**Transportation Synthesis Report**

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# Highway Maintenance Response Time Standards, V. 2

*Prepared for*
**Bureau of Highway Operations**
**Division of Transportation Infrastructure Development**

*Prepared by*
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**WisDOT RD&T Program**
**December 6, 2004**

*Transportation Synthesis Reports (TSRs) are brief summaries of currently available information on topics of interest to WisDOT technical staff in highway development, construction and operations. Online and print sources include NCHRP and other TRB programs, AASHTO, the research and practices of other state DOTs, and related academic and industry research. Internet hyperlinks in TSRs are active at the time of publication, but changes on the host server can make them obsolete.*

## Request for Report

Traffic signal knockdowns, pavement blow-ups and washouts, or damage to attenuators and guardrail can present serious threats to driver safety that require timely mitigation. "Responsive maintenance," the repair or replacement of failed facilities and restoration to safe, normal operation, is typically unscheduled and addresses unexpected failure or damage. "Emergency maintenance" is likewise initiated by a fault or trouble report but the fault is more serious and requires immediate action. WisDOT's Bureau of Highway Operations is reviewing the advisability of establishing time standards for responsive maintenance and emergency maintenance activities. The bureau asked for an assist from WisDOT's RD&T Program in locating examples of best practice and research in this area.

## Summary

To zero in on current state DOT practices, RD&T surveyed AASHTO Research Advisory Committee members in the U.S. and Canada through the RAC Listserv. Valerie Kalhammer, AASHTO Program Manager for Transportation Operations was very helpful in facilitating distribution of the survey and collection of state responses. (See **RAC Survey** below.) Forty-six agencies replied to the survey. Eight of these reported having quantified response time standards for equipment categories such as traffic signs and signals, guardrail and attenuators, while five agencies have also established standards for traffic crash maintenance/response. (See **Attachment A-Survey Responses** and **Attachment B-Survey Summary Table**.) Several states as well as British Columbia and Nova Scotia attached documentation to their responses that provides a detailed look at their policies. (See **Attachment C – State Documentation**.)

We also found additional published information, summarized below, produced by **State DOTs**, **FHWA**, **Municipalities** and **International Agencies**. Highlights include:

- *Scope of Services: Highway Asset Management Contract (Rev. 08/23/01)*, Florida Department of Transportation. The contractor is required to respond and deploy resources within 15 minutes of initial notification, 24x7, including holidays, to any emergency occurring on the roadway corridors, including marine collisions to bridges and their fender systems.
- *City of Portland Office of Transportation*. The Bureau of Transportation System Management maintains, modifies and repairs traffic signals for approximately 1,100 traffic signal intersections to provide safe, reliable and efficient operation of the signals for vehicles, bicycles and pedestrians. Police, inspectors, citizens, traffic engineers, Tri-Met and other public agencies report traffic signal maintenance needs. Response times range from less than an hour to days.
- *Lincolnshire County Council (UK)*. The county draws a contract for delivery of the majority of highway maintenance functions throughout the county. The current contract stipulates a response time in dealing with emergencies of one hour from notification to the contractor to actual attendance on site.

## RAC Survey

RAC members were asked by WisDOT Research Administrator Nina McLawhorn 1) whether their states have response time standards for emergency maintenance operations, 2) what operations are covered by the standards (and to list or attach pertinent documents if available), and 3) what are the response times established for each operation (and to list or attach pertinent documents, if available). Answers were accepted through Nov. 5, 2004.

Six states reported that they have specific emergency response/repair times for traffic signal knockdown or malfunction, including Rhode Island (immediate response during work hours), Indiana and New Jersey (two hours) and Virginia (2.5 hours). Four states and British Columbia specify response/repair times for regulatory critical signs, including New Mexico (urban one hour and rural 1.5 hours during work hours), New Jersey (two hours), and Virginia (same day for stop sign repair in high volume populated areas.) Three states and British Columbia specify response times ranging from immediate to four hours for pavement washouts, blow-ups or potholes, while three states and Nova Scotia stipulate response/treatment times for highways or bridges impacted by snow, ice or frost.

A collective digest of all of the replies is available in **Attachment A** appended to this report. **Attachment B** contains a table that distills the replies and provides a quick scan of states' response times for 15 emergency situations. **Attachment C** contains response/maintenance policy and procedure documentation provided by the following agencies: British Columbia Ministry of Transportation (maintenance specifications), Indiana DOT (guardrail and impact attenuator policies), Kansas DOT (maintenance activity priorities), Maryland SHA (revised response guidelines), Minnesota DOT (snow and ice control), Missouri DOT (incident response process), Nova Scotia Department of Transportation and Public Works (winter maintenance standards), Ohio DOT (established response processes), and Virginia DOT (snow removal standards).

## STATE DOTs

**Florida Department of Transportation**
**Scope of Services: Highway Asset Management Contract (Rev. 08/23/01)**
http://www.dot.state.fl.us/statemaintenanceoffice/SMSP/Highway%20Asset%20Management%20Scope%20(08-21-03).doc.
Project Background and Consideration (Page 1)- The Florida DOT has an innovative highway asset management program whereby the department will contract with a private entity for the management of all assets located within the right-of-way for an entire geographical area or portion of roadway.
Incident Response (Page 7)- The contractor will respond and deploy resources within 15 minutes of initial notification, 24x7, including holidays, to any emergency occurring on the roadway corridors, including marine collisions to bridges and their fender systems. The contractor will arrive on site, prepared to take necessary action with necessary manpower and typical emergency response equipment, within a maximum time of 60 minutes from initial notification of the incident. The contractor will develop an incident response plan, to include details on public/agency notifications, incident management, how the safety of motorists will be insured, handling of hazardous waste, coordination with law enforcement and other appropriate agencies, traffic control, submission of incident reports, the establishment and maintenance of detour routes when needed for closure of the interstate and primary roads, emergency repairs, removal of debris and evacuation response. The contractor will notify the department within 24 hours of all roadway closures exceeding one hour and re-openings, or major incidents upon occurrence.
Highway Lighting and Navigational Lighting (Page 15)- Navigational lighting outages that cannot be repaired within one hour during the periods when navigational lights are to be in operation will require placement of temporary navigational lights. There will be a $100 per hour or portion thereof, per bridge, reduction of the contractor's monthly lump sum payment for periods in excess of two hours when navigational lights (either permanent or temporary lights) are nonfunctional during times when navigational lights should be in operation, following notification.
Incident Response (Page 16)- If the contractor does not arrive on site, prepared to take necessary action within 60 minutes from initial notification of an incident, $1,000 per hour or portion thereof, per incident, will be deducted from the contractor's monthly lump sum payment for each hour past the allowed response time it took the contractor to be on site.

**Mississippi Department of Transportation**
**Annex 1- Emergency Traffic Signal Repair Response Plan**
http://www.gomdot.com/cetrp/annex_i_traffic_signal_repair.pdf.
1. Purpose (Page I-1)- The purpose of the plan is to establish MDOT's operational procedures for emergency response maintenance to repair traffic signals on the state highway system and to provide consistency in

coordinating with other governmental agencies and businesses to delineate the financial participation and maintenance by the MDOT for traffic signals. This plan covers signal equipment, the installation and maintenance thereof, when one or more of the streets controlled by the signal is on the state highway system. Such participation by MDOT is contingent upon availability of funds for these purposes.
III. Responsibilities. B. 3. Traffic Engineering Division (Page I-2)-
a. Traffic Signal Technician will be on call 24 hours, seven days per week including holidays for the purpose of making repairs.
b. Dispatch Traffic Signal Technician when notification of traffic signal malfunction is received.
c. Emergency repairs will be made by the Traffic Signal Technician when he is unable to restore normal operations within 24 hours.

