

Policy 2: Infrastructure Preservation



Summary

Ensure the structural integrity of the transportation systems serving people and freight. Mn/DOT will carry out an investment program to repair and replace fracture critical and structurally deficient state highway bridges consistent with the directives of the 2008 Minnesota Legislature. Mn/DOT will continue to work toward achieving established performance targets for the condition of all state bridges, pavements, and other infrastructure. However, given the outlook for future revenues and other competing needs, it is unlikely that all targets will be achieved within the planning period. Mn/DOT will apply cost-effective strategies such as pavement reclamation and preventive maintenance programs to maximize available resources. Mn/DOT will also work with other public and private transportation systems of statewide importance to monitor the condition of their physical assets, identify investment needs, and provide technical assistance where appropriate.

- 2A. State Highway Bridge Conditions:** Mn/DOT will develop and implement a state highway bridge improvement program that is focused on meeting the overall bridge performance targets as well as fulfilling the requirements set forth by the 2008 Legislature.
- 2B. State Highway Pavement Conditions:** Mn/DOT will work toward meeting state highway pavement performance targets while minimizing life-cycle costs.
- 2C. Other State Highway Infrastructure:** Mn/DOT will systematically invest in other highway infrastructure such as drainage, traffic signals, lighting, and safety rest areas.
- 2D. Other Transportation Infrastructure:** Mn/DOT and its partners will monitor, report the condition of, and identify investment needs for key transportation infrastructure that is owned and operated by other jurisdictions and/or private sector companies, including roads, airports, rail, and port facilities.

Background and Context

Minnesota's transportation system is a complex network of roads, bridges, airports, railroads, ports, and other elements that have been developed over many years. While this system is constantly changing, it is composed of approximately 132,000 miles of roadways with more than 19,000 bridges, 4,500 miles of rail track, 28 major river/lake ports, 136 publicly owned airports, 50 full-service safety rest areas, numerous transit vehicles and routes, and one light rail transit line. This infrastructure has a replacement value in the billions of dollars. Maintaining the structural integrity and hence the functionality and efficiency of these systems is an enormous responsibility that is essential to supporting Minnesota's economy.

Infrastructure preservation focuses on capital investments that assure timely replacement of transportation system elements.

Like all states, Minnesota faces challenges associated with an aging transportation system, where many components are nearing the end of their design life and need major repairs and/or replacement. In addition, the components face constant deterioration due to use, age, and exposure to the environment.

Within the framework of the overall plan, Policy 2: Infrastructure Preservation, focuses on capital investments that assure timely replacement¹ and preventive maintenance of transportation system elements to maximize utility and maintain lowest life-cycle costs. The transportation infrastructure addressed within this policy area focuses primarily on state highway infrastructure such as highway pavements, bridges, safety rest areas, culverts, and signs. It also addresses the preservation of local road infrastructure as well as that of other travel modes such as airport runways, railroads, transit fleets, and ports.

Strategies

This section contains the strategies that Mn/DOT will use, in partnership with other agencies, organizations, and the private sector, to address transportation system preservation issues.

2A. State Highway Bridge Conditions

Mn/DOT will develop and implement a state highway bridge improvement program that is focused on meeting the overall bridge performance targets as well as fulfilling the requirements set forth by the 2008 Legislature.²

Mn/DOT is responsible for more than 4,500 bridges on the state highway system and these bridges are inspected either on a two-year cycle, or more frequently, depending upon their condition. Through preventive maintenance, rehabilitation, and replacement, the physical condition of Minnesota's bridges, as a whole, has improved in recent years and has met the identified system performance targets. However, a number of large, costly bridges will require replacement over the next 10 years due to their age and condition. Additionally, there are a number of bridges in poor condition that must be managed to ensure public safety.

The sizes of bridges being built today are an average of six times as large as their predecessors.

