



Report on Department of Transportation Management Changes

February 1, 2011



Your Destination...Our Priority



Contents

| | |
|-------------------------------------------------------------------------------------------------------------------|----|
| INTRODUCTION | 3 |
| Minnesota Session Laws Chapter 350 Section 9 – Report On Department of Transportation Management Changes | 3 |
| EXECUTIVE SUMMARY | 4 |
| ORGANIZATIONAL STRUCTURE AND CHANGES SINCE AUGUST 2007 | 7 |
| District Organization and Staffing | 7 |
| Bridge Maintenance | 7 |
| Bridge Inspections | 7 |
| Central Office Bridge Organization and Staffing | 8 |
| Bridge Inspections Unit | 8 |
| Bridge Data Management Unit | 9 |
| Bridge Ratings Unit | 9 |
| Bridge Construction Unit | 9 |
| Bridge Inspection and Maintenance Expenditures | 10 |
| DIVISION OF BRIDGE RELATED DUTIES AND RESPONSIBILITIES | 11 |
| Bridge Inspection Related Duties and Decision Making Responsibilities | 11 |
| Bridge Office Responsibilities | 12 |
| Delegated Responsibilities | 13 |
| Bridge Maintenance Related Duties and Decision Making Responsibilities | 14 |
| Mn/DOT District Maintenance Functions | 14 |
| Mn/DOT Bridge Office Maintenance Support | 15 |
| CURRENT AGENCY PROCEDURES AND PROCESSES AND RELATED CHANGES | 17 |
| Bridge Re-Rating: Initiation and Use of Bridge Inspection Findings | 17 |
| Gusset Plates Included in Bridge Load Rating Analysis | 17 |

| | |
|------------------------------------------------------------------------------------------------------------------------------------------|-----------|
| Fracture Critical Inspection Reports Reviewed by Bridge Office Engineers | 18 |
| Guidelines for Rating Engineers and Inspectors Added to Mn/DOT Manuals..... | 18 |
| Implementation of Agency Wide Standards for Documenting Inspection Findings and Decision Making for Post-Inspection Maintenance | 18 |
| Bridge Inspection Maintenance Assessment Form..... | 19 |
| Maintenance Repair Planning Spreadsheet..... | 19 |
| Performance Measures..... | 19 |
| Bridge Inspection Software..... | 20 |
| Changes to Further Ensure or Enhance Minnesota’s Transportation Infrastructure Safety | 20 |
| Changes to Bridge Construction Specifications | 20 |
| Checking Requirements for Consultant Prepared Plans for Major Bridges..... | 20 |
| Risk-Based Analysis Added to Mn/DOT’s Bridge Project Planning Process | 21 |
| Changes to Truck Loading Models for Bridge Rating | 21 |
| Additional Load Ratings to Address 2007 FHWA NBIS Review Findings..... | 21 |
| BUDGET ANALYSIS FOR TRUNK HIGHWAY CONSTRUCTION PROJECTS FY 2012-18..... | 22 |
| Budget Analysis of Anticipated Funding and Funding Allocations..... | 22 |
| 2012 to 2018 Performance-Based Needs | 22 |
| Funding Challenges and Risks | 24 |

INTRODUCTION

This report on Department of Transportation Management Changes is submitted by the commissioner of the Minnesota Department of Transportation in response to the requirements specified in the 2010 Session Laws of Minnesota, Chapter 350, Section 9.

The estimated costs associated with the preparation of this report include the following:

Staff time \$12,000

Minnesota Session Laws Chapter 350 Section 9 – Report On Department of Transportation Management Changes

(a) By February 1, 2011, the Commissioner of Transportation shall submit a report electronically to the members of the Senate and House of Representatives committees with jurisdiction over transportation policy and finance concerning recent changes in the department’s organizational structure, internal procedures and practices and anticipated budget. The report must include, but is not limited to:

(1) a summary and review of the department’s organizational structure for bridge management, maintenance, and inspections, including a brief explanation of any relevant structural or organizational changes made since August 1, 2007;

(2) an analysis of the division of bridge-related duties and decision-making responsibilities between districts and central administration;

(3) a summary of current agency procedures and processes and any changes made since August 1, 2007, related to:

- (i) initiation of bridge re-rating and use of bridge inspection findings in the re-rating process;
- (ii) implementation of agency-wide standards for documenting bridge inspection findings and decision making for post-inspection bridge maintenance; and
- (iii) other changes designed to ensure or enhance the safety of Minnesota’s transportation infrastructure; and

(4) A budget analysis of anticipated funding and funding allocations for pavement preservation and highway maintenance, safety projects, mobility enhancement projects, and highway and bridge construction for fiscal years 2012 through 2018, including a discussion of any anticipated budgetary challenges or risks.

(b) In addition to an electronic report, the commissioner shall prepare a summary of findings from the report for distribution and oral testimony to the chairs of the Senate and House of Representative committees with jurisdiction over transportation finance, who shall make every reasonable effort to arrange testimony from the department during the 2011 legislative session.

EXECUTIVE SUMMARY

Mn/DOT has made several changes to its bridge inspection and maintenance processes after the collapse of the Interstate 35W bridge, which resulted in the tragic death of 13 people and injury to more than 100 others. While the National Transportation Safety Board investigation concluded that the bridge collapse was the result of inadequately designed gusset plates, their investigation process, along with findings from Minnesota's Office of the Legislative Auditor and others, identified shortcomings in Mn/DOT's bridge inspection and maintenance programs. This report documents changes Mn/DOT has made since the collapse of the bridge. It also contains a budget analysis of planned allocations for all highway projects for fiscal years 2012 through 2018.

Mn/DOT uses a decentralized organization to operate and maintain its transportation infrastructure, guided by a central organization that is responsible to provide support and to set policy and management direction to accomplish statewide transportation goals. Mn/DOT's eight transportation districts are responsible for inspecting and maintaining their bridge inventory. Each District's Bridge Engineer is responsible to manage those activities within the district. The centrally located Bridge Office provides training and technical support to the districts and maintains a bridge management data system to store current and historical record of bridge condition and inventory. By the Code of Federal Regulations, the Mn/DOT Bridge Office is delegated responsibility for managing the statewide bridge inspection program for all state and locally owned bridges. Within the Bridge Office, staff assigned to the Bridge Construction and Maintenance Section are responsible for working with District Bridge Engineers to accomplish district and statewide bridge maintenance and inspection goals.

