge 6535 was damaged by a towed farm implement and will remain closed until it can be repaired in the spring.

[d] Bridge 9340 collapsed on August 1, 2007.

[e] The Federal Highway Administration status was not available.

SOURCES: Minnesota Department of Transportation bridge inventory as of April 2007, except for updated Federal Highway Administration statuses of bridges 6535 and 9340; Minnesota Department of Transportation, "Truss Bridges," January 15, 2008, http://www.dot.state.mn.us/i35wbridge/pdfs/trussbridges2.pdf, accessed January 16, 2008.

Age Distribution of Structures on the State Trunk Highway System by District, 2006
APPENDIX C

Percentage of Bridge Deck Area

	Duluth	Bemidji	Brainerd	Detroit Lakes	Rochester	Mankato	Willmar	Metro	Statewide
10 years or less	6.2%	16.6%	22.8%	16.1%	19.9%	11.5%	15.9%	20.3%	17.5%
11-20 years	21.4	11.6	25.5	23.9	15.3	17.8	29.3	31.3	26.1
21-30 years	30.6	32.7	24.7	12.4	14.7	28.3	31.4	25.8	25.3
31-40 years	34.2	16.1	17.3	34.4	31.2	31.7	11.0	15.4	21.4
41-50 years	6.2	15.3	7.5	10.8	14.8	8.5	6.5	6.4	7.9
51-60 years	0.2	6.5	1.0	1.9	1.8	1.4	2.5	0.5	1.0
61-70 years	0.9	1.2	0.9	0.4	2.1	0.2	1.3	0.2	0.6
Over 70 years	0.3	0.1	0.3	0.1	0.3	0.6	1.9	0.1	0.2
Deck Area (in square feet)	6,178,908	1,304,742	2,885,856	1,367,954	4,672,642	3,017,320	1,006,525	23,675,311	44,109,258
Median Age	24	27	22	30	31	30	22	20	23

Percentage of Culverts

	Duluth	Bemidji	Brainerd	Detroit Lakes	Rochester	Mankato	Willmar	Metro	Statewide
10 years or less	12.4%	12.8%	15.6%	11.0%	7.2%	16.6%	11.4%	23.0%	12.7%
11-20 years	10.0	22.9	11.1	19.2	9.6	13.5	15.9	12.2	13.6
21-30 years	16.7	21.8	10.6	22.7	11.5	16.6	14.1	5.8	14.7
31-40 years	10.5	8.5	10.1	10.5	12.0	13.9	12.7	16.5	11.8
41-50 years	12.4	11.2	11.1	10.5	13.2	13.9	5.0	8.6	11.1
51-60 years	13.9	14.4	11.6	12.2	15.6	12.6	16.4	19.4	14.5
61-70 years	13.9	3.7	19.1	4.1	12.2	8.5	10.9	5.8	10.4
71-80 years	8.6	4.8	10.1	9.3	18.0	4.5	12.3	5.0	10.3
Over 80 years	1.4	0.0	1.0	0.6	0.7	0.0	1.4	3.6	1.0
Culverts	209	188	199	172	417	223	220	139	1,767
Median Age	41	27	42	30	48	32	36.5	39	38

NOTES: Table reflects information for Minnesota's Area Transportation Partnerships (ATPs). In some cases, ATP boundaries differ from MnDOT district boundaries. Age is calculated as 2006 minus the year built or year rehabilitated. Percentages may not sum to 100 due to rounding.

SOURCE: Office of the Legislative Auditor, analysis of data from the Minnesota Department of Transportation bridge inventory.

Excerpts from an Interview with Dan Dorgan, Director, MnDOT Office of Bridges

APPENDIX D

As noted earlier, our examination of issues related to the I-35W bridge was quite limited, and we certainly did not attempt to determine why the bridge collapsed. Nevertheless, in some interviews with Minnesota Department of Transportation (MnDOT) officials and employees, we asked questions about MnDOT's inspections and assessments of the bridge before it collapsed. In particular, we asked several bridge-related questions in our interview with Dan Dorgan, Director of MnDOT's Office of Bridges and State Bridge Engineer. The interview was conducted on January 14, 2008; it lasted approximately two hours; it was recorded and transcribed; and we required Mr. Dorgan to answer our questions under oath. The following are key excerpts from the interview:

First, we discussed why MnDOT hired URS, an engineering consulting firm, to assess the I-35W bridge in 2003.