Many bridges were constructed during the interstate era, 1950s to 1970s, and are nearing the end of their design life. These bridges, often referred to as the "bridge bubble" or "bridge bulge" as illustrated in Figure 7.2.1, will pose significant financial challenges in the coming years.³ In addition, the sizes of bridges being built today are on the average six times as large as their predecessors.

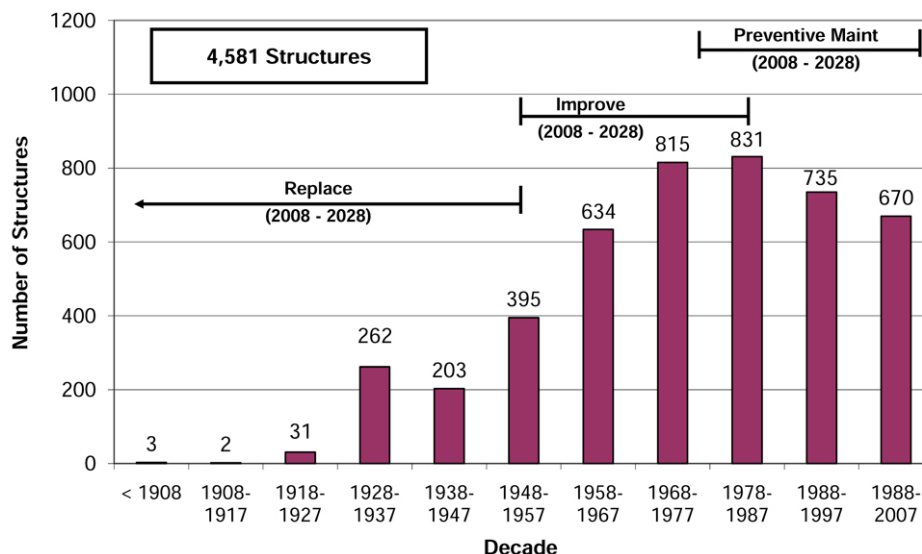


Figure 7.2.1 Age Profile and Investment Strategy of State Highway Bridges

Source: Mn/DOT Bridge Office

Requirements of Minnesota Laws 2008, Chapter 152

The collapse of the I-35W Bridge over the Mississippi River on August 1, 2007, resulted in a re-examination of Mn/DOT’s bridge inspection and preservation programs. The Legislature acted in February 2008 by passing Chapter 152, which provides new revenue and directs Mn/DOT to address specific state highway bridge preservation needs within 10 years based on specific criteria established in the law. Using the criteria set forth, Mn/DOT has identified 133 bridges that will either be replaced, undergo major rehabilitation, or be under contract for these improvements by June 30, 2018, at a preliminary cost estimate of \$2.4 billion. These bridge improvements will also work towards meeting bridge performance targets.

Existing Bridge Performance Targets

Mn/DOT has established bridge condition performance measures and targets that apply to the more than 4,500 bridges on the state highway system. While the Chapter 152 bridge program allows for 133 bridges to be rehabilitated or replaced over the next 10 years, Mn/DOT will also be required to make significant investments in the other nearly 4,400 bridges to meet performance targets and minimize life-cycle costs.

Mn/DOT is making changes in its bridge inspection methods and follow-up procedures, it is accelerating its bridge preventive maintenance activities,⁴ and it is significantly increasing its investment in bridge rehabilitation/replacement. The focus of these efforts is to limit ongoing bridge maintenance issues and to ensure public safety.

Mn/DOT is making changes in its bridge inspection methods and follow-up procedures.

Definition of Terms

In the aftermath of the I-35W Bridge collapse, the terms structurally deficient and/or fracture critical became part of the public discussion of bridge condition and public policy. It is helpful to have a clear and common understanding of these terms as there is a focus on the bridge program to repair and replace bridges deemed structurally deficient and/or fracture critical.