**Western Transportation Institute, for Oregon DOT, 1999**
**Intelligent Transportation Systems Maintenance Plan**
http://www.odot.state.or.us/its/PDFs/ITSDocuments/MainPlanExecutiveSummary2900.pdf.
Priority Guidelines (scroll to Executive Summary, p. vi)
Having a maintenance model provides a framework for performing ITS repairs, but it provides little guidance as to which activities should occur when. While not addressing ITS specifically, electrical repair priority guidelines in ODOT's current highway maintenance manual indicate that ITS devices would likely merit 24x7 maintenance support. Based on meetings with stakeholders, it was determined that there were varying perspectives on the relative repair priority of different types of ITS devices based partly on regional needs. In order to harmonize these guidelines across regions, stakeholders were surveyed as to how they normally prioritize repairs within their jurisdiction. Survey results indicated that stakeholders believe that devices should be prioritized for repair not on the basis of a particular technology but on the basis of how critical it is to the mission of ODOT. Identification of mission-critical devices is expected to vary between urban and rural regions, as well as between summer and winter weather conditions. The following guidelines represent the general order of prioritizing repair:

- Fulfill legal mandates.
- Address safety hazards, such as devices physically impeding the safety of the traveling public or devices providing motorists with errant and potentially harmful information.
- Repair safety-critical devices, generally focusing on field devices first, communications links next, and information dissemination third.
- Repair operations-critical devices, generally focusing first on where traveler benefit is maximized.
- Restore all other devices, focusing first on devices that have the most visibility to the traveling public.

Preventative Maintenance (scroll to Executive Summary, p. vii)
Stakeholders indicated that preventative maintenance is often neglected in favor of performing repair maintenance. Efforts to emphasize preventative maintenance – through integration of preventative maintenance tasks into logging and tracking procedures and through allocation of resources to preventative maintenance – are needed to ensure that these activities will not continue to be neglected.

**New York State DOT**
**Maintenance and Operations First Guidance (Draft)**
Prepared by the Operations Division in conjunction with the 2004 Multi-year Program Update, August 2004.
Page 2: A well-maintained infrastructure is vital to the transportation system mobility, reliability, safety and the economic competitiveness of New York State. In an effort to improve the infrastructure and transportation services, the department has adopted a Maintenance and Operations First approach to be incorporated in this Program Update Cycle. The Maintenance and Operations First strategy provides a focus on maintenance and operations with an emphasis on systems management, operations management, response maintenance, preventive maintenance and design modification (corrective) maintenance.

Page 2: The Maintenance and Operations First approach goes beyond the traditional asset management approach that focuses mainly on physical assets, and instead also deals with services (such as transportation management center operations and Highway Emergency Local Patrol [HELP] and systems such as Advanced Traffic Management Systems). A key element in this new approach is recognition that ITS operations and traveler information services are considered as integral to the strategy. That is, these activities are essential to maintaining the maximum availability of the capacity, mobility, reliability and safety of the system. For example, a HELP truck response, and resultant quicker clearance of an incident, is critical to timely restoration (maintenance) of the normally available highway capacity.

Page 3: A state of good repair for operations includes appropriate response times to restore system capacity, reliability and safety and manage the system effectively when it has been impacted.

Page 5: Tables 1 (p. 12) and 2 (p. 17) summarize the preventive maintenance, design modification (corrective) maintenance, response maintenance, and operations activities that should be targeted during this program update. The region must prioritize projects or activities based on region-specific conditions and maintenance needs. For all regions, the first priority is preservation of assets on trade and intercity corridors.

Page 11: Overhead Sign Structures Maintenance Guidance- Response maintenance actions include the replacement and/or tightening of components such as nuts, bolts, u-bolts, anchor bolts and cover plates. It would also include the repair of cracked welds and other repair actions required to handle flags produced by the inspections. Replacing missing post caps, chord and truss/arm end caps and wire inlets keeps debris and small animals from entering the structure, which can lead to problems with the drainage system.

Page 11: Lighting Maintenance Guidance- Crews must respond to bulb failures or pole hits/knockdowns in accordance with department response policy.

Page: 15: (from Signal Operations and Maintenance Guidance)- Crews must respond to "dark" or "flashing" signals as soon as possible and within timeframe specified in Regional Signal Response Policy. Crews must respond immediately to pole hits or other system disruption/damage (i.e. storm damage) to restore normal operations, inspect equipment for damage and make emergency repairs.

Page 16: (from Intelligent Transportation Systems [ITS] Maintenance and Operations Guidance)- Preventive, response and design modification (corrective) maintenance activities are largely focused on field infrastructure (ITS devices and systems) which includes replacement of existing systems as they reach their useful physical or technical life. This would also include any consultant effort related to engineering support to assess the impacts of projects on the existing system or to design planned replacement of the system.

Page 18: Appendix A: Definitions- "response maintenance" – actions performed on an as-needed basis. This is also known as demand maintenance, emergency maintenance, incident response and accident response. It is required when the system breaks down or malfunctions. Upon notification, the responsible agency is expected to dispatch an assessment and/or a response team to secure the site, diagnose the problem, mobilize the response, and record work accomplishment.

## FHWA

**FHWA Report No.: FHWA-OP-04-011, 2002**
**Guidelines for Transportation Management Systems Maintenance Concept and Plans**
http://ops.fhwa.dot.gov/Docs/TMSMaintCptandPlans/toc.htm.
1.2. Purpose
http://ops.fhwa.dot.gov/Docs/TMSMaintCptandPlans/chapter1.htm#section1.2.
This document offers technical guidance to practitioners on (1) defining a system's maintenance concept, (2) determining the elements to include in the concept, and (3) integrating the maintenance concept into all phases of the system life-cycle.
3.11. Time Responses
http://ops.fhwa.dot.gov/Docs/TMSMaintCptandPlans/chapter3.htm#section3.11.
When specifying responsive maintenance time, agencies have a tendency to require excessively rapid response. When writing the scope of work for the maintenance component of a contract, the agency needs to consider how the contractor is going to cost the response. A reasonable balance needs to be developed between timeliness and costs. Some agencies use the following type of wording:

- The contractor is required to provide two years of maintenance on all elements of the system following acceptance by the state of each element.
- The contactor shall provide one phone number that will be the state's sole contact point for requesting maintenance. The timing for the maintenance response shall begin with the phone call to the contractor. The contractor shall ensure that the phone is answered or a message system is always available.
- The contractor shall be on-site and commence work within four hours of being informed by the state that a repair is required. Only business hours (7 a.m. to 4 p.m.) will be counted for the maintenance response time.

Changing the various time periods within the above wording can be done to suit the agency. Of course, the implications of the changes to the costs need to be considered.

## Municipalities

**City of Portland Office of Transportation**
Traffic Signals Maintenance
http://www.trans.ci.portland.or.us/services/Signals/SignalMaintenance.htm.
The Bureau of Transportation System Management maintains, modifies and repairs traffic signals for approximately 1,100 traffic signal intersections to provide safe, reliable and efficient operation of the signals for vehicles, bicycles and pedestrians. Police, inspectors, citizens, traffic engineers, Tri-Met and other public agencies report traffic signal maintenance needs.
Response repair
http://www.trans.ci.portland.or.us/services/signals/signalmaintenance.htm#Repair.
Response times range from less than an hour to days. Maintenance work is often a specific response to call-in reports including: lamp burnouts, controller malfunctions, detection failures, physical damage, traffic progression problems, off-hour responses to safety risks at intersections.