Since August 2007, statewide staffing to perform bridge maintenance has increased by about 50 percent, or 55 positions. Standard methods have recently been developed and are being used statewide to report maintenance needs during bridge inspections and to prioritize and schedule follow-up maintenance. In 2009, new performance measures were developed to report progress in completing planned preventive maintenance and high priority reactive maintenance items identified during bridge inspections. The first year of reporting showed that 88 percent of high priority maintenance items (excluding inspections to detect and remove loose bridge deck concrete) were completed within one year after being reported, and 100 percent of planned preventive maintenance was done. Since 2006, funding for bridge maintenance activities has increased by \$3,789,000, or nearly 60 percent, and nearly 27 percent since 2008.

District bridge inspectors perform routine inspections of all trunk highway bridges at least once every 24 months. Bridges in poor condition and fracture critical bridges are inspected every year. The Bridge Office performs in-depth inspections of fracture critical bridges located on both the state and local highway systems. The Rochester and Metro Districts perform fracture critical inspections of many of their trunk highway bridges under the direction and authority of the Bridge Office. Written policy regarding fracture critical inspections was changed in 2008, which clearly placed responsibility for fracture critical inspections with the Bridge Office.

Mn/DOT has developed performance measures for bridge inspections. In 2009, 2,874 (94.1 percent) of scheduled routine bridge inspections were completed on time. The remaining 181 inspections were completed during their scheduled year, but were more than 30 days late. In 2009, 99 percent of all fracture critical inspections were completed on time. One was completed more than 30 days late. Funding for bridge inspections has increased from \$2,138,000 in 2006 to \$4,633,000 by the end of FY 2010, an increase of more than 100 percent. Funding levels were even higher in 2008 (\$7,052,000) following the collapse since all trunk highway bridges were inspected that year by a governor's mandate, regardless of inspection due date. A significant part of this increase resulted from changes in federal regulations, which nearly doubled the number of fracture critical inspections Mn/DOT was required to perform each year, and which expanded Mn/DOT's responsibility to manage the statewide bridge inspection program. Bridge Office Inspection Unit staffing has increased by five staff members. Currently, there are 86 Mn/DOT employees statewide certified as Team Leader to perform bridge inspections.

Significant changes in the inspection program since 2008 include development of a written Quality Control/Quality Assurance policy for bridge inspections and a new requirement that a structural engineer review and evaluate all fracture critical bridge inspection reports. This ensures that the district or local agency bridge owner is informed whether the bridge is performing as designed, if a new load rating is needed, or if significant structural repairs are needed to maintain load capacity. New inspection elements were added to inspection reports that specifically rated paint condition and distortion of truss gusset plate connections. All gusset plate connections on trunk highway bridges have been inspected visually and corrosion has been measured using non-destructive testing methods (NDT). Using newly-developed analysis methods, all trunk highway truss bridges have been rated, including an accurate assessment of the capacity of gusset plate connections. As a result, one truss bridge was closed and rebuilt and three truss bridges were repaired and strengthened. Local agencies screened all 87 of their truss bridges and chose to close 27, and another 24 were re-rated using the new rating methods. Mn/DOT manuals have been updated to provide inspectors and ratings engineers additional guidance to recognize conditions that are likely to reduce bridge load capacity. The Bridge Office is working with districts to begin using new bridge inspection software and hardware that will allow the bridge inspector and the bridge engineer to access inspection manuals, photographs, plans, inventory data and previous inspections while they are on site performing inspections.

Mn/DOT has also modified its construction specifications to clearly identify the maximum weights of material stockpiles and construction equipment that can be stored on a bridge that is under construction. The Bridge Office has developed new policy requiring an independent design check of bridges with spans over 250 feet and a peer review by a second design consultant for other unique bridge types. The Bridge Office is also working with a national expert to incorporate risk factors into its bridge project programming process, beginning in 2011.

Although there is a commitment to funding bridge and other program needs through 2018, there are significant funding gaps in some programs. Chapter 152 Tier 1 and Tier 2 bridges will be fully funded, but only 85 percent of Tier 3 bridge preservation projects are projected to be funded. Only 51 percent of pavement preservation, 20 percent of safety, and 1 percent of mobility projects are funded based on

projected performance based needs. The result will be a decrease in ride quality and reduced expectations for mobility within the Twin Cities Metro area and Greater Minnesota and for Regional and Community Improvement Priorities.

ORGANIZATIONAL STRUCTURE AND CHANGES SINCE AUGUST 2007

Summarize and review the department organizational structure for bridge management, maintenance, and inspections, including a brief explanation of any relevant structural or organizational changes made since August 1, 2007.

Mn/DOT has a decentralized organizational structure to operate and maintain its transportation infrastructure. The state is divided into eight transportation districts, each of which are held accountable by central office functions to, among other things, inspect, maintain and manage the bridge inventory located within district boundaries.

District Organization and Staffing

Each Mn/DOT district has a management position, delegated by the District Engineer, that is assigned responsibility for directing the district's bridge maintenance resources, including bridge maintenance and inspection staff. In addition to the management position, all districts have a separate District Bridge Engineer position that is responsible to administer the district's bridge inspection program, prioritize the work of bridge maintenance staff, and select contracted bridge repair projects. A summary of district bridge maintenance functions and changes that have occurred since August 1, 2007 follows:

Bridge Maintenance

Each district has specially trained bridge workers and supervisors responsible for maintaining their bridge inventories. The number of bridge workers in each district varies according to the number of bridges in the district, average bridge condition and traffic carried. Most smaller districts have two bridge crews with as few as four bridge workers per crew. Metro District, which maintains more than half of the total bridge area in the state, had five crews prior to August 1, 2007. Rochester District had three crews. Since then the Metro District has added one crew and the Duluth District has added one crew.

Bridge Inspections

Bridge safety inspections are performed by the district's Bridge Maintenance Supervisors and senior bridge workers who have been certified as Team Leaders. This certification requires five years of bridge inspection experience and completion of a Federal Highway Administration approved comprehensive bridge inspection training course. Five districts have engineering staff assigned to coordinate or to assist with district inspections. Metro and Rochester districts also have engineers and technicians assigned to perform fracture critical bridge inspections within their district under the direction of Mn/DOT's Bridge Office. In 2008, Mn/DOT had 75 employees statewide who were certified to perform bridge inspections. In 2010, Mn/DOT had 86 employees certified as inspection Team Leaders.