Structurally Deficient:

Structurally deficient refers to bridges that have a structural condition rating of 4 or less (deemed to be in poor condition). Structurally deficient means that elements of the bridge need to be more carefully monitored or repaired. The fact that a bridge is deficient, however, does not imply that it is likely to collapse or is unsafe. Most deficient bridges are left open to traffic while undergoing maintenance and repair. It would be expected that a bridge which becomes structurally deficient requires greater maintenance and closer monitoring in the latter stages of its service life. As reflected in the bridge measures and targets, Mn/DOT's objective is to manage the bridge inventory such that no more than 2 percent of the bridge area on principal arterials and no more than 8 percent of the bridge area on non-principal arterials are deemed to be structurally deficient in any given year.

Fracture Critical:

The term fracture critical indicates that if one main component of a bridge of the fracture critical design were to fail, the entire structure could fail. Fracture critical bridges are not necessarily structurally deficient and the designation of fracture critical does not mean the bridges are inherently unsafe. Fracture critical bridges built in the 1980s required more fracture resistant steel as well as a fracture control plan for welding. In Minnesota, the last bridges with a fracture critical detail were built in 1989.

Tier 1 Bridges:

Any bridge that has average daily traffic volume (ADT) greater than 1,000 and has a sufficiency rating at or below 50, or is identified by the commissioner as a priority bridge.

Tier 2 Bridges:

Any bridge that is not a Tier 1 bridge and is classified as fracture critical, or has a sufficiency rating of 80 or below. The legislation calls for the repair or replacement of all Tier 1 and Tier 2 bridges by June 30, 2018.

2B. State Highway Pavement Conditions

Mn/DOT will work toward meeting state highway pavement performance targets while minimizing life-cycle costs.

The number of miles of state highway pavements in “poor” condition is expected to double by 2030.

Mn/DOT maintains pavements for approximately 29,000 lane miles of state highways throughout Minnesota. This network moves the majority of people and freight and is critical to Minnesota’s economy. Poor pavement conditions can result in increased costs due to vehicle damage and damage to loads as well as safety problems.

The overall pavement conditions on state highways have deteriorated over the past five years and this trend is expected to continue. In fact, the percentage of pavements in poor condition is expected to double between 2007 and 2012 based on current conditions and planned projects.⁵ This trend is primarily due to fewer miles of pavement reconstruction or rehabilitation work that is done.



This picture shows a roadway with a “poor” pavement condition rating of ride quality index two or less.

While limited by increasing construction costs and the need to provide a balanced investment program across competing objectives, Mn/DOT will strive to improve pavement performance. To accomplish this Mn/DOT will:

- a. Over the short term, increase the level of investment in pavement reconstruction and rehabilitation over previous levels.
- b. Continue pavement preventive maintenance strategies such as seal coats, joint seals, micro-surfacing, and overlays.
- c. Employ lower-cost fixes such as reclamation⁶ to make dollars stretch further and employ cost-effective safety improvements to address safety concerns.
- d. Encourage research activities for the development of new materials, processes, and procedures that gain efficiencies and/or extend life-cycles.
- e. Evaluate innovative contracting methods and assess potential advantages of bundling projects to lower costs.

2C. Other State Highway Infrastructure

Mn/DOT will systematically invest in other highway infrastructure such as drainage, traffic signals, lighting, and safety rest areas.

The highway system is comprised of many other infrastructure elements that are important to its overall function. These include traffic signals that control traffic flow at intersections, drainage features which channel, control and filter runoff, lighting which illuminates intersections or roadways to improve visibility and safety, signs which direct and guide motorists, and safety rest areas which afford motorists a safe location to take a break during their trip. All of these infrastructure elements age with time and, as a result, need to be replaced or rehabilitated.

To address these other highway infrastructure needs, Mn/DOT will:

- a. Improve existing systems and/or develop asset management systems for essential system elements including signals, drainage, retaining walls, signage, and safety rest areas. It will use these systems to monitor and track performance trends as well as assist in identifying future capital needs.⁷
- b. Continue to perform preventive maintenance to extend infrastructure life-cycle.
- c. Develop new ways to track and systematically improve electronic traffic management systems including the Regional Traffic Management Centers (RTMC) and Transportation Operations Communication Centers (TOCC).