> MR. NOBLES: [W]hy was URS brought into a consulting relationship with MnDOT specific to an analysis of the 35W bridge?
>
> MR. DORGAN: I would like to step back…. First of all…we recognize, certainly, that the 35W bridge was a fracture critical structure, being just two trusses. And also being constructed in a period in the 1960s before there was a lot of knowledge of how welding techniques impacted fatigue considerations. So we're… building this in the year of the 1960s before a lot of the problems with fatigue have shown up in steel bridges.
>
> So given those concerns, in the late '90s we retained…Dr. Dexter of the University of Minnesota, and Dr. Dexter was a national expert in fatigue…. Dr. Dexter conducted this study of the main truss spans and found that fatigue cracking was not expected in the main trusses during the life of that structure. That's not an exact quote, but we could certainly find it from the report if you desired that.[1]
>
> So that was good news to an owner. And we could have stopped at that point. And I think a lot of owners certainly would have been reasonable in stopping there, because we never had seen a

---

[1] The report Mr. Dorgan referenced is: O'Connell, Heather M., Robert J. Dexter, PE, and Paul M. Bergson, P.E., *Fatigue Evaluation of the Deck Truss of Bridge 9340* (St. Paul: Minnesota Department of Transportation, March 2001).

> fatigue crack in the main truss, so that alleviated a lot of our concerns. But we decided to continue further. And I think it's just sort of a belts and suspenders maybe overly conservative approach. Which, ironically, we're being questioned, it seems here and there, as to why we did so many studies, but we decided to go further and we asked the question, okay, well, it's very remote, or as Dr. Dexter said, there's no expectation we'd have a problem. Let's just ask the question, if we ever were to have a problem, where might it occur.
>
> So URS was really retained to pursue that question of if there ever was to be a problem, where is the most likely place it may initiate, and what steps possibly could be taken to mitigate that possibility. So that's…what URS was really retained to do.

Asked to describe the work URS did to assess the I-35W bridge, Mr. Dorgan said:

> MR. DORGAN: [T]hey utilized, as a beginning, the University of Minnesota work because from the University of Minnesota work we had actually done load tests on the bridge so we had good strain gauges on the bridge, instrumented it, and ran loads over the bridge as part of Dr. Dexter's study. And, of course, all that was very well done. So he had a model, and that's important when you analyze a bridge such as this, you want to have strain gauges on it, run a known load, and see what the response is so then you can calibrate your -- your computer model to that. To replicate the results and then you know your model is giving you credible results. So they used that as a basis. They did inspection work initially themselves, and I cannot recall if they did it independent or participated with our inspection teams, but I know they were out looking at the structure also. And then they began to do modeling and different analyses, and identified, and I believe our contract originally said to identify the eight most critical members of the bridge, in the end that was expanded to 13 members…. And then what happens is, since the bridge is symmetrical about its center, and there's two sides to it, … you have to multiply [13] by four, that becomes 52…. And what we were looking for is members that have the highest stress range because that's where fatigue typically begins, and then also that in conjunction with the known fatigue details were of concern….
>
> Then the next step was what type of mitigation, if any, could the owner, as an owner could we consider for those members. And that culminated in their January of '07 summary that gave us three different options for those 52 members. One was adding reinforcement plates to the 52 members, and I'd like to make it clear 'cause this goes back to some of the unfortunate news accounts, these were reinforcing the members only, they had

> nothing to do with gusset plates, which has been in the news some. So it was -- that was one of the options…. [A] second option was, instead of doing reinforcing, doing what they term nondestructive evaluation, and what that really is is in-depth inspections along with whatever testing one needs to do in the field to look for cracks. And for us a lot of that was ultrasonic testing as probably the state of the art for field testing. So that was the second option, that nondestructive evaluation. And then the third was a combination of reinforcing a portion of those 52 members and then doing the nondestructive evaluation on the remainder. So we were given those three potential options.

We discussed at length why MnDOT chose not to reinforce the 52 members of the bridge but to monitor and evaluate the bridge for cracking. In summing up his answers, Mr. Dorgan said:

> MR. DORGAN: [W]hen we looked at the three options, and since they were presented as three equally viable options by URS, and as we discussed them our staff and myself felt they were truly three equally viable options. We chose the nondestructive evaluation, I think one of the reasons for doing it was, again, back to, while we were confident we could probably -- well, I shouldn't say confident. While we believed we could put on the plating without any unintended consequence, there is some point of risk there. And that was a concern. So given that we had three equally viable options, we chose the inspection option, since our staff said they felt confident that if there w[ere] cracks of that size they could locate them.