Mn/DOT districts have significantly increased resources dedicated to bridge maintenance and inspections. Prior to August 2007, statewide bridge maintenance and inspection staffing totaled 119

positions. As of July 2010, staffing has increased by 55 positions or nearly 50 percent. In Metro, Duluth, and Rochester districts, where nearly 80 percent of the state's bridge inventory is located, 44 new positions were added. One significant change in Metro District was the creation of a management level position to direct the district's bridge maintenance and inspection functions. Due to the number and complexity of bridges located in the Twin Cities metro area, a structural engineer with strong bridge design background was hired to fill the position. The Duluth and Rochester districts have also added new positions under their District Bridge Engineer to assist with inspections and to help identify and prioritize bridge maintenance needs.

Central Office Bridge Organization and Staffing

Mn/DOT's Bridge Office is responsible to manage the statewide bridge inspection program, to provide structural engineering support as requested by District Bridge Engineers, and based on inspection data, to recommend contract bridge repairs and replacements. The Bridge Office is divided into three separately managed functions: Bridge Design, Bridge Planning, and Bridge Construction and Maintenance. The manager of the Bridge Construction and Maintenance Section is primarily responsible for developing the policies and measures needed to manage the state's bridge inspection program and to support the district bridge maintenance efforts.

In addition to providing direction and support to the districts, federal regulations (Title 23 Part 650 Subpart C) hold Mn/DOT responsible for inspection of all state and locally owned bridges. Several of the functions within the Bridge Construction and Maintenance Section support that federal mandate. A summary follows of the Bridge Office maintenance and inspection functions, and changes to those functions that have occurred since August 1, 2007.

Bridge Inspections Unit

This unit is responsible for administering the statewide bridge inspection program, including the statewide fracture critical bridge inspections program. In addition, the unit performs special inspections for bridges with special features that require in-depth inspections or non-destructive testing (NDT). The unit provides training for bridge inspectors and program administrators. This certification program is for inspectors who meet state and federally regulated qualifications, perform quality review of district and local agency administered bridge inspection programs, develop inspection guidance, manuals and policy, and perform or direct all trunk highway and local agency fracture critical bridge inspections.

The National Bridge Inspection Standards was substantially rewritten in December 2004. Mn/DOT's plan to implement those changes was submitted to the FHWA in 2006. The revised NBIS rules nearly doubled the statewide number of fracture critical bridge inspections Mn/DOT was doing each year, and increased Mn/DOT's oversight responsibilities for local agency bridge inspection programs. Those changes greatly increased the unit's staffing and equipment needs. Prior to August 1, 2007, the Bridge Inspections Unit was staffed with five engineering or technical positions. Since then staffing has doubled and consists of seven engineering and four technical positions. Three new under-bridge inspection vehicles have been purchased, increasing the fleet to seven vehicles.

Bridge Data Management Unit

This unit is responsible for collecting inspection reports and data from all inspection agencies statewide and reporting that data on an annual basis to the FHWA. The unit produces numerous reports relating to statewide bridge conditions, inspections, ratings and trends that are requested each year by Commissioner's staff, district staff and others. Staffing consists of one engineer and two technicians. No changes to staffing levels have occurred since 2007.

Bridge Ratings Unit

This unit is responsible to calculate load ratings and load posting requirements for all trunk highway bridges and to approve overweight truck permit route requests. Changes to load ratings are based on deterioration reported during bridge inspections, to account for increases in legal truck loads, or when significant changes have been made to bridge engineering codes. Due to changes in legal truck loads and to changes bridge rating codes and rating software the number of bridges that require new ratings on both the state and local systems has increased significantly. A third ratings engineer was added to the unit in 2009. No other changes have occurred since 2007.

Bridge Construction Unit

Bridge Construction Unit engineers are responsible to provide support for projects under construction and to recommend bridges for contract repairs. Three engineers in the unit are assigned to work on a daily basis with district construction and maintenance staff located in each of the northern, Twin Cities metro area and southern regions of the state. Every four years the Bridge Construction Unit, together with input from District Bridge Engineers, uses bridge inspection data to prepare a master list of projects that should be considered for replacement or major repair during 10- and 20 -year planning periods. The Unit consists of 4 engineering positions and a senior engineering specialist. No significant changes have been made recently.

Since August 1, 2007, a special unit of the Bridge Design Section has been assigned responsibility to review all In-Depth Fracture Critical and special inspections reports in order to identify significant structural issues. They assess whether the bridge is functioning as designed, if high priority repairs to the bridge are needed and if changed conditions indicate the bridge should be re-rated. Their evaluation is forwarded to the district or local agency bridge engineer and to Mn/DOT's Bridge Ratings Engineer, if necessary. Four additional positions were added to the Bridge Design Section to create this Bridge Repair and Evaluation Unit. Recent retirements have reduced staffing to two engineers. Other design engineers in the Bridge Design Section have been enlisted to assist in reviewing the reports when required.

Bridge Inspection and Maintenance Expenditures

The following is a breakdown of bridge maintenance-related expenditures made since FY 2006.

| Year | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 |
|-------------------|----------------|----------------|----------------|----------------|----------------|
| District | \$6,310,349 | \$9,381,492 | \$7,919,731 | \$9,012,312 | \$10,029,548 |
| Central Office | \$114,642 | \$149,205 | \$129,392 | \$155,755 | \$184,949 |
| Total Maintenance | \$6,424,991 | \$9,530,697 | \$8,049,123 | \$9,168,067 | \$10,214,488 |

The following is the history of inspection-related expenditures made since FY 2006.

| Year | FY 2006 | FY 2007 | FY 2008 | FY 2009 | FY 2010 |
|------------------|----------------|----------------|----------------|----------------|----------------|
| District | \$1,516,406 | \$1,387,227 | \$1,994,132 | \$1,989,386 | \$2,317,543 |
| Central | \$621,395 | \$750,385 | \$5,057,528 | \$2,101,608 | \$2,314,991 |
| Total Inspection | \$2,137,801 | \$2,137,612 | \$7,051,660 | \$4,090,994 | \$4,632,535 |

The above figures include expenditures plus open encumbrances at fiscal close, inventory draws, equipment use in proportion to use, and Bridge and Road Construction (BARC) funds.