2D. Other Transportation Infrastructure

Mn/DOT and its partners will monitor, report the condition of, and identify investment needs for key transportation infrastructure that is owned and operated by other jurisdictions and/or private sector companies, including roads, airports, rail, and port facilities.

Governmental jurisdictions and private-sector companies are responsible for numerous other transportation networks and infrastructure such as local roads, rail, air, water, and transit networks. These networks and services are critical to the overall transportation system and frequently interface with other system elements. There is a strong public interest in ensuring that these transportation networks remain workable and that agencies and private sector companies are reinvesting in these systems. For this reason, Mn/DOT will:

- a. Work with local transportation authorities to track the condition of the County State Aid Highway (CSAH) pavements.
- b. Work with partners to inspect and report the condition of publicly owned airport pavements in Greater Minnesota. Mn/DOT will work with its local airport partners to guide investment decisions that maintain and preserve airport pavements.
- c. Work with partners to report the condition of the Greater Minnesota and Metro Area transit fleets.
- d. Develop methods for tracking and reporting the condition of Class 1 rail systems and port conditions.

- e. Develop modal investment plans in consultation with its partners. These plans will evaluate the needs of these systems, prioritize investments, and establish implementation roles and responsibilities.

Performance Measures and Indicators

Performance measures and/or indicators provide quantitative information to managers and/or decision makers. This information will be tracked over time to monitor yearly performance levels. Numerous performance measures and indicators have been either developed or identified for this policy area. Measures in **bold** have been selected as prime examples and are presented in this section. A full description of all performance measures and indicators associated with this plan is provided in Appendix D.

- **Structural Condition of State Highway Bridges**
- **Ride Quality Index (RQI) for State Highway Pavements**
- Remaining Service Life (RSL) for State Highway Pavements
- Physical Condition of Safety Rest Areas
- Remaining Service Life (RSL) for State Highway Signage
- Pavement Condition for Public Airports in Greater Minnesota
- Remaining Service Life (RSL) for Transit Fleets in Greater Minnesota
- Average Bus Age for Metro Transit's Fleet
- Ride Quality Index (RQI) for County Highway Pavements
- Structural Condition for Local Road Bridges

Developmental Measures

- Track Speed on Class 2 and 3 Railroads
- Drainage System Condition
- Condition of State Highway Signals and Lighting
- Port Conditions

Structural Condition of State Highway Bridges

The condition measure for state highway bridges is based on the National Bridge Inventory (NBI) structural condition index.⁸ This rating is a measure of the structural integrity of critical bridge elements and is based on a scale of one to nine with nine being the best. The physical condition of Minnesota’s bridges is determined through field inspections. Most Minnesota bridges are inspected on a two-year cycle, with the remaining bridges inspected annually by virtue of their condition. The actual bridge condition system performance measure is based on the percentage of bridge deck area that is in good, fair, and poor categories.⁹ The intent is to have a large percentage of bridges deck area in the “good” and “fair” categories and a very small percentage in the “poor” category.

Figures 7.2.2 and 7.2.3 show bridge condition trends for the principal arterial and non-principal arterial highways on the state highway system.