**City of Sugar Land, TX Public Works**
Traffic Alternate Power Source
http://www.sugarlandtx.gov/content/Public_Works_-_Traffic_Alternate_Power_Source.htm.
In order to restore operation of traffic signals during extended power outages, the city's traffic signal control panels have been retrofitted to quickly accept an alternate power source that allows the use of a portable generator unit. Other cities have used generators to power signals, but Sugar Land's concept is different because a connection is built into each signal cabinet that eliminates the need for a technician to physically disconnect the power supply. Disconnecting service cables and installing jumper cables to power an intersection with a generator is time-consuming and exposes technicians to electrical hazards. The Sugar Land Traffic Control Division designed and built an emergency response unit capable of distributing a generator to a location in a matter of minutes. The response unit is also equipped to provide refueling of the generators to ensure uninterrupted operation for extended periods. The unit -- a custom trailer that can hold up to six generators -- is ready to roll 24 hours per day and attaches to any Sugar Land Public Works vehicle.

**City of Peoria, AZ Public Works Department**
Streets Division- Traffic Signals
http://www.peoriaaz.com/PublicWorks/pw_streets_traffic_lights.asp.
City staff maintain 64 traffic signals; all traffic signals on Grand Avenue and Loop 101 are handled by ADOT.
Repair Request Form – Traffic Signal
http://www.peoriaaz.com/PublicWorks/pw_streets_signalrepair_form.asp.
Persons who report traffic signal outages or other repair needs using the form on this page are told to expect repairs to be scheduled for completion within 24 hours during the work week and 72 hours on weekends.

## International Agencies

**Lincolnshire County Council (UK)**
Transport and Roads: Street Services- Maintenance
Prioritisation of Highway Works
http://www.lincolnshire.gov.uk/section.asp?catId=2280.

- Reactive Maintenance - involves the making safe of highway defects and other safety issues that require urgent attention and which can arise from our own inspections, both statutory and ad hoc, along with observations from Town and Parish Councils, members of the public and the emergency services.
- Standards - in accordance with national guidance, Lincolnshire County Council within the Highway Maintenance Plan has set out specific maintenance standards.
- Safety Defects - safety defects are those defects which are defined as likely to create a danger or serious inconvenience to the users of the network. Such defects shall be made safe as soon as is reasonably practical to do so, and in all cases this should be within 24 hours. The Highway Divisions have an excellent working relationship with LCR Highways Ltd, our appointed maintenance contractor. LCR have recently been awarded (having won via the rigorous tendering process) the Contract for the delivery of the majority of the highway maintenance functions throughout the County. This has allowed both parties to continue to build on our partnering working with the aim to seek continual improvement in service delivery. Within the

current contract there is a response time in dealing with emergencies of one hour from notification to the contractor (LCR) to the actual attendance on site.

Highway Defects to be repaired or made safe within 24 hours
http://www.lincolnshire.gov.uk/section.asp?docId=33860.
Listing includes:
* All signs which have fallen into the highway or are in an unsafe condition.
* Traffic signals:
  - damage which makes signals electrically unsafe.
  - knocked down signal heads in the highway.
  - two red lamps failed on a single approach.
  - junction all out - no signals operating.
  - signals stuck on red.
  - signal head twisted/pointed in the wrong direction.
  - failure of temporary signals.

**Norfolk County Council (UK)**
Department of Planning and Transportation Highways Maintenance Plan 2004/05
Appendix 6: Reactive Maintenance- Objectives, Standards and response
http://www.norfolk.gov.uk/transport/highways/maintenance/maintenanceplan/pdfs/Appendix6.pdf.
1.1: P1 or P2 orders deal with category 1 defects (24-hour response). Our response to attending defects is as follows:
-- P1 Emergency Works Order - Defects which could lead to a significant risk of injury or damage to property. Ganger or Contractor on site within 1½ hours either to effect repair or make safe through signing, guarding and lighting.
-- P2 Priority Works Orders - Ganger or Contractor on site between 1½ hours and seven days.
1.2: Defects and Situations Warranting Emergency Works Order (P1). Defects which could lead to a significant risk of injury or damage to property [include]:

- Dangerous potholes in heavily trafficked A, B or C road particularly where traffic is fast moving which cannot be dealt with in 24 hours.
- Obstructions of the highway - debris on the carriageway - unprotected or unlit equipment on roads and verges.
- Broken slabs in heavily pedestrianised locations.
- Road accidents - clean up- make safe damaged signs/other items.
- Collapse of road or verge.
- Damaged street furniture (e.g. leaning/fallen signs, pedestrian safety fencing).

Note. The action to be taken will consist of carrying out permanent works where possible or make safe by carrying out appropriate works or erecting such signs, barriers, cones and lamps as are required.
1.3: Defects and Situations Warranting Priority Works Orders (P2) [include]:

- Pot-holes which are judged not to require urgent attention as defects which could lead to a significant risk or injury or damage to property but need attention before the next order can be placed.
- Damaged stop/give way signs, bridge height signs.

**Ontario - Minimum Maintenance Standards for Municipal Highways - The Regulation**
http://www.canlii.org/on/laws/regu/2002r.239/20040802/whole.html.
Scroll to: Signs 11. (1) If any sign of a type listed in subsection (2) is illegible, improperly oriented or missing, the minimum standard is to deploy resources as soon as practicable after becoming aware of the fact to repair or replace the sign. O. Reg. 239/02, s. 11 (1). (2): This section applies to the following types of signs: checkerboard; curve sign with advisory speed tab; do not enter; one way; school zone speed limit; stop; stop ahead; stop ahead, new; traffic signal ahead, new; two-way traffic ahead; wrong way; yield; yield ahead; yield ahead, new. O. Reg. 239/02, s. 11 (2).
Scroll to: Traffic Control Signal Systems 13. (1) If a traffic control signal system is defective in any way described in subsection (2), the minimum standard is to deploy resources as soon as practicable after becoming aware of the defect to repair the defect or replace the defective component of the traffic control signal system. O. Reg. 239/02, s. 13 (1). (3) Despite subsection (1) and paragraph 8 of subsection (2), if the posted speed of all approaches to the intersection or location of the non-functioning signal lamp or pedestrian control indication is less than 80 kilometres per hour and the signal that is not functioning is a green or a pedestrian "walk" signal, the minimum standard is to repair or replace the defective component by the end of the next business day. O. Reg. 239/02, s. 13 (3).

**Ontario – "Minimum Maintenance Standards for Municipal Highways, A.K.A. Roads"**
By Don Payne, Chair, Federation of Ontario Cottagers Associations Roads Advisory Group, 2003
http://www.foca.on.ca/Infobase/Roads/minmaintenance.htm.
When portions of provincial highways were downloaded to municipalities a few years ago, municipalities found that they were faced with more roadway to maintain without adequate provincial grants to do so. In addition, they found that they were saddled with liability insurance costs for those roads. In order to better address the liability costs, a number of attempts to standardize road maintenance issues were made. On Nov. 1, 2002 "Minimum Maintenance Standards for Municipal Highways" came into being as Regulation 239/02 of the new Municipal Act.

# Attachment A: Maintenance Response Time Survey
# AASHTO Research Advisory Committee Listserv
# Wisconsin Department of Transportation RD&T – December 6, 2004

**Alabama**
Respondent: Stacey Glass [Assistant State Maintenance Engineer, Management & Training]; 334-242-6277; glasss@dot.state.al.us.
Alabama DOT does not have response time standards.

**Alaska**
Respondent: Frank Richards [Statewide Maintenance & Operations Engineer]; 907-465-3906; frank_richards@dot.state.ak.us.
We do not have response time standards in Alaska. Please send me the results of your survey though so I can see what others states do have.

**Arizona**
Respondent: Linda Anestasi; LAnestasi@azdot.gov.
We have the following response times standards for incidents: when someone from maintenance acknowledges an incident (calls in after being called or paged) to our Traffic Operations Center (TOC); then when they arrive at the scene of the incident (they call again and give us a status); and then when the scene of the incident is cleared (they call again and let the TOC know that all lanes are open).

In rural areas the time to acknowledge is 15 minutes, 60 minutes to respond and 120 minutes to close the incident. In the Phoenix metro areas, the times are 10 minutes to acknowledge, 30 minutes to respond and 120 minutes to close.