We asked Mr. Dorgan a series of questions about who made the decision not to replate the bridge at that time, as well as whether cost was a consideration in the decision. We started by asking if ultimately he, as the state's bridge engineer, was responsible for the decision.

> MR. DORGAN: Yes, that's a correct statement. These were engineering decisions and we're relied upon to make those decisions for the department as a group of engineers. And being the state bridge engineer, you know, it does end with me. Ultimately, if I was uncomfortable I would have questioned and pursued it further. But also I'd say I don't make those decisions in a vacuum, I have staff there, we have a consultant, I certainly want to hear consensus out of the group and we had that.
>
> MR. NOBLES: Did you ever discuss this specific issue with Commissioner Molnau or Bob McFarlin [Assistant to Commissioner Molnau] of replating the 35W bridge?
>
> MR. DORGAN: Not at that time. Since the collapse there ha[ve] been a number of discussions in the department.

> MR. NOBLES: So prior to the collapse you never had a specific discussion with either of them about the option of replating the bridge?
>
> MR. DORGAN: No. No, I did not…. [However] it would have been discussed between our office and our metro district who owns the bridge and would have to put up the million and a half. So that would have been the levels that discussion occurred in.
>
> MR. NOBLES: Specifically, at any point, were you ever told not to pursue the replating option because it cost too much?
>
> MR. DORGAN: Absolutely not.

At another point in the interview, we asked again about money in MnDOT's consideration of the three options. That exchange was as follows:

> MR. NOBLES: Was MnDOT…willing to allocate the money for replating if that was the option that was chosen?
>
> MR. DORGAN: Certainly. And actually, as far as the money for replating, we had programmed, and I'd have to go back, sometime in '06 we had programmed one-and-a-half million dollars for a contract in the fall of 2008 -- no, 2007, I'm sorry. It was in the fall of 2007. We had a contract scheduled for that. Once January of '07 comes and we find that we have these three other -- these three options, one of them not requiring a plating, we instructed -- our metro district instructed, or rather we told our metro district in January of '07, delay the plating contract one year, still hold the money in the program, and the reason for doing that was we were going do the inspections in 2007. Had the inspections found problems, we would have returned to the plating concept. So the money was kept in our program, it was just set back then from the fall of '07 to sometime in '08. I think it was the fall of '08. And this was a million and a half dollars. This is a time period when we're spending 80 million a year on existing bridges, 40 million more on new bridges, a million and a half is not a concern given the 35W bridge and the importance on our system that that bridge had.

We also asked Mr. Dorgan about a newspaper article which suggested that, for at least a year before August 1, 2007, MnDOT engineers had openly discussed the possibility that the I-35W bridge could collapse and might have to be condemned. That discussion was as follows:

> MR. NOBLES: [M]y question to you is…were there officials, to your knowledge, at MnDOT, that were talking about the possibility that the 35W bridge could collapse and might have to be condemned?

> MR. DORGAN: No, I'm not aware of a conversation such as that. But, you know, I am aware as engineers we talked about the fact that it's a fracture critical structure. By definition, if one member fails, the bridge could collapse. So we certainly talked, in terms of the study, we talked about that, but it was not in the context that the bridge is in such condition that we're in dire concerns that it's going to collapse. It's more just the engineering fact that the way it's designed means if you lose a member it could collapse. But there wasn't anything about the 35W bridge, its condition at that point, that told us there was an imminent concern. Had there been we would have closed the bridge, if we truly had that concern.

Our interview with Mr. Dorgan covered various other topics, including a discussion about MnDOT's financial needs, the decision to hire the Wiss, Janney, Elstner Associates engineering firm after the collapse of the I-35W bridge, and whether MnDOT officials have restricted what he can say about MnDOT-related issues. An audio recording and transcript of the complete interview with Mr. Dorgan are available in our work papers.