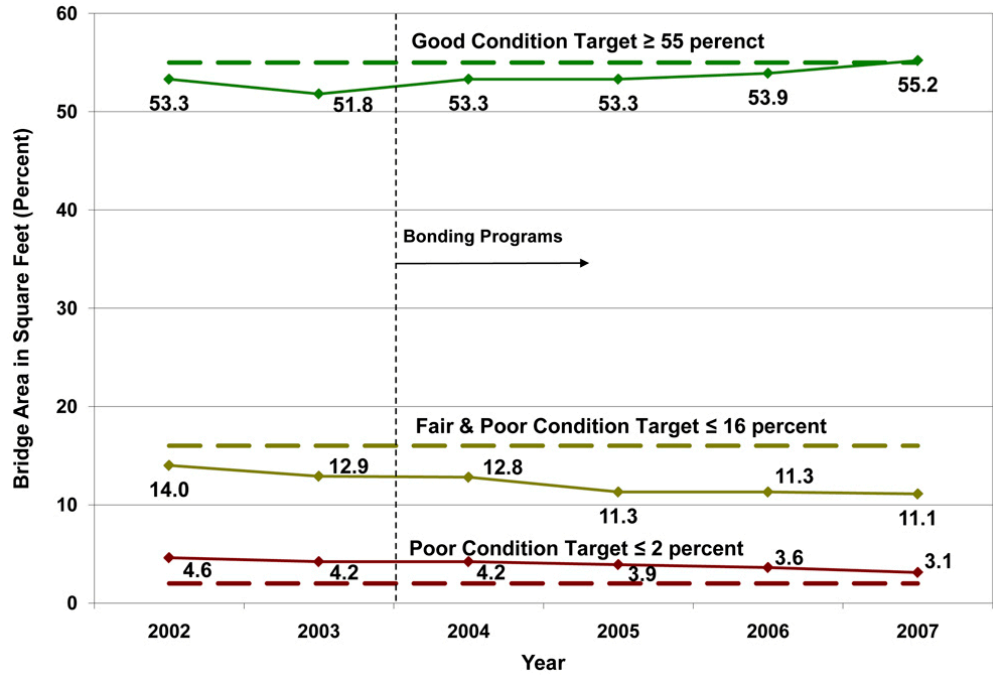


Figure 7.2.2 Principal Arterial Bridge Condition

Source: Mn/DOT Bridge Office

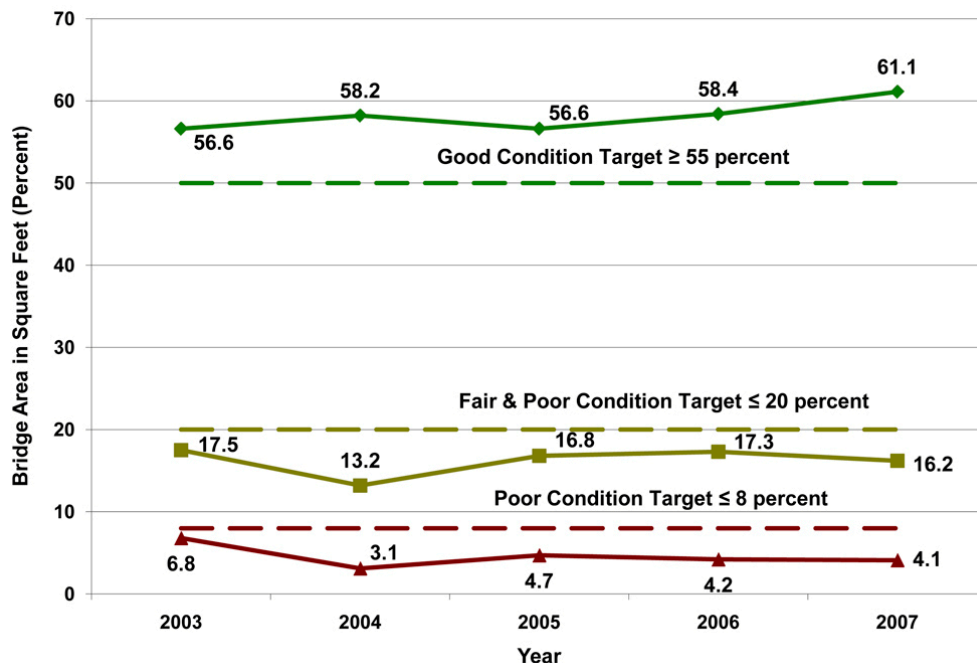


Figure 7.2.3 Non-Principal Arterial Bridge Condition

Source: Mn/DOT Bridge Office

Based on these system performance measures, bridge conditions have held steady and/or improved slightly in recent years. As a percentage of total bridge deck area, principal arterial and non-principal arterial bridges in “good” condition have both increased since 2003. Principal arterial bridges surpassed the target of 55 percent in both 2006 and 2007, while non-principal arterial bridges have consistently met targets for the past 5 years. The recent upward trend is largely a result of bridge replacement and system expansion.