We have three levels of incidents. To summarize:

* Level 3 is debris on the road, a car stalled on the shoulder, or a dead animal on the side of the road, etc. that does not interfere with the flow of traffic.
* Level 2 can be an accident, or a lane closure - construction or anything that interrupts the flow of traffic.
* Level 1 is the highest level including fatalities, complete freeway closures, ramp to ramp freeway closures, impedes the flow of traffic, or in some instances stops it completely, even in the case of a snow packed road that is impassable.

If any of our incidents take longer than four hours to close or clear -- that incident requires a debriefing where we have a meeting with the maintenance organization and district involved, DPS and TOC. No one likes to have four-hour debriefings so that's a good incentive to get things done and cleared on time. Lots of times it is out of our control however, like waiting for a coroner's report, or for another agency to arrive, etc.

**Arkansas**
Respondent: Ruth Foggo; Ruth.Foggo@arkansashighways.com.
Arkansas does not have response time standards for emergency maintenance operations.

**California**
Respondent: Len Nelson [Division of Maintenance- Emergency Operations and Maintenance Safety Branch]; 916-654-6723; len_nelson@dot.ca.gov.
Does your state have response time standards for emergency maintenance operations?

Other than for incident response, the answer is basically no. We do classify responsive maintenance tasks into three basic time categories; emergency or urgent, quick, and ordinary or routine. For example, a downed stop sign or malfunctioning traffic signal would fall into the "emergency or urgent" category (requiring an immediate response, including the use of overtime or callouts), whereas a broken guide sign may be more of a "quick" task. "Routine" tasks would include litter retrieval, highway sweeping operations, etc.

2. What operations are covered by the standards? Please list or attach pertinent documents, if available.

While we do not technically have "time response" standards for emergency maintenance operations, we have established a performance goal for Maintenance accident/incident response. Our Maintenance forces typically respond to highway incidents at the behest of the California Highway Patrol (CHP) to provide traffic controls and/or debris removal/load salvage.

3. What are the response times established for each operation? Please list or attach pertinent documents, if available.

The established performance goal is that Maintenance employees will respond to all highway incidents within 30 minutes of notification/callout.

Thanks for giving us the opportunity to respond. If you have any additional questions, or require any additional information, please feel free to contact me via e-mail or by telephone.

**Attachment A: Maintenance Response Time Survey**
**AASHTO Research Advisory Committee Listserv**
**Wisconsin Department of Transportation – December 6, 2004**

**Colorado**
Respondent: Wayne Lupton; Wayne.Lupton@DOT.STATE.CO.US.
Colorado DOT does not have response time standards for emergency maintenance operations.

**Connecticut**
Respondent: David Kilpatrick [Research Engineer]; David.Kilpatrick@po.state.ct.us.
Connecticut's Maintenance Director, Mr. Chuck Drda, has answered your survey question regarding "Response Time Standards" by responding to Ms. Valerie Kalhammer, Program Manager for Transportation Operations American Association of State Highway & Transportation Officials, Oct. 18 request. He provided the following response:

> CONNDOT has a goal of one hour response time for all highway incidents. Response times have been tracked from the initial contact until DOT personnel arrive on scene. The average response time is 45 minutes. However, this goal is not always achieved. Our field staff are required to live within a 15 mile radius of their assigned maintenance facility which ensures a short commute. Also, note that Connecticut is a relatively small state therefore, the response area of each facility is in close proximity to the garage.

**Delaware**
Respondent: Donald Weber; DWeber@mail.dot.state.de.us.
We don't have response times dictated however there are conditions that we do provide an immediate dispatch of crews to attend to (such as incidents, a signal failure, downed stop sign etc.). Because of our size we are able to respond fairly quickly to most locations (we are only 90 miles long by 45 miles wide). Hope this assists.

**District of Columbia**
Respondent: James Austrich [Chief, Roadway Operations Patrol Branch- District Department of Transportation]; 202-671-1494; james.austrich@dc.gov.
DDOT does have response standards of 24 hours or less for emergency maintenance operations, such as stop signs, attenuators, traffic signal failures, potholes and incidents.

**Hawaii**
Respondent: Kelly Sato; Kelly.Sato@hawaii.gov.
Hawaii DOT Highways Division does not have a response time standard for emergency maintenance operations.

**Idaho**
Respondent: Greg Laragan [Assistant Chief Engineer- Operations]; 208-334-8535; glaragan@itd.state.id.us.
Although the Idaho Transportation Department has dispatch notification requirements for such things as damaged stop signs and inoperable traffic signals, we have nothing that amounts to a performance measure or standard.

Chart below provided by: Dave Jones [Maintenance Engineer]; 208-332-7893; Dave.Jones@itd.idaho.gov.
(From: Idaho Transportation Department Maintenance Manual, Chapter 300 [Traffic Services], Fig. 301.0-A: http://www.itd.idaho.gov/manuals/Online_Manuals/Maintenance/index.htm.)

**<u>Attachment A:</u> Maintenance Response Time Survey**
**AASHTO Research Advisory Committee Listserv**
**Wisconsin Department of Transportation – December 6, 2004**

| TRAFFIC CONTROL DEVICES MAINTENANCE SERVICE LEVELS | | | |
|---|---|---|---|
| | LEVEL 1 | LEVEL 2 | LEVEL 3 |
| PAVEMENT MARKINGS | Continuous edge, center and lane lines. Highly visible both day and night. See Traffic Manual 12-202<br><br>Significant loss of pavement markings should be repaired within 15 days weather permitting. | Same as Level 1.<br><br>Significant breaks in pavement markings must be repaired during striping season. Edge lines restriped not more than half as often as centerlines. | Same as Level 1, except only use edge lines where road widths are 22 feet or greater and shoulder condition is adequate to maintain lines. See Traffic Manual 12-202.<br><br>Breaks in pavement markings tolerated not more than one striping season. Edge lines restriped only when needed to restore visibility. |
| SIGNING | Replace signs when retroreflectivity/legibility is noticeably deteriorating. See Maintenance Manual 5-321. | Replace signs when retroreflectivity/legibility is marginal. See Maintenance Manual 5-321. | Replace signs when legibility is marginal. See Maintenance Manual 5-321. |
| DELINEATORS | Delineators on curves, transitions and intersections should be repaired or replaces within 180 days.<br><br>Delineators on tangents should be repaired or replaced when approximately 10% are missing or have lost retroreflectivity. | Same as Level 1.<br><br>Delineators on tangents should be repaired or replaced when approximately 25% are missing or have lost retroreflectivity. | Same as Level 1.<br><br>Delineators on tangents should be repaired or replaced when approximately 25% are missing or have lost retroreflectivity. |
| TRAFFIC SIGNALS | Treat all signals alike. Repair or replace within 30 days when damaged or not working. | Same as Level 1. | Same as Level 1. |
| LUMINAIRES | Treat all Luminaires alike . Repair or replace within 30 days when damaged or not working. | Treat all Luminaires alike . Repair or replace within 60 days when damaged or not working. | Treat all Luminaires alike . Repair or replace within 90 days when damaged or not working. |
| BARRIERS (Guard rails, Bridge rails, Attenuators, Barricades, etc.) | Repair or replace within 15 days when structurally damaged. See Maintenance Manual 5-324. | Repair or replace within 30 days when structurally damaged. See Maintenance Manual 5-324. | Repair or replace within 90 days when structurally damaged. See Maintenance Manual 5-324. |

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## Attachment A: Maintenance Response Time Survey
## AASHTO Research Advisory Committee Listserv
## Wisconsin Department of Transportation – December 6, 2004

**Illinois**
Respondent: David Johnson; JOHNSONDB@dot.il.gov.
The Illinois Department of Transportation does not have emergency response time standards. We try to respond to emergencies in a timely fashion, but due to many variables that can occur; we feel having set times could cause liability issues if they weren't met. If we set standards for the worst case scenario, the standards would be meaningless.