DIVISION OF BRIDGE-RELATED DUTIES AND RESPONSIBILITIES

Analyze the division of bridge related duties and decision making responsibilities between districts and central administration.

Mn/DOT has divided its responsibility for operation and maintenance of state highways into eight regional districts all within Mn/DOT's Operations Division. District maintenance and inspection staff are typically supervised by one or more professional engineers. Maintenance workers generally are well trained and experienced and they have the skills and equipment needed to maintain their bridges. When maintenance staff have questions about a condition noted on a bridge inspection, or how to proceed with a repair, the District Bridge Engineer is locally available to quickly assess the situation and to respond appropriately. The District Bridge Engineer confers with Mn/DOT's Bridge Office engineers when repairs are structural in nature.

Mn/DOT's Bridge Office is an expert office within the Engineering Services Division. The office is responsible for preliminary bridge planning, bridge design, managing the statewide bridge inspection program and to provide construction, maintenance and hydraulic technical services to districts. The Design Section is responsible for designing the state's bridges and managing the bridge design consultants. Because of its bridge design responsibilities, the Bridge Office is able to maintain a stable population of experienced bridge engineers with strong structural backgrounds. These engineers form the candidate pool for other bridge-oriented positions within the office and bridge-related operations or maintenance positions within the districts.

The following is an analysis of the division of bridge-related duties and decision-making responsibilities with respect to bridge inspections between the districts and central administration:

Bridge Inspection-Related Duties and Decision-Making Responsibilities

National Bridge Inspection Standards require each state to have an organization that is responsible for statewide bridge inspection policies and procedures, quality assurance and quality control, preparation and maintenance of a bridge inventory database, bridge inspections and load ratings. They also require that the state have a qualified Program Manager who has been delegated these responsibilities.

Mn/DOT's State Bridge Engineer has delegated authority for, among other things, the Statewide Bridge Inspections Program. The State Bridge Engineer has assigned Inspection Program Manager responsibilities to the Bridge Construction and Maintenance Engineer. In turn, the Bridge Construction and Maintenance Engineer works with the Bridge Inspections Engineer and the Bridge Inspections Unit to administer the statewide bridge inspection program. Many of the responsibilities for administering district bridge inspection programs have been further delegated through District Transportation Directors down to the District Bridge Engineers. The FHWA annually conducts a review of Mn/DOT's bridge inspection program to determine if it is compliant with NBIS requirements.

Bridge Office Responsibilities

As NBIS Program Manager, the State Bridge Construction and Maintenance Engineer is responsible for overseeing the following functions within the Bridge Office:

Inspection Policies

The bridge office has issued three technical memorandums which establish standard statewide policies governing bridge inspections: 1) *No. 08-01-B-01: Guidelines for In-Depth inspection of Fracture Critical Bridges, Special Inspections for Other Bridges, and for Underwater Inspections;* 2) *No. 08-02-B-02: Critical Deficiencies found during Bridge Inspections;* and 3) *No. 04-08-B-01: Guidelines for Bridge Inspection Frequency.* It also maintains a Bridge Inspection Manual which provides detailed descriptions used by state and local inspectors to rate bridge condition and to report data. Mn/DOT's quality assurance and quality control procedures governing its statewide inspection program is described comprehensively on the Mn/DOT website in the document titled: *Mn/DOT Quality Assurance and Quality Control Procedures for Bridge Inspections.*

Quality Assurance Review of District Bridge Inspection Programs

Mn/DOT's Bridge Inspections Unit assists the FHWA to review one or two Mn/DOT district bridge inspection programs each year. District reviews are rotated so that all districts are reviewed every five years. The purpose of the review is to evaluate whether the districts' procedures and operating practices meet requirements of the NBIS. The unit conducts similar reviews with approximately 20 percent of county and municipal inspection agencies each year. The Unit also provides annual statewide training to all district and local agency bridge inspectors and maintains an inspector certification process to assure only inspectors who meet federal qualification standards perform bridge inspections.

Statewide Inspection Data Management

Mn/DOT districts and local agencies enter bridge inspections and bridge inventory data into Mn/DOT's Pontis Data Management System. The Bridge Data Management Unit is responsible for checking that all districts enter their data correctly and on time, and that the data is formatted correctly. The unit annually submits bridge inspection and inventory data to the FHWA per federal reporting requirements. The unit is also responsible to sort through the data to help forecast future trunk highway bridge funding needs and to report bridge performance measures each year.

Bridge Rating and Load Restrictions

The Bridge Ratings Unit is primarily responsible to determine truck load capacity for bridges on the trunk highway system. The unit is also responsible for estimating impacts of truck weight increases on both the state and local highway systems. Load rating requires specialized bridge analysis and engineering computational skills typically found within the Bridge Office or bridge engineering consultants. The Rating Engineer relies on District Bridge Engineers to request a

new rating when a bridge has undergone significant change in condition since its last rating, but will initiate new ratings when changes to truck legal loads or changes to bridge engineering codes occur.

Fracture Critical Bridge Inspections

All fracture critical bridges are inspected by Bridge Inspections Unit staff or by district Inspection staff under the direction of the Bridge Inspections Engineer. In addition to Bridge Office staff, the Rochester and Metro districts have staff trained to do fracture critical inspections and to perform non-destructive testing. Prior to August 1, 2007, Metro and Rochester districts planned and performed inspections within their districts with little oversight from the Bridge Office. Districts typically requested assistance from the Bridge Office when more than one inspection crew was needed to minimize the time traffic was restricted, or when District Bridge Engineers determined an inspection finding required structural analysis.

After the bridge collapse and as a result of earlier changes to the NBIS, the Bridge Office rewrote Technical Memorandum No. 08-01-8-01. Among other things it stated that Mn/DOT's Bridge Office was responsible for all fracture critical bridge inspections and for the quality of inspections done by districts or others. A new Quality Assurance Plan was attached to the Memorandum that addressed inspection frequency, Bridge Office participation in inspections, and time limits for reporting critical findings and significant findings. Since then pre-inspection meetings are held with districts doing fracture critical inspections to discuss specific details needing non-destructive or special inspections, past inspection findings, access and special equipment needs and staffing. A uniform report format and submittal schedule has been established. Responsibility for performing some bridge inspections is rotated between the district offices and the Bridge Office for purposes of Quality Control. A separate structural review of all in-depth inspection reports is made by the Bridge Office Design Section.