Critical Deficiencies Found in Bridge and Culvert Inspections, 2007
APPENDIX E

Bridge	Bridge Owner	County Location	Road	Inspected By	Reason	Action	Result
6690	State	Kittson	MN 11	Bemidji District	Fascia beam cracks at welds.	Bridge was closed to traffic that evening. Permit loads changed and repair plan sent 8/21/07. Bridge repaired and reopened 8/25/07.	Resolved
49004	State	Morrison	US 10 Ramp	Brainerd District	High load hit resulting in steel crack of south fascia beam at weld.	Drill holes in the cracks to stop progression on 8/24/07.	Resolved
9988	County	Faribault	CNTY 126	Faribault County	Crushed timber pier cap on southern end of east pier.	Reduced the traffic to one lane on the northern half of the bridge. Barricades, stop signs, and "take turn" signs have also been installed at the bridge. Bridge is scheduled for replacement in 2009. PONTIS report will provide notes to reflect this critical finding.	Resolved
5804	County	Koochiching	CSAH 1	Koochiching County	Center stringers have 100% section loss in web in bearing areas.	Repair consisting of cribbing a support beam under the stringers from the bridge seat on the abutments. Repair to be completed by 10/9/07.	Resolved
5980	County	Lac Qui Parle	CSAH 15	Lac Qui Parle County	Severe section loss at floorbeam ends.	Inspection performed by consultant. New load rating completed that went from 26-40-40 to 10-16-16. Stickers put over current sign until new signs are made.	Resolved
5816	County	Norman	CSAH 3	Norman County	Continued undermining of east abutment now has all piling exposed.	Consultant recommended to close bridge. Bridge Office also stressed to close bridge. Bridge was closed on 9/7/07.	Bridge Closed
89850	County	Redwood	CSAH 17	Redwood County	Ultrasonic testing indication of pin at panel point L1.	Consultant’s nondestructive testing (NDT) personnel found the indication. Bridge will remain closed until Bridge Office verifies readings with own NDT people by 10/31/07. Meeting to take place on 11/7/07 to discuss findings and prepare plan of action. 11/30/07: Vertical clearance restriction and 6 ton posting signs in place. Advanced warning signs in place also. Bridge is reopened.	Resolved

Critical Deficiencies Found in Bridge and Culvert Inspections, 2007 (continued)

Bridge	Bridge Owner	County Location	Road	Inspected By	Reason	Action	Result
L6926	County	Redwood	TWNS 185	Redwood County	South abutment failure due to earth pressure and timber pile deterioration.	The County hired engineering consultant to complete a special inspection and load rating. Since the south abutment is failing due to earth pressure and timber pile deterioration, the consultant recommended closing the bridge. The County closed the bridge.	Bridge Closed
L2642	County	Sibley	CSAH 8	Sibley County	Timber columns all in condition state 4 (poor). Bearing capacity compromised.	Physical Inspection rating and substructure condition review per county engineer. Posted Bridge Weight Limit 5 tons (8/20/07). 12/21/07: Inspection rating received by County. Waiting on photos of 5 ton posting signs to verify.	Resolved pending photos of post sign
7738	County	St. Louis	CSAH 68	St. Louis County	Section loss of bottom chord increased from 37% to 45%.	New load rating completed for county. Rating was lowered and bridge to be posted. County notified of new rating on 9/5/07. Bridge was posted 28-40-40 based on load rating analysis on 10/10/07.	Resolved
1357	City of Carver	Carver	MUN 18 (Ash St)	Carver County	Element ratings all 2s and 3s (critical or serious).	Carver County recommending to City to close bridge entirely (currently open to pedestrian traffic).	Bridge Closure pending
L8864	City of Maple Grove	Hennepin	MSAS 140 (105th Ave)	City of Maple Grove	Timber bearing caps on abutments are not supporting superstructure as designed. Beam ends now supported by backfill.	City is having consultant work on a load rating (12/5/07). Results should be available in a few days.	Resolved pending new load rating
L9621	City of Russell	Lyon	MUN 5	Lyon County	West abutment cap severely crushed.	Bridge was closed by County Engineer until further analysis can be done.	Bridge Closed
L6509	Mountain Lake Township	Cottonwood	TWNS 38	Cottonwood County	Half of the pier timber piling hollow and crushing. Timber pier cap also crushing under the dead load.	Found during an inspection compliance review by the Bridge Office. This bridge was chosen for a field visit. County chose to close the bridge at 2 pm on 10/12/07 until further analysis could be completed.	Bridge Closed

Critical Deficiencies Found in Bridge and Culvert Inspections, 2007 (continued)