**Indiana**
Respondent: Carl Tuttle; CTUTTLE@indot.state.in.us.
1. Does your state have response time standards for emergency maintenance operations?
   Yes, for some items.
2. What operations are covered by the standards? Please list or attach pertinent documents, if available.
   Guard Rail Maintenance, Impact Attenuator Maintenance and Traffic Signal (Trouble Call) Maintenance.
3. What are the response times established for each operation? Please list or attach pertinent documents, if available.
   Guard Rail and Impact Attenuator Maintenance should be completed within five working days (of notification) [**see Attachment C: Indiana- guardrail, impact atten. policies**]. Traffic signal maintenance - Technician to be at location within two hours of notification. Intersection to be "secured" or total maintenance completed before technician leaves (policy being updated at this time and is not available).

**Iowa**
Respondent: Will Zitterich [Office of Maintenance]; 515-239-1396; William.Zitterich@dot.iowa.gov.
For maintenance operations at the Iowa Dept. of Transportation, we have very few specified response times for maintenance operations. Some of the ones we do have is to treat ice and frost on bridges within three hours after notification of that condition. There is a three hour response time when we have notice of snow and ice on the highways. There is a general time limit of getting the highways back to a serviceable condition within 24 hours after the storm ends. Most of the instructional memorandums or maintenance standards for activities such as pavement blow-ups do not have a specified time but use words like "as soon as practical" or "as soon as possible". If you would like any more specific information please give me a call.

**Kansas**
Respondent: Susan Barker [Technology Transfer Engineer]; 785-291-3847; SusanB@ksdot.org.
The Kansas Department of Transportation does not have response time standards for emergency maintenance operations. We would be very interested in receiving a copy of your results though. If I can be of further assistance, please contact this office.
**See Attachment C: Kansas Maintenance Activity Priorities**. This documentation notes that priorities for maintenance work activities are established to determine the actual work to be performed when planned maintenance and operations resources are for any reason unavailable to be applied to planned work. All maintenance work activities may be grouped into the following priority classifications: Priority I, Priority II, Priority III and Priority IV. The documentation lists the general priority designations for specific maintenance activities.

**Kentucky**
Respondent: Chuck Knowles [Acting Executive Director- Office of System Preservation and Operations]; Chuck.Knowles@ky.gov.
Kentucky has no time standards for responding to specific incidents, manmade or natural.

**Louisiana**
Respondent: John Collins; JohnCollins@dotd.louisiana.gov.
Louisiana does not have any response time standards for maintenance activities. However, we are revising our maintenance standards at this time and would be interested in learning the results of your survey.

**Maine**
Respondent: Brian Burne [Highway Maintenance Engineer]; Brian.Burne@maine.gov.
We don't have clear standards right now, but we are in the process of working on it as part of defining numerous level-of-service standards for our various types of work.
Respondent: Dan Robbins [Assistant Division Engineer – Traffic]; 207-624-3631; dan.robbins@maine.gov.
We really have no written policy standards. The closest we come is a desired 24 hour repair for traffic signals, but it can be less or greater than that depending on the severity of the outage (completely out or on flash - signalization

completely gone or partially functioning), the location of the intersection (i.e. the risk to the traveling public), and the availability of labor to affect the repair. If the issue is severe enough, we address the problem as soon as we are informed of it. For other types of outages, we may not even learn of them for a month or longer. The work gets scheduled as soon as the maintenance need is discovered, and it will be addressed based the risk the malfunction has on the traveling public, and on the current backlog. If the risk is high, and we cannot immediately correct the problem, we contract the work out. This is expensive, so we are somewhat dollar driven based on need and severity, rather than on meeting arbitrary response timelines. As pointed out by South Dakota, the legal ramifications for not meeting your own guidelines are hideous.

**Maryland**
Respondent: Tom Hicks; THicks@sha.state.md.us. (For additional info contact Bob Snyder: bsnyder@sha.state.md.us.)
1. Does your state have response time standards for emergency maintenance operations?
   Yes.
2. What operations are covered by the standards? Please list or attach pertinent documents, if available.
   Traffic control signal timing calls, on-flash operations, lamp outages, complete outages, knock-downs.
3. What are the response times established for each operation? Please list or attach pertinent documents, if available.
   Upon receipt of a maintenance call, the call is immediately forwarded to the appropriate Signal Operations Team personnel for handling.

**See Attachment C: Maryland Revised Response Guidelines**.

[The following response from the Maryland State Highway Administration - Office of Maintenance applies only to highway maintenance emergencies, not bridges or signals.]
Respondent: Francis McGrath [Deputy Director, Office of Maintenance]; 410-582-5508; fmcgrath@sha.state,md.us.
1.Yes- but not in writing.
2. Pot hole repair, STOP sign repair/replacement, guard rail damage, large sign repair.
3. STOP sign repairs are done immediately upon notification (24x7) or discovery. Pot holes are repaired upon notification unless condition warrants otherwise then they are repaired immediately (24x7). Guard rail damage is delineated with cones or other devices and hazards removed upon notification and work order is given to contractor for repair. Large ground mounted sign damage is delineated with cones or other devices and hazards removed. Office of Traffic and Safety is then notified for repair/replacement.

**Minnesota**
Respondent: Bob Vasek [Maintenance Operations Support Engineer]; 651-297-5113; robert.vasek@dot.state.mn.us.
The Minnesota Department of Transportation (Mn/DOT) does not have response time standards for emergency maintenance operations. The type of activities in your examples have general priorities attached to them depending on the relative impact on traffic flow and safety of motorists and the general public.

We do have some statewide Performance Measures with time frames that could be viewed as standards. Performance Measures are internal targets to gauge our own performance. The two activities with specific time frames for performance targets are: Snow and Ice Clearance and Incident Clearance. I have attached our current guidance for snow and ice (**see Attachment C: Minnesota- snow and ice control**). The performance measure for snow and ice clearance is called "bare lane regain time" and varies depending upon roadway traffic volume. Our current Incident Clearance target is 35 minutes.

Any questions please give me a call or send a note.

**Mississippi**
Respondent: Wes Dean [State Traffic Engineer]; wdean@mdot.state.ms.us.
There are no established time standards.

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**Missouri**
Respondent: Scott Stotlemeyer [Technical Support Engineer]; 573-526-1759; scott.stotlemeyer@modot.mo.gov.
The Missouri Department of Transportation has not established any response time standards for our emergency maintenance operations. We do, however, assign priority to such events. A listing of these priorities is included in our department's Incident Response Plan. I have attached the pertinent section of this plan for your reference (**see Attachment C: Missouri- incident response process**). Should you have any questions regarding this response, our plan, or the priority list, please respond to me directly.

**Montana**
Respondent: Susan Sillick; ssillick@state.mt.us.
The state has not established response time standards for emergency maintenance operations.

**Nebraska**
Respondent: Dalyce Ronnau [Operations & Maintenance]; 402-479-4544; dronnau@dor.state.ne.us.
The Nebraska Department of Roads has not established response times to the items you listed. The best answer that can be given is we try to respond as quickly as possible. Especially where definitive traffic control situations are involved (stop signs, traffic lights, etc.).

**Nevada**
Respondent: Frank Taylor [Chief Maintenance Engineer]; ftaylor@dot.state.nv.us.
NDOT responds to emergencies immediately, and public concerns or complaints as soon as field staff can respond, and get back to the caller with activities planned, but we do not have any formalized response times standards. We get to the situation as soon as we can, and immediately if there is a threat to life/property, or we have a lane closure. We are committed to keeping traffic moving.