Delegated Responsibilities

The following functions are delegated to the appropriate NBIS Program Administrator, as detailed in Minnesota Statue and Rules:

Routine Bridge Inspections

Federal regulations require that each bridge be inspected at least once every 24 months. Those inspections are termed routine inspections. Districts have been assigned responsibility to routinely inspect all trunk highway bridges within their boundaries ever since inception of the program in the late 1960s. It's likely a decentralized inspection program allowed the inspection program to develop quickly and more economically using existing staff, and maintenance needs could be addressed more directly than if inspections were performed centrally. About 2,500 bridges are routinely inspected on the trunk highway system each year.

Today, all districts assign a Professional Engineer to supervise the district's inspection program. They review inspection reports to identify and schedule bridge maintenance activities. The District Bridge Engineer is locally available to district bridge inspectors and can quickly and knowledgeably assess if

conditions found are serious or require a more in-depth structural review. District Bridge Engineers have authority to immediately close a bridge or restrict traffic if critical conditions are reported. Inspection staffs are not required under federal rules to be engineers, but they must meet minimum experience and training requirements. Districts are able to maintain trained inspection staff in part because bridge inspection positions fit into a career ladder for some of the more technically minded bridge maintenance staff and engineers.

Bridge Maintenance-Related Duties and Decision-Making Responsibilities

Prior to 1960, bridge maintenance was a centralized function. There were four bridge maintenance crews and one bridge painting crew that operated statewide and were centrally managed and financed. With the growth of the interstate and trunk highway systems in the 1960s the number, location and funding for bridge crews gradually changed. In 1970, the remaining Bridge Office-managed bridge crews and funding were transferred to district maintenance organizations. The Bridge Office retained responsibility to provide technical support to bridge maintenance crews. A bridge maintenance manual was developed and maintained by the Bridge Office to standardize bridge maintenance practice and repair methods used across the state. Engineers from the Bridge Office Construction and Maintenance Section continue to work closely with district bridge maintenance crews helping them identify structurally significant deteriorations to bridges and providing structural plans and procedures necessary to make those repairs.

Mn/DOT District Maintenance Functions

Today Mn/DOT continues to maintain a decentralized model for bridge maintenance, as it does for road maintenance. Bridge crews are hired and supervised locally to maintain bridges throughout the year but are also assigned to clear the roads and plow snow during winter months. Bridge maintenance workers are typically recruited from building trade occupations such as carpentry, masonry, iron work, welding and heavy equipment operations. Both bridge maintenance and roadway maintenance functions are typically managed by the District's Maintenance Engineer, who delegates bridge maintenance responsibilities to the District Bridge engineer.

Bridge maintenance can be classified as either reactive or preventive. Simply put, reactive maintenance fixes elements that are broken or badly deteriorated, and preventive maintenance slows the rate of deterioration of elements that are still in fair or good condition. District Bridge Engineers are responsible to review bridge inspection reports and then identify bridge components in need of maintenance and also to prioritize when maintenance should be completed. High priority maintenance items are scheduled to be completed within one year of being reported in the inspection report. District maintenance crews typically have many years of experience performing most common bridge repairs. However, when they are not sure how to proceed, they either reference the Bridge Maintenance Manual or contact the Bridge Office Regional Construction Engineer for help. If the District Bridge Engineer becomes aware of conditions that may be unsafe or may significantly decrease the load carrying capacity of the bridge, they are authorized to close the bridge immediately until the condition is evaluated by the Bridge Office or until the condition is repaired.

When repairs are considered too large or specialized for crews to do themselves, the District Bridge Engineer is responsible to recommend the repairs be made under a construction contract. Bridge deck replacement or overlays, and repainting bridges are examples of work typically contracted. The District Bridge Engineer also consults with other district and Bridge Office staff to plan major bridge improvement, rehabilitation and replacement projects.

Mn/DOT Bridge Office Maintenance Support

Mn/DOT's Bridge Office supports District bridge maintenance operations primarily through frequent contacts and travel to district offices. Three Regional Bridge Construction Engineers are assigned to one of three regions of the state – the South region includes the Rochester, Mankato, and Windom districts, which account for about 21 percent of the state's bridges; the North region includes the Duluth, Bemidji, Brainerd, and Detroit Lakes districts which account for about 27 percent of the state's bridges; and the Metro region which contains 52 percent. Each regional engineer has several years experience either designing or rating bridges and is responsible for visiting each district's bridge repair and bridge construction projects to provide technical assistance to contract administration and bridge maintenance staff.

Because of its structural expertise, the Bridge Office continues to be responsible to advise districts about the kind of repairs to bridges that are necessary to maintain load carrying capacity and to prolong bridge life. The Bridge Maintenance Manual is written and maintained by the Bridge Office and is referenced regularly by District Bridge Engineers and other maintenance staff. The purpose of the manual is to provide a comprehensive collection of proven standard bridge maintenance and repair methods that can be referenced by maintenance staff that have not made similar repairs recently. The manual is divided into seven major sections. The first section generally describes district and Bridge Office organizations, responsibilities and policies. The second section defines preventive maintenance and describes 16 preventive maintenance activities. The other five sections describe specific bridge repair methods and processes relating to maintaining the bridge supports, the superstructure, and the channel and other features beneath the bridge. The manual has been recently updated and is available electronically on the Mn/DOT bridge website.

In addition to the providing guidance via the Bridge Maintenance Manual, the Bridge Office has also worked very closely with District Maintenance Supervisors and Bridge Engineers to focus preventive maintenance efforts on several common and effective maintenance activities. These activities include flushing salts from bridge decks, railings and bridge joints, sealing bridge decks, repairing bridge joints, and spot painting bridge beams and gusset plates. The Bridge Management Unit generates reports listing bridges eligible for preventive maintenance based on bridge inspection reports and other data contained in the bridge inspection and inventory database. Districts then use those reports together with their own assessments to schedule the annual preventive maintenance program. Beginning in 2009, districts have reported back to the Bridge Office their success or failure to complete the preventive maintenance work planned for the year. Those reports are compiled by the bridge office and presented to the Operations Division and Commissioner's staff. A similar process is used to track completion of high priority, reactive maintenance items.