Bridge	Bridge Owner	County Location	Road	Inspected By	Reason	Action	Result
L1462	Wiscoy Township	Winona	TWNS 204	Winona County	Substructure NBI = 2 (critical) due to leaning east abutment with exposed rebar. Wing walls are also severely undermined.	The County is hiring Erickson Engineering to complete a load rating. Bridge is currently posted at 10 tons.	Pending new load rating
90664	Railroad	Hennepin	MUN 97 (St. Anthony Pkwy)	City of Minneapolis	3 of 11 stringers bearing on pier #3 cap. Bearing areas severely deteriorated on all. 11/9: Truss diagonals have 75% web loss on 1 of 2 channels near sidewalk level.	City and Bridge Office notified immediately. Special critical findings report sent out 11/7/07. This will remain in condition state 2 (critical) until a plan of action to post or repair the bridge is determined. 11/9: Meeting will be held next week with city and load rating consultant to determine course of action for truss diagonals. Pier #3 stringers are to be repaired next week.	Repairs to be made
5730	State Forest	Wabasha	SGAM 222	DNR	Scour 5' below the footing of west abutment.	Bridge closed to traffic on 11/9/07. Barricades in place. Bridge will remain closed until replaced most likely.	Bridge Closed

NOTE: These critical deficiencies were identified during inspections of roughly 3,900 state trunk highway structures and 10,500 local structures. MnDOT, local governments, and consultants conducted the inspections from spring 2007 through December 31.

SOURCE: Minnesota Department of Transportation data.

Minnesota Department of Transportation

Transportation Building
395 John Ireland Boulevard
Saint Paul, Minnesota 55155-1899

February 14, 2008

James R. Nobles
Legislative Auditor
State of Minnesota
Centennial Office Building
658 Cedar Street
St. Paul, Minnesota 55155

Dear Mr. Nobles:

On behalf of the Minnesota Department of Transportation and our entire management team, please accept my sincere appreciation for the thorough and professional nature of the Office of Legislative Auditor's evaluation of Minnesota's state roads and bridges and of Mn/DOT's infrastructure management systems.

The report provides accurate information and helpful recommendations. I believe the report will contribute to an enhanced discussion among all parties on how to cost-effectively preserve our critical transportation infrastructure.

Mn/DOT is pleased that the Office of the Legislative Auditor (OLA) has recognized that the agency carried out the great majority of recommendations made in a similar OLA report issued in 1997. Among these actions by Mn/DOT have been:

- Establishment of target performance levels for bridge and pavement condition.
- Development of a method to plan for future bridge performance needs, and improvement of our tools for predicting future pavement condition and needs.
- Regular reporting of the resources needed to achieve target performance levels.
- Establishment of pavement and bridge preventive maintenance programs.

Mn/DOT has taken additional steps, noted in this report, that we think go beyond specific 1997 recommendations. We are committing up to $80 million annually in new federal SAFETEA-LU revenues to replacement and rehabilitation of major bridges. We are also establishing new project scoping and cost estimating procedures to better manage project costs.

As noted in the report, pavement condition ratings are lower today than in 2002 and the percentage of miles of pavement below desired condition ratings is a concern. However, Mn/DOT has made improving pavement quality an investment priority and has achieved some measurable gains since 2003. Despite some recent success in stemming the decline in pavement condition, continuing and increasing investment in this area is, and will remain, a Mn/DOT priority, with the goal of meeting our pavement condition targets.

With respect to bridge condition, we appreciate that the report acknowledges the improvements and successes achieved in recent years through increased investment in bridge preservation. Mn/DOT has reduced the number of structurally deficient state bridges from 121 in 2002 to 94 in 2006. We are close to meeting our established performance targets for the system.

We agree that the inspection, maintenance and replacement of fracture critical bridges in poor condition is a very high priority. Replacement of several of these structures is scheduled, including the TH 11 Drayton Robin Bridge in 2008 and the Lafayette Bridge in 2011.

We appreciate your thorough analysis of Mn/DOT's bridge inspection and maintenance process, and your suggestions. Consistent with the report's recommendations, Mn/DOT will develop a statewide system for tracking maintenance decisions made in response to bridge inspections. With respect to the report's findings on the frequency of inspections, we respectfully believe that the proper bottom-line number to focus on is that more than 95% of inspections are completed within the established time limit. The Federal Highway Administration has consistently found Minnesota's inspection program to be in compliance.

Also consistent with the report's recommendations, Mn/DOT initiated and is substantially carrying out new financial management policies, though they are not yet formally adopted. We look forward to discussions on these policies with the Department of Finance and the Legislature.