**New Hampshire**
Respondent: James Colburn [Project Manager]; 603-271-0383.
Lyle (Butch) Knowlton, Director of Operations, at the New Hampshire Department of Transportation requested that I respond to your recent request. This Department has not placed any time standards on emergency response. Each emergency is evaluated on its criticality and the resources available to respond to it. Every effort is made to respond with the appropriate resources based on the assessment of the emergency. Like other Departments, we are concerned about liability issues that might arise when we are not able to meet the requirements of an established policy. We always make the best effort to address all issues as soon as possible. Should you have any questions, please feel free to call me.

**New Jersey**
Respondent: Nicholas P. Vitillo [Manager, Bureau of Research]; 609-530-5637; Nick.Vitillo@dot.state.nj.us.
Immediate response is required for traffic control devices that have sustained damage. Two-hour response is required for signs such as: STOP, DO NOT ENTER, YIELD, and other regulatory signs (red and white or black and white). Also, for traffic signal knockdowns, a two-hour response time is mandated (internally). For other outages such as a green light out, those can wait until the next business day. Red lamp-out response depends on what redundancy we have at the intersection. If there are four heads at the intersection and one is out, generally it can wait until the next business day. With the switch to LED, we have far fewer lamp-outs than we used to get. For pavement problems, it depends on the extent of the problem. If called after hours, a supervisor usually goes to make an assessment. If we have a washout, it requires immediate response. But a larger pothole or something like that needs assessment. Drawbridge problems like stuck gates or bascule leafs require immediate response also (two hours).
Respondent: Michael Pilsbury; Michael.Pilsbury@dot.state.nj.us.
The NJDOT has a response time standard for emergencies of one hour during working hours, and two hours during off hours although 90 minutes is the encouraged goal. We have a database of potential situations that our dispatchers use to determine if it is an emergency. For instance, a red or yellow lamp out in a traffic signal is an emergency, but a green lamp is not. A tree down in the shoulder is an emergency but a tree off the pavement on our ROW is not.

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**New Mexico**
Respondent: Tom Raught [State Maintenance Engineer]; Tom.Raught@nmshtd.state.nm.us.
We do not have a formal document establishing response times. We do however, have a draft document that never was put into place as part of our old compass measurements that establish times at 60 minutes for urban response during work hours and 90 minutes for after hours call out. We also had set up a 90 minute rural response time and 120 minute after hour response time. Emergency operations were not defined but would be such things as stop sign problems, traffic accidents, structure failures and livestock in the roadway. It should be noted that law enforcement has a really quick 24 hour response time and they go in first to stabilize the situation. The DOT follows on with a more permanent fix.

**New York**
Respondent: Steve Wilcox [Associate Director of Maintenance- NYSDOT Transportation Maintenance Division]; 518-457-6911; SWILCOX@dot.state.ny.us.
Our state does not have response time standards for emergency maintenance operations, except to say we drop whatever we're doing and respond asap.

**North Carolina**
Respondent: Lacy Love; llove@dot.state.nc.us.
We don't have any response times for emergency times in NC.

**North Dakota**
Respondent: Allan Covlin; acovlin@state.nd.us.
North Dakota has not established response time standards. We respond as soon as possible.

**Ohio**
Respondent: Mike McColeman [Central Office, Maintenance Administration]; 614-644-7155; Mike.McColeman@dot.state.oh.us.
Attached you will find Ohio's response (**see Attachment C: Ohio Established Response Processes**).

**Oregon**
Respondent: Joel Fry [Field Operations, ODOT- Office of Maintenance]; 503-986-4485; Joel.D.FRY@odot.state.or.us.
ODOT has response times for various maintenance activities but there is no distinction between normal or emergency maintenance operations. We do have an emergency operations plan for critical business functions but this addresses issues at a higher level.

**Rhode Island**
Respondent: Frank Corrao [Managing Engineer- Traffic Engineering]; fcorrao@DOT.STATE.RI.US.
The RIDOT does have standard response times for traffic signal malfunction. If the failure is during the normal work day, response is immediate. If the failure is off-working hours, the crews are on-call and if called to respond, they have 15 minutes to call headquarters. This response time is greatly reduced because of the Nextel two-way. Our Maintenance forces then have 45 minutes +/- to address the problem. If we are notified about a missing sign, our sign crews try to replace the sign within 24 hours. Any type of emergency pavement problems are handled similar to traffic signal responses.

**South Carolina**
Respondent: Richard Werts; WertsRB@dot.state.sc.us.
South Carolina DOT does not have any official response times for emergencies.

**South Dakota**
Respondent: John Adler [Traffic Operations Engineer]; 605-773-4759; John.Adler@state.sd.us.
South Dakota has not attempted to place time standards on emergency operations. Certain activities will, naturally, take a higher priority, but to place some time requirements would be very difficult. In many parts of the state distance from possible activities and the crews and equipment necessary would make it much more difficult to achieve than other locations.

I think that there is always some concern that requirements such as this would open the Department up to legal ramifications. For instance, suppose that some activity is to be performed within 2 hours and it happens at a time when a crew needs to be assembled and travel time makes it impossible, what would the ramifications be if something happens 2 hours and 5 minutes after notification? This is not to say that a best effort will not be made to fix all conditions as quickly as possible.

**Texas**
Respondent: Joe Graff [Deputy Director- Texas DOT Maintenance Division]; 512-416-3195; JGRAFF@dot.state.tx.us.
You might get several responses from Texas as Maintenance and Operations are different divisions.

1. Does your state have response time standards for emergency maintenance operations?
   Generally the answer to this question is no. We do have policies in our manual that indicate "As soon as possible" or "As soon as practical." This generally means we respond 24 hours a day to the "As soon as possible" items (signals out, stop signs, bridge hit, etc.). As soon as practical would mean on a normal work day.
2. What operations are covered by the standards? Please list or attach pertinent documents, if available.
   Level of service guidelines are addressed in our Maintenance Manual. The following link will get you to the TxDOT on-line Maintenance Manual: http://manuals.dot.state.tx.us/dynaweb/colinfra/@Generic__CollectionView;cs=default;ts=default. In the Maintenance Management Manual, look at Chapter 3 - Level of Service. In the Maintenance Operations Manual, look at all chapters for a description of the work and priorities.
3. What are the response times established for each operation? Please list or attach pertinent documents, if available.
   Again, we have not developed response times requirements, mostly to make sure we are not setting our self up for lawsuits. We have developed some response times for our asset management contractor. The specification can be found at: http://www.dot.state.tx.us/mnt/specs/maintspec.txt. See Performance Standards, beginning on the bottom of page 5. Let me know if you have any questions.

**Utah**
Respondent: David Kinnecom [Traffic Management Engineer, Traffic Operations Center]; 801 887-3707; dkinnecom@utah.gov.
The Utah Department of Transportation does not have specific time standards for emergency response. However, we do have a number of practices intended to improve our response time to public safety problems.

We have a traffic signal technician on-call every night and weekend. These technicians are called in by the Traffic Operations Center or the Department of Public Safety for traffic signal problems that affect safety. These may include knockdowns, exposed wires, flashing intersections, or twisted heads. The on-call technician is generally expected to respond to the scene in less than one hour, although that is not a written standard. During the day, when several technicians are on duty, they are expected to respond to a safety issue as soon as possible when notified. Typically, this time is less than one half hour, depending on location.

Highway, maintenance personnel also are requested to respond to public safety problems as soon as possible. They may be called in after normal hours for problems such as sign knockdowns, spilled loads, pavement or bridge damage, or winter maintenance. UDOT's Incident Management Team is also subject to be called in after hours to assist with traffic incidents.

Please feel free to contact me if I can be of further assistance.

**Vermont**
Respondent: Richard Tetreault; Richard.Tetreault@state.vt.us.
Vermont does not have response time standards for emergency maintenance operations.