The Bridge Office is also responsible for establishing guidelines for bridge replacements and contracted bridge repairs and improvements. Technical Memorandum No. 06-10-B-01: Bridge Preservation, Improvement and Replacement Guidelines, was written as an aid to district and Bridge Office personnel when selecting candidate projects and identifying the specific preservation, improvement, rehabilitation or replacement recommendations for an existing bridge. Every four years the Bridge Office works closely with Mn/DOT's Office of Capital Programs and Performance Measures and with District Bridge Engineers to identify bridges that are likely to need contract replacement, rehabilitation or major repair during 5-, 10- and 20-year planning periods. The Bridge Office uses a process based on guidelines, current bridge conditions and estimated deterioration rates to generate a candidate list of bridge projects. District Bridge Engineers then review and edit the list as needed according to their more direct and detailed knowledge of the bridge and its maintenance history.

CURRENT AGENCY PROCEDURES AND PROCESSES AND RELATED CHANGES

Summarize current agency procedures and processes, and any changes made since August 1, 2007

In addition to changes to procedures and processes already described, several other new processes and changes to procedures have occurred since August 2007 that relate to the initiation of bridge re-rating and use of inspection findings in the re-rating process, and in the implementation of agency-wide standards for documenting bridge inspection findings and decision-making for post inspection bridge maintenance. Still others have been made that are designed to further ensure or enhance the safety of Minnesota's transportation infrastructure.

Bridge Re-Rating: Initiation and Use of Bridge Inspection Findings

Gusset Plates Included in Bridge Load Rating Analysis

Shortly after the collapse of the Interstate 35W bridge, all similar truss bridges on the trunk highway system were inspected to determine if there were any significant signs of distress that had not been previously reported. None were found. In 2008, after underdesigned gusset plates were identified as a possible cause of collapse, a special inspection of all trunk highway truss gusset plate connections was made. Detailed non-destructive ultrasound measurements were made to map corroded areas of gusset plates and straightedges were used to measure distortion along the edges. In March 2008, the Trunk Highway 23 bridge over the Mississippi River in St. Cloud was immediately closed after small distortions were found on several heavily loaded gusset plates. In April and May 2008, two additional bridges, one in Duluth and one in Winona, were closed or partially closed until repairs to corroded gusset plates could be made. Several gusset plates on the Trunk Highway 61 bridge at Hastings were stiffened after inspections found pack rust that had developed between plates was causing gusset plates to bow outwards.

Concurrent with the inspections, 25 special truss ratings were done by Mn/DOT and consulting engineers using a newly developed rating procedure to calculate the load carrying capacity of truss members and their gusset plate connections. Eight of the trusses were rated by Mn/DOT staff and 17 were rated by nine separate consultants at a cost of \$617,857. Before then, gusset plate strength, in Minnesota or nationally, had not been evaluated by bridge load rating programs.

Based on results of trunk highway inspections and ratings, screening criteria were developed to select locally owned bridges that were most likely to need gusset plate ratings. Of the 87 truss bridges located on local roads in 2009, county engineers chose to close 27 and to inspect and re-rate 24 at a cost to the State Aid budget of approximately \$840,000.

In 2009, Mn/DOT created two new inspection elements and rating criteria to report the condition of gusset plates on truss bridges. One element rates the amount of section loss and the condition of paint at each gusset plate location, while the other reports the amount of distortion measured. Neither element had previously existed nationally.

Fracture Critical Inspection Reports Reviewed by Bridge Office Engineers

Prior to the collapse of the Interstate 35W Bridge, Metro and Rochester districts were responsible for fracture critical inspections of the trunk highway bridges located within their district boundaries. Mn/DOT's Bridge Office was responsible for trunk highway and local bridges in the remainder of the state. As a result, attention to structure details and writing and reviewing inspection reports varied depending on who performed the inspection.

Since then, a special unit has been created within the Bridge Design Section to formally review all fracture critical reports. Registered engineers in the section are assigned to determine if the bridge is functioning as designed or if the bridge load rating should be reevaluated. The evaluation is forwarded to the local agency or to the District Bridge Engineer who, in addition to reviewing the report and developing a work list, is required to acknowledge receipt of the assessment and his/her concurrence with its recommendations. Evaluations of trunk highway bridges that are determined to need new load ratings are forwarded directly to the Mn/DOT Ratings Engineer.

Guidelines for Rating Engineers and Inspectors Added to Mn/DOT Manuals

A section on Bridge Ratings has been added to the Load and Resistance Factor Design Bridge Design Manual that, among other things, describes Mn/DOT's rating forms, special permit trucks and other Mn/DOT specific requirements for rating bridges. The manual is a familiar reference to all public and private engineers who regularly perform ratings for Mn/DOT or local agencies. Load ratings must be certified by a registered engineer and checked by another registered engineer.

While some guidance is provided in the AASHTO Manual for Bridge Evaluation, the Mn/DOT Bridge Inspection Manual more specifically describes the responsibilities that the inspector and the inspections program administrator must fulfill in order to preserve public safety and prolong the life of the bridge. The Mn/DOT Bridge Inspection Manual was updated in 2009 with a new section describing the responsibilities of inspectors to identify changes in condition that are likely to indicate reduced load carrying capacity, and the role of the program administrator to review inspection reports for reduced load capacity issues and to take appropriate actions.

Implementation of Agency-Wide Standards for Documenting Inspection Findings and Decision Making for Post-Inspection Maintenance

Immediately following the Interstate 35W bridge collapse, the governor requested a "stem to stern" review of Mn/DOT's inspection procedures and policies. The engineering consulting firm, PB Americas, was hired to perform the review and to recommend areas to improve the inspection program. As part of that process, in spring 2008, PB Americas organized a series of process improvement workshops. Inspection and maintenance staffs from district offices and from the Bridge Office were invited to participate. In addition to seven recommendations previously made by PB Americas, workshop participants identified several areas to improve the processes used to communicate and document inspection findings and for scheduling follow-up maintenance. Since then Mn/DOT has been working to implement many of those recommendations.

Bridge Inspection Maintenance Assessment Form

A task force consisting of district and Bridge Office engineers was formed to standardize the processes districts use to report and prioritize bridge maintenance needs. After reviewing several processes already in use, a bridge inspection maintenance assessment form that had been developed for use by Metro District inspectors was modified for statewide use. The form lists 36 elements that bridge inspectors commonly rate during the routine bridge inspection. Space is provided adjacent to each element for the inspector to recommend maintenance work while he/she is on site performing the inspection, and for the District Bridge Engineer to subsequently prioritize and schedule maintenance. In August 2008, districts were directed to begin using the form or something similar in order to standardize how maintenance needs identified during the bridge inspections are documented.