The percent of total deck area in the combined “fair” and “poor” category has been steady or decreasing (improving) since about 2002 and continues to meet the targets for both principal and non-principal arterial bridges.

Bridge deck area in “poor” condition (structurally deficient) has been fairly steady for both principal and non-principal arterial bridges. In 2007, principal arterial bridges failed to meet targets for the percentage of system in “poor” condition, while non-principal arterial bridges met targets. When measured in terms of bridges, rather than bridge deck area, there has been improvement. The number of structurally deficient bridges has fallen from 121 in 2002, to 94 in 2006. The percentage of bridge deck area in poor condition will begin to improve as larger bridges are programmed for replacement in the short term.

Ride Quality Index for State Highway Pavements

The condition of state highway pavement condition is measured by the Ride Quality Index (RQI). The RQI is Mn/DOT’s assessment of ride smoothness and is measured on a scale of zero to five with five being the best. The objective is to provide a smooth ride (good condition = rating of three or better) for a large percentage of the state highway system and limit the number of miles that have a rough ride (poor condition = two or less). The pavement measures have been broken into two subsets of state highways – one for principal arterials (roadways that have the highest levels of traffic and connect major trade centers), and one for non-principal arterials (all other state highways).

Figures 7.2.4 and 7.2.5 show the pavement condition trends for both principal arterials and non-principal arterials. The performance trend shows that the percentage of “good” pavements has declined while the percentage of “poor” pavements has increased. Based on the pavement model, this trend is expected to continue with the present level of transportation funding.