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**Virginia**
Respondent: Jim Cline [Assistant Director for Infrastructure Management- Asset Management Division]; 804-786-4271; James.Cline@VDOT.Virginia.Gov.
**See Attachment C: Virginia Snow Removal Standards** for response time standards.
In addition, we (VDOT) will have ready for publication by Nov. 1, 2004, a "Best Practices Guideline" that we will be providing to our field staff as another tool in their toolbox. If you would like, we can send you one. Please advise, if you would like to receive this manual. (Readers may request a hard copy version of "Asset Management Best Practices" from: Robert Kardian [Special Studies Engineer- Asset Management Division]; 804-786-2849; Bob.Kardian@VDOT.Virginia.gov. A copy is also available in the WisDOT Library.)

**Washington State**
Respondent: Chris Christopher; christc@wsdot.wa.gov.
Washington State DOT Highway Maintenance does not have response time standards for emergency maintenance operations.

**West Virginia**
Respondent: Ray Lewis [Staff Engineer- Traffic Research and Special Projects, Traffic Engineering Division, Division of Highways]; 304 558 3063; rlewis@dot.state.wv.us.
We have specific response times in two primary areas. For traffic signals maintained by the Division of Highways, we maintain a duty officer. Calls outside of business hours are routed to our Charleston Control operator, who then notifies the duty officer. If the signal outage is confirmed, the duty officer can dispatch maintainers to the site. The crew can depart Charleston within an hour of being called out, on a 24/7 basis. Our Maintenance Manual contains response and repair policies for guardrail (see Response Maintenance Table- Guardrail- West Virginia). Should you have any further questions, please contact me.

**Wyoming**
Respondent: Ken Shultz [State Maintenance Engineer]; 307-777-4458; ken.shultz@dot.state.wy.us.
Wyoming has no documented response time standards for emergency maintenance operations. We would be interested in the results of your survey.

## International:
**Alberta**
Respondent: Nick Bucyk [Operations Specialist, Alberta Transportation]; 780-422-6431; Nick.Bucyk@gov.ab.ca.
Please find below my response to your survey. For your information all the highway maintenance work has been outsourced to private maintenance contractors.
1) Alberta Transportation requires that the maintenance contractors take immediate response when it comes to Emergency Duties. There is no specific time frame. The contractor is to respond as soon as he becomes notified of the problem.
2) The following operations are covered under emergency duties:
- Repairing or replacing critical signs
- Removing road kill and debris from surface of roadway that may create a hazard
- Repairing traffic signals
- Responding to accidents to provide traffic control
- Dispatching snow & ice control equipment
- Provide adequate marking for hazards such as frost heaves
- Repair and/or marking of unsafe poor pavement conditions
- Repair and/or marking of unsafe poor bridge conditions
- Repair and/or marking of unsafe poor gravel road conditions.

3) There is no specific time frame. The contractor is to respond as soon as he becomes notified of the problem.
If you have any further questions please advise.

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**British Columbia**
Respondent: Nicole Pharand-Fraser [A/Manager, Maintenance Program]; Nicole.PharandFraser@gems4.gov.bc.ca.
Yes, we do have response times for "emergency" maintenance operations. I am attaching the maintenance specifications for:
- sign maintenance
- flood control and washout response
- mud, earth and rock slide response
- structure damage response
- highway incident response.

(**See Attachment C: British Columbia- maintenance specifications.**)
All our maintenance specifications are available on our Web site if you want to peruse them.
(See: http://www.th.gov.bc.ca/bchighways/contracts/maintenance/Sched_21_Maint_Specs_Oct30.pdf.)

**Nova Scotia**
Respondent: Bruce Fitzner [Director of Highway Operations]; 902-424-2348; fitznebr@gov.ns.ca.
1. Does your state have response time standards for emergency maintenance operations?
   Yes.
2. What operations are covered by the standards? Please list or attach pertinent documents, if available.
   Signs; Potholes; Storm Sewer and Culverts; Snow and Ice Control (there are standards for other maintenance operations but these are the only ones that have urgent time lines in some cases).
3. What are the response times established for each operation? Please list or attach pertinent documents, if available.
   (**See Attachment C: Nova Scotia Winter Maintenance Standards**.)

## Attachment B: MAINTENANCE RESPONSE TIME SURVEY – SUMMARY TABLE
## AASHTO RESEARCH ADVISORY COMMITTEE LISTSERV
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| | URGENT | NOT URGENT |
|---|---|---|
| **Debris on road** | **Arizona**: Rural- 15m for mtc. to acknowledge, 1h to respond, 2h to close incident. Phoenix metro area- 10m to acknowledge, 30m to respond, 2h to close.<br>**British Columbia**: contractor must start repairs for mud, earth or rock slides in accordance with the following maximum response times-<br>(i) Slides completely blocking a highway and isolating a community – 45m on Summer Highway Classification (SHC) 1 and 2 highways.<br>(ii) Slides completely blocking a numbered route or main highway not covered in (i) – 1.5h on SHC 1 and 2.<br>(iii) Slides blocking only one or more lanes and restricting traffic – 4h on SHC 1 and 2.<br>Also see Attachment C: B.C.- Mud, Earth and Rock Slide Response. | |
| **Car stalled on shoulder** | **Arizona**: Rural- 15m for mtc. to acknowledge, 1h to respond, 2h to close incident. Phoenix metro area- 10m to acknowledge, 30m to respond, 2h to close. | |
| **Livestock** | **Arizona** (on roadside): Rural- 15m for mtc. to acknowledge, 1h to respond, 2h to close incident. Phoenix metro area- 10m to acknowledge, 30m to respond, 2h to close.<br>**New Mexico** (in roadway): draft document: Urban- 1h response during work hours, 1.5h after hours. Rural- 1.5h during work hours, 2h after hours. | |
| **Traffic crash** | **Arizona**: Rural- 15m for mtc. to acknowledge, 1h to respond, 2h to close incident. Phoenix metro area- 10m to acknowledge, 30m to respond, 2h to close.<br>**British Columbia**: contractor must immediately, from the time the incident was detected by or reported to the contractor, implement traffic control.<br>Also see Attachment C: B.C.- Highway Incident and Vandalism Response.<br>**California**: maintenance accident/incident response- maintenance forces typically respond to highway incidents at the behest of the California Highway Patrol to provide traffic controls and/or debris removal/load salvage. The established performance goal is that maintenance employees will respond to all highway incidents within 30m of notification/callout.<br>**New Mexico** draft document: Urban- 1h response during work hours, 1.5h after hours. Rural- 1.5h during work hours, 2h after hours.<br>**Virginia**: Contract: Incident Response- on site within 20m; Traffic Control- set up within 1h during work hours, 1.5h after work hours. | |
| **Sign repair: regulatory critical** | **British Columbia**: maximum time from the time the deficiency was detected by or reported to the contractor, within which the contractor must complete the cleaning, resetting, repair and/or relocation of sign systems and pickets-<br>* Regulatory and warning – 24h on Summer Highway Classification (SHC) 1 and 2 highways.<br>* School and pedestrian – 24h on SHC 1 and 2.<br>* Parking and stopping – 24h on SHC 1 and 2.<br>Also see Attachment C: B.C.- Sign System Maintenance.<br>**New Jersey**: 2h.<br>**New Mexico** draft document: Urban- 1h response during work hours, 1.5h after hours. Rural- 1.5h during work hours, 2h after hours.<br>**Rhode Island**: 24h to replace a missing sign.<br>**Virginia**: response time for stop sign repair ranges from same day in high volume populated areas to 24h from time of notification for low volume secondary roads. | |