Maintenance Repair Planning Spreadsheet

The task force also reviewed methods that several districts used to compile and schedule maintenance activities from the inspection reports. The most sophisticated system was a spread sheet program that had been developed by the Bridge Engineer in the Willmar District. The task force modified the spreadsheet to work in conjunction with the Inspection Maintenance Assessment form. Definitions for high, medium, low and preventive maintenance work were developed to help standardize how work was prioritized and scheduled across all districts. In December 2008, districts were notified to begin using the Maintenance Repair Planning Spreadsheet or a similar database application to record and prioritize maintenance needs and to report maintenance work completed.

Performance Measures

Once the processes used to report and prioritize bridge maintenance activities had been standardized, new performance targets were developed to measure success in performing high priority reactive and preventive bridge maintenance. The target for high priority reactive bridge maintenance items is that 100 percent of those items identified during an inspection cycle are repaired or otherwise acted on within one year after the deficiency was reported. In 2009, 66 percent of high priority reactive maintenance items were completed on schedule. The completion rate of this work is 88 percent when special inspections to remove loose concrete from the bottom of bridge decks are excluded from the count. The target for preventive maintenance is that 100 percent of those preventive bridge maintenance activities planned within a year are completed as scheduled. In 2009, districts reported that 100 percent of their bridge preventive maintenance activities were completed as planned.

Additional performance measures were developed to report success completing bridge inspections on time. The target set is for all inspections to be completed on time, in accordance with NBIS rules with respect to frequency of inspections. In 2009, 90 of 91 fracture critical inspections scheduled were completed on time, one was late by more than 30 days. Of the 3,065 routine inspections scheduled in 2009, a total of 2,874 were completed on time, and 181 were completed late. This is a completion rate of 94 percent, up from 89 percent in the previous year.

Bridge Inspection Software

Several recommendations from the workshop related to the difficulty inspectors and bridge engineers had accessing information about the bridges, particularly while they were at the inspection site. They wanted easier access to previous inspection reports, pictures to compare current and past conditions, bridge plans, bridge manuals, and bridge rating information. In addition, they wanted inspection software that reduced the amount of double entry and integrated maintenance assessment and planning tools. In late 2008, a small task force was formed to identify new inspection software products, to interview vendors and agencies using their products and finally to recommend the product that was the most fully developed to meet identified needs. A software program used by Indiana DOT and which was also being purchased by Iowa DOT was selected for a pilot demonstration project costing \$32,000. Since then, based on a return on investment study and on experience gained during the pilot, modifications to the program are underway. The new inspection software, called SIMS (Structure Inventory Management System) will become available to all district and local bridge inspection agencies in April 2011 at a cost of \$335,000.

Changes to Further Ensure or Enhance Minnesota's Transportation Infrastructure Safety

In addition to the changes in the areas of inspection, rating and bridge maintenance discussed above, Mn/DOT has made other changes that have been implemented to further enhance public safety.

Changes to Bridge Construction Specifications

In 2008, it was determined that the contractor had placed heavy construction loads on the Interstate 35W bridge, and that the capacity of the bridge to support those loads had not been accurately assessed. As a result, Mn/DOT's Bridge Office made modifications to the Standard Specifications for Construction. Specification 1513, titled *Restriction of Heavy Loads and Equipment*, was re-titled *Restriction on Movement and Storage of Heavy Loads and Equipment*. New wording was added which limited the weight of materials and equipment stockpiled in any 1,000-square foot area, the amount that can be concentrated in a 100 square foot area, and the combined weight of stockpiles and equipment operating within a span of a bridge. This change in specifications clearly alerts the contractor and construction inspectors to the limits on construction loading allowed on a bridge. For loading that is larger than permitted within the specification, the contractor is required to conduct a structural analysis and submit calculations to Mn/DOT showing that the proposed loading does not overstress the bridge.

Checking Requirements for Consultant Prepared Plans for Major Bridges

Prior to August 2007, the LRFD Bridge Design Manual and its earlier version addressed checking of bridge plans. However, after the bridge collapse, Mn/DOT's Bridge Office recognized it lacked the experience and level of staffing necessary to thoroughly check the designs of many complex bridge types. Also, lack of available time and resources sometimes limits the ability to conduct a thorough check on many larger bridge designs. To address concerns that another design error might be missed, a

new policy was added to the LRFD Bridge Design Manual requiring an independent check by a second design team for bridges with spans more than 250 feet and peer review by a separate bridge design consultant for other unique bridge types.

Risk-Based Analysis Added to Mn/DOT's Bridge Project Planning Process

Mn/DOT introduced legislation, which was passed in the 2010 session, requiring the prioritization of bridge rehabilitation and replacement projects using a risk-based approach. To that end, the agency has developed a bridge risk assessment tool to help evaluate whether a bridge is a candidate for bridge rehabilitation or improvement, and prioritize that work within the Mn/DOT bridge program. The intent of introducing risk assessment into Mn/DOT's bridge project selection process is to provide a more comprehensive look at factors that affect the likelihood of a service interruption and the impacts of the service interruption to the traveling public. Risk assessments will consider bridge condition, age, fracture criticality, scour, geometric factors, special vulnerabilities, traffic volume, heavy commercial traffic, detour length and highway classifications. Mn/DOT has worked with a consultant who is nationally recognized for its work in the area of risk assessment. The new process will generate a candidate bridge project list for mid-term and long-term planning, beginning in spring 2011 and annually thereafter.

Changes to Truck Loading Models for Bridge Rating

Prior to 2008, bridge load ratings were based on a set of AASHTO truck models that included a short single truck weighing 48,000 pounds, in addition to the 80,000-pound semitrailer and double truck configurations. But for many years, companies whose trucks carrying aggregates, concrete, raw milk and other bulk materials have redesigned their trucks with up to seven axles that can legally carry the full 80,000 pound load. In 2008, AASHTO revised its load rating truck models to include single trucks with up to seven axles. The Mn/DOT Bridge Office evaluated all trunk highway bridges and posted 26 bridges with insufficient capacity for these short heavy trucks.

The ratings for nearly 1,400 local bridges are currently identified as needing to be reevaluated using the short heavy truck models. As of November 2010, a consultant contract costing \$800,000 has been awarded to perform special inspections and to rate 581 of the most vulnerable local bridges. When this contract is complete, several additional phases of this local bridge rerating effort are planned.