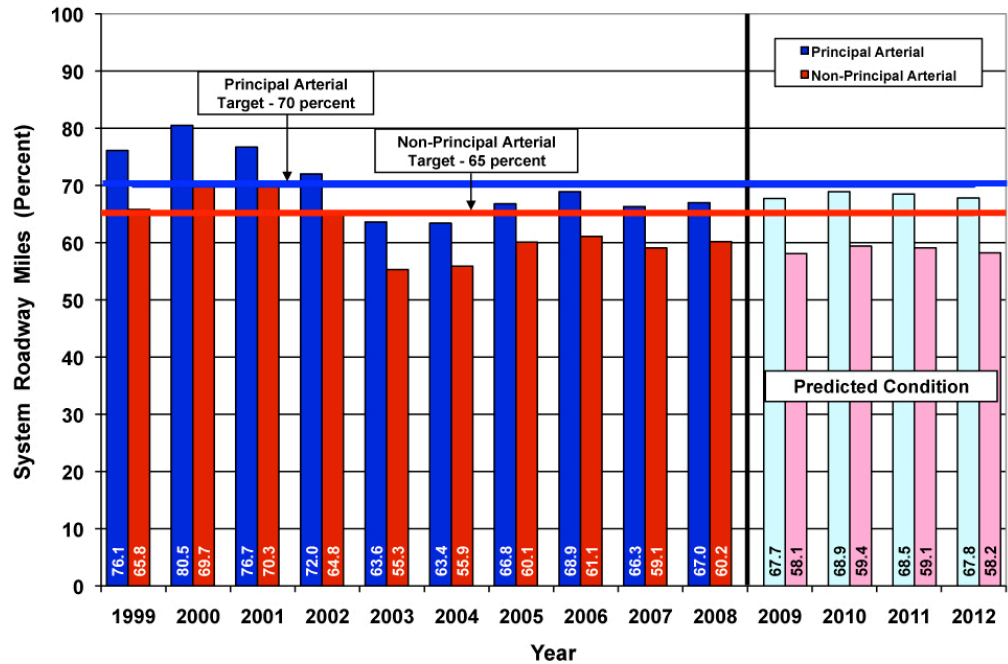


Figure 7.2.4 Percentage of State Highway System in Good Condition

Source: Mn/DOT Office of Materials Services

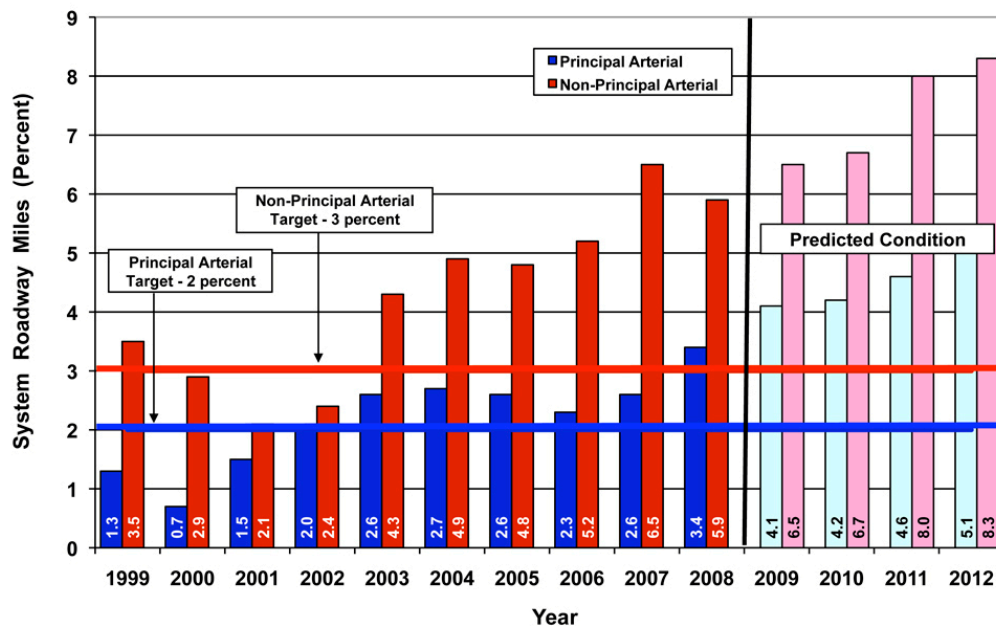


Figure 7.2.5 Percentage of State Highway System in Poor Condition

Source: Mn/DOT Office of Materials Services

- ¹ In contrast, Policy 3: System Maintenance and Security address system operations and maintenance activities that optimize the operations of the elements of the transportation system.
- ² Minnesota Laws 2008, Chapter 152.
- ³ The annual funding needs for state highway bridge preservation will rise to \$145 million in current dollars in the 2024 to 2030 time frame.
- ⁴ Bridge inspection, inspection follow-up, and preventive maintenance are discussed in Policy 3: Maintenance and Security.
- ⁵ Based on assessment using Mn/DOT’s pavement management model.
- ⁶ Reclamation is a form of pavement rehabilitation in which old asphalt and base materials are pulverized and compacted to produce a strong, durable base for either an asphalt or concrete surface. Reclamation projects often have a more limited scope and, therefore, lower costs than a traditional reconstruction project and can be a good option for lower volume roads with adequate capacity.
- ⁷ Mn/DOT is in the process of developing drainage data (HYDINFRA), sign management (SignTrk), and safety rest area management systems.
- ⁸ The National Bridge Inventory (NBI) structural condition rating index is used for rating the physical condition of bridges and culverts with a deck span of 20 feet or longer.
- ⁹ Scores of four or less are poor, five and six are fair, and seven through nine are good. System percentages for the three different categories are determined by aggregating individual bridge ratings together. Individual bridge ratings are weighted by the size of the bridge (square feet of bridge deck). The total square feet in each category is then compared to the total square feet of bridge deck in the entire system. This is done for both principal and non-principal roadways.