The Minnesota Department of Transportation shares the desire of all Minnesota citizens for wise stewardship of our transportation infrastructure. We are committed to preservation of our state road and bridge system as our top priority, and to working with all parties to identify how together we can sustain a safe and sound transportation system.

Sincerely,

Carol Molnau

Carol L. Molnau
Lieutenant Governor and Commissioner

Recent Program Evaluations

Forthcoming Evaluation
Charter Schools, June 2008

Agriculture
"Green Acres" and Agricultural Land Preservation Programs, February 2008
Pesticide Regulation, March 2006
Animal Feedlot Regulation, January 1999

Criminal Justice
Substance Abuse Treatment, February 2006
Community Supervision of Sex Offenders, January 2005
CriMNet, March 2004
Chronic Offenders, February 2001
District Courts, January 2001

Education, K-12, and Preschool
School District Student Transportation, January 2008
School District Integration Revenue, November 2005
No Child Left Behind, February/March 2004
Charter School Financial Accountability, June 2003
Teacher Recruitment and Retention: Summary of Major Studies, March 2002
Early Childhood Education Programs, January 2001
School District Finances, February 2000

Education, Postsecondary
Compensation at the University of Minnesota, February 2004
Higher Education Tuition Reciprocity, September 2003
The MnSCU Merger, August 2000

Environment and Natural Resources
Watershed Management, January 2007
State-Funded Trails for Motorized Recreation, January 2003
Water Quality: Permitting and Compliance Monitoring, January 2002
Minnesota Pollution Control Agency Funding, January 2002
Recycling and Waste Reduction, January 2002
State Park Management, January 2000
Counties' Use of Administrative Penalties for Solid and Hazardous Waste Violations, February 1999
Metropolitan Mosquito Control District, January 1999

Financial Institutions, Insurance, and Regulated Industries
Liquor Regulation, March 2006
Energy Conservation Improvement Program, January 2005
Directory of Regulated Occupations in Minnesota, February 1999
Occupational Regulation, February 1999

Government Operations
County Veterans Service Offices, January 2008
Pensions for Volunteer Firefighters, January 2007
Postemployment Benefits for Public Employees, January 2007

Government Operations (continued)
State Grants to Nonprofit Organizations, January 2007
Tax Compliance, March 2006
Professional/Technical Contracting, January 2003
State Employee Health Insurance, February 2002
State Archaeologist, April 2001
State Employee Compensation, February 2000
State Mandates on Local Governments, January 2000

Health
Financial Management of Health Care Programs, February 2008
Nursing Home Inspections, February 2005
Minnesota Care, January 2003
Insurance for Behavioral Health Care, February 2001

Human Services
Human Services Administration, January 2007
Public Health Care Eligibility Determination for Noncitizens, April 2006
Substance Abuse Treatment, February 2006
Child Support Enforcement, February 2006
Child Care Reimbursement Rates, January 2005
Medicaid Home and Community-Based Waiver Services for Persons with Mental Retardation or Related Conditions, February 2004
Controlling Improper Payments in the Medicaid Assistance Program, August 2003
Economic Status of Welfare Recipients, January 2002
Juvenile Out-of-Home Placement, January 1999

Housing and Local Government
Preserving Housing: A Best Practices Review, April 2003
Managing Local Government Computer Systems: A Best Practices Review, April 2002
Local E-Government: A Best Practices Review, April 2002
Affordable Housing, January 2001
Preventive Maintenance for Local Government Buildings: A Best Practices Review, April 2000

Jobs, Training, and Labor
JOBZ Program, February 2008
Misclassification of Employees as Independent Contractors, November 2007
Prevailing Wages, January 2007
Workforce Development Services, February 2005
Financing Unemployment Insurance, January 2002

Miscellaneous
Economic Impact of Immigrants, May 2006
Gambling Regulation and Oversight, January 2005
Minnesota State Lottery, February 2004

Transportation
State Highways and Bridges, February 2008
Metropolitan Airports Commission, January 2003
Transit Services, February 1998

Evaluation reports can be obtained free of charge from the Legislative Auditor's Office, Program Evaluation Division, Room 140 Centennial Building, 658 Cedar Street, Saint Paul, Minnesota 55155, 651-296-4708. Full text versions of recent reports are also available at the OLA web site: http://www.auditor.leg.state.mn.us