Additional Load Ratings to Address 2007 FHWA NBIS Review Findings

Approximately 63 out of about 2,500 bridges on the trunk highway system were cited by the FHWA in 2008 for not having ratings calculated according to more recent rating methods. All had been previously rated using an older rating code. Many of the bridges cited were complex bridge types that require special analysis. Mn/DOT has resolved ratings issues on 26 of the bridges. New ratings for 27 of the bridges have been contracted at a cost of \$550,000.

BUDGET ANALYSIS FOR TRUNK HIGHWAY CONSTRUCTION PROJECTS FY 2012-18

Analyze anticipated funding and funding allocations for pavement preservation, and highway maintenance, safety projects, mobility enhancement project and highway and bridge construction for FY 2012-18, including a discussion of any anticipated budgetary challenges or risks.

Budget Analysis of Anticipated Funding and Funding Allocations

Mn/DOT annually updates its 10-year highway investment plan. This 10-year plan includes the four years of the Statewide Transportation Improvement Program (STIP) and the anticipated fiscally constrained investment for the subsequent six years. As part of the annual update, Mn/DOT also adopts guidance used by Mn/DOT's eight regional districts to prioritize investments for the next 10 years. The investment guidance currently in place calls for each of Mn/DOT districts to do the following:

- Fully fund improvements for Chapter 152 Bridges (addressing Tier 1 and 2 Bridges);
- Fund at least 85 percent of the identified other bridge (Tier 3) preservation needs to meet established performance targets;
- Set aside three times the district's Highway Safety Improvement Program (HSIP) goals to fund both stand alone preventive safety projects and to fund preventive roadway enhancements on other highway projects. Roadway enhancements include: edge treatments, centerline rumble stripes; rural intersection lighting, and turn lanes; and
- Set aside a minimum of 70 percent of the remaining funds after funding bridges and safety (per above) for pavement preservation.

Remaining funds after following the above guidance may be spent at the district's discretion on mobility projects, large safety projects, regional and community improvement priorities, or for additional investments on system preservation.

The table below shows the 2012 to 2018 Performance-based Needs for the Strategic Policy areas of Preservation, Safety and Mobility, and the anticipated investments.

2012 to 2018 Performance-Based Needs

As part of the Minnesota Statewide Transportation Policy Plan: 2009 to 2028 performance-based investment needs were developed for the major policy areas (Safety, Preservation, and Mobility). The performance-based needs are based on the following:

- Bridge preservation needs are based on the repair or replacement cost for Tier 1 and Tier 2 bridges and an estimate cost to maintain Tier 3 bridges.

- Pavement preservation needs are based on the Mn/DOT Materials Office Pavement Model to meet the performance targets identified in the Statewide 20-year Highway Investment Plan 2009-2028 by 2018.
- Safety needs are based on roadway enhancements identified in the Strategic Highway Safety Plan (SHSP) and safety capacity improvements based on criteria developed in the Statewide 20-year Highway Investment Plan 2009-2028.
- Mobility needs are based on estimated improvements needed to meet the performance targets for the Interregional Corridors (IRCs), estimated improvements in Greater Minnesota urban areas based on criteria developed in the Statewide 20-year Highway Investment Plan 2009-2028, and an estimate of the improvements needed within the Twin Cities Metro area.

Mn/DOT's districts also identified Regional and Community Improvement Priorities within the Statewide 20-year Highway Investment Plan 2009-2028. For the 20 years from 2009-2028, the districts estimated \$3 billion to \$5 billion in Regional and Community Improvement Priorities. These were not broken down for the 2012 to 2018 time period.

ESTIMATED PERFORMANCE-BASED NEEDS AND ANTICIPATED INVESTMENTS 2012 TO 2018

| Strategic Policy Area | Performance Based Needs | Anticipated Investments | Projected Gap | Percent of Needs Funded |
|---------------------------------------------------------------------------------------------------------|-------------------------|-------------------------|---------------------------|------------------------------|
| Chapter 152 Bridges (Tier 1 & 2) | \$1,559 M | \$1,447 M | \$112 M ^{Note 1} | 93% (100%) ^{Note 1} |
| All Other Bridge Preservation | \$675 M | \$623 M | \$52 M | 92% |
| Pavement Preservation | \$2,883 M | \$1,654 M | \$1,228 M | 57% |
| Other Infrastructure Preservation (e.g., drainage, signing, lighting, signals, rest areas, etc.) | \$378 M | \$192 M | \$186 M | 51% |
| Safety | \$2,077 M | \$411 M | \$1,666 M | 20% |
| Mobility | \$25,388 M | \$256 M | \$25,132 M | 1% |
| Regional and Community Improvement Priorities | Note 2 | \$297 M | N/A | N/A |
| Right of Way and Set asides | Note 3 | \$190 M | N/A | N/A |
| Total | \$32,959 M | \$5,070 M | | |

Source: Highway Investment Plan Annual Update 2010-2019, Office of Capital Programs and Performances Measures, March 2010

Note 1: Mn/DOT is committed to funding 100% of the Tier 1 & Tier 2 Bridges by 2018. The \$112 M gap will be filled as the design and cost estimates of bridge in the latter years become more refined.

Note 2: Performance-based needs have not been defined Regional and Community Improvement Priorities.

Note 3: Right of way and set asides support the other Strategic Policy areas.

Funding Challenges and Risks

Under the current investment guidance Mn/DOT is committed to address all the Tier 1 and 2 bridges by 2018, to sufficiently fund Tier 3 Bridge Preservation to meet 85 percent of the identified bridge needs to meet established performance targets. This funding guidance ensures that Minnesota’s bridges will be adequately maintained and safe. Following the recommendations developed in the Strategic Highway Safety Plan (SHSP), District Safety Plans, and County Safety Plans, Mn/DOT is incorporating preventive roadway enhancements in both stand alone projects and as part of all preservation, mobility, regional and community improvement priority projects.

To meet Minnesota’s bridge preservation and safety needs, Mn/DOT is unable to meet the performance targets established for Pavement Preservation. The result will be decreased ride quality on a greater share of the state’s highways. Mobility needs in both the Twin Cities and in Greater Minnesota, and Regional and Community Improvement Priorities are also not fully addressed.