## Attachment B: MAINTENANCE RESPONSE TIME SURVEY – SUMMARY TABLE
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| | | |
|---|---|---|
| **Sign repair: regulatory non-critical** | **British Columbia**: maximum time from the time the deficiency was detected by or reported to the contractor, within which the contractor must complete the cleaning, resetting, repair and/or relocation of sign systems and pickets-<br>* Delineators and pickets – 24h on Summer Highway Classification 1 and 2 highways.<br>Also see Attachment C: B.C.- Sign System Maintenance.<br>**New Jersey**: 2h.<br>**Rhode Island**: 24h to replace a missing sign. | |
| **Sign repair: advisory** | | **British Columbia**: maximum time from the time the deficiency was detected by or reported to the contractor, within which the contractor must complete the cleaning, resetting, repair and/or relocation of sign systems and pickets-<br>* Direction [guide] – 2d on Summer Highway Classification (SHC) 1 and 2 highways.<br>* Information – 2d on SHC 1 and 2.<br>* Service and attraction – 2d on SHC 1 and 2.<br>* All other signs – 7d on SHC 1 and 2.<br>Also see Attachment C: B.C.- Sign System Maintenance. |
| **Traffic signal knockdown or malfunction** | **Indiana**: technician to be at location within 2h of notification. Intersection to be "secured" or total maintenance completed before technician leaves.<br>**Maine**: desired 24h repair for traffic signals. If the issue is severe enough, problem is addressed upon being informed of it.<br>**New Jersey**: 2h.<br>**Rhode Island**: immediate response during work hours. After hours, crews called to respond have 15m to call HQ; mtc. forces then have 45m +/- to address problem.<br>**Virginia**: response time for traffic signal failure about 2.5h; in the most severe situations repairs are usually made, even though they may be temporary, within 12 hours.<br>**West Virginia**: mtc. crew can depart Charleston within an hour of being called out, on a 24x7 basis. | **New Jersey**: next business day for other outages such as green light out. Red lamp out response depends on what redundancy exists at the intersection. If there are four heads at the intersection and one is out, generally it can wait until the next business day. |
| **Pavement washout** | **British Columbia**: contractor must perform flood control and washout response in accordance with the following maximum response times-<br>(i) Washouts completely cutting a highway and isolating a community – 45m on Summer Highway Classification (SHC) 1 and 2 highways.<br>(ii) Washouts completely cutting a numbered route or main highway other than those covered by (i) – 1.5h on SHC 1 and 2.<br>(iii) Washouts cutting one or more lanes of a highway – 4h on SHC 1 and 2.<br>Also see Attachment C: B.C.- Flood Control and Washout Response.<br>**New Jersey**: 2h. | |
| **Bridge damage or malfunction** | **British Columbia**: contractor must-<br>* immediately, from the time the damage was detected by or reported to the contractor, notify the Province of any damage to any structure, so that the Bridge Structural Engineer may make an inspection;<br>* start installation of temporary barriers or railing placements within 24h from the time the damage was detected by or reported to the contractor.<br>Also see Attachment C: B.C.- Structure Damage Response.<br>**New Jersey**: 2h. | |
| **Pavement blow-up** | **Rhode Island**: immediate response during work hours. After hours, crews called to respond have 15m to call HQ; mtc. forces then have 45m +/- to address problem. | |
| **Traffic crash attenuator repair** | **Virginia**: Contract: mitigate immediately. If badly damaged, repair or replace within two days. Damaged but functional, repair or replace within one week. | **Indiana**: impact attenuator maintenance should be completed within five working days of notification. |

## Attachment B: MAINTENANCE RESPONSE TIME SURVEY – SUMMARY TABLE
## AASHTO RESEARCH ADVISORY COMMITTEE LISTSERV
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| | | |
|---|---|---|
| **Pothole** | **Virginia**: Contract: immediate when causing a threat to safety, all others within two days of notification. | **New Jersey**: A larger pothole or something like that needs assessment. |
| **Severe weather conditions: snow/ice/frost removal** | **Iowa**: treat ice and frost on bridges within three hours after notification of that condition. Three-hour response time after notification of snow and ice on highways. General time limit of getting highways back to a serviceable condition within 24h after a storm ends.<br>**Minnesota**: see Attachment C: Minnesota- snow and ice control: Table 1, 5-791.310- Bare Lane Indicator Guidelines.<br>**Nova Scotia**: from the time unfavorable road conditions occur and winter equipment is required, Operations Supervisor has a maximum of 1h to have the required equipment working in the assigned areas of responsibility.<br>**Virginia**: see Attachment C: Virginia Snow Removal Standards. | |
| **Guardrail** | **Virginia**: Contract: mitigate immediately. If badly damaged, repair or replace within two days. Damaged but functional, repair or replace within one week.<br>**West Virginia**: interstate and other expressways: non-func. GR- place appropriate warning devices immediately after being notified; utilize State Forces or emergency mobilization clause of GR contract to effect repairs as soon as reasonably possible. | **Indiana**: guardrail maintenance should be completed within five working days of notification.<br>**West Virginia**:<br>Interstate and other expressways: func. GR- place appropriate warning devices the next scheduled workday; schedule repairs to be completed within 60 days.<br>NHS and routes with ADTs greater than 6,000: non-func. GR- place appropriate warning devices when notified or no later than the next scheduled workday; mobilize GR contractor or State Forces to effect repairs as soon as practical within a 30-day maximum. Func. GR- place appropriate warning devices the next scheduled workday; schedule repairs to be completed within 60 days.<br>Other routes with ADTs 1,000 - 6,000: non-func. GR- place appropriate warning devices the next scheduled workday, schedule repairs by contract as soon as practical, within 60 days maximum. Func. GR- schedule repairs to be completed within 90 days.<br>Routes less than 1,000 ADTs: non-func. GR- place appropriate warning devices as site specific conditions dictate; schedule the repairs by contract unless they are minor in nature within 90 days. Func. GR- schedule repairs to be completed within 120 days. |

**Connecticut DOT** has a goal of 1h response time for all highway incidents. Response times have been tracked from the initial contact until DOT personnel arrive on-scene. The average response time is 45 minutes. However, this goal is not always achieved. Field staff are required to live within a 15-mile radius of their assigned maintenance facility which ensures a short commute. Connecticut is a relatively small state -- the response area of each facility is in close proximity to the garage.

# Attachment C

## MAINTENANCE RESPONSE TIME SURVEY – STATE DOCUMENTS
## AASHTO RESEARCH ADVISORY COMMITTEE LISTSERV
## Wisconsin Department of Transportation RD&T
## December 6, 2004

1. British Columbia – Maintenance Specifications
2. Indiana – Guardrail Maintenance
3. Indiana – Impact Attenuator Maintenance
4. Kansas – Maintenance Priorities
5. Maryland – Revised Response Guidelines
6. Minnesota – Snow and Ice Control
7. Missouri – Incident Response Process
8. Nova Scotia – Winter Maintenance Standards
9. Ohio – Established Response Processes
10. Virginia – Snow Removal Standards

**B.C. MINISTRY OF TRANSPORTATION**

**Maintenance Specification Chapter 7-760**

# FLOOD CONTROL AND WASHOUT RESPONSE

## 1. OBJECTIVE

To safeguard Highway Users and adjacent properties; to prevent damage to Highways and Bridges; to restore traffic movement and to repair damage caused by flood and washout events.

## 2. GENERAL PERFORMANCE SPECIFICATIONS

### 2.1 Routine Maintenance Services

All services for this Maintenance Specification are Routine.

### 2.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

## 3. DETAILED PERFORMANCE SPECIFICATIONS

### 3.1 Routine Maintenance Services

The Contractor must:

a) prepare for floods and washouts;

b) take all actions required to control the flow of water on or adjacent to Highways;

c) take all actions required to protect the Highway, including placing Rip-rap in accordance with the Maintenance Specification for *Shore, Bank and Watercourse Maintenance*, with no credit for such work under the Maintenance Specification for *Shore, Bank and Watercourse Maintenance*, unless mutually agreed to between the Province and the Contractor;

d) repair any damage to Highway infrastructure resulting from floods and/or washout events in accordance with the relevant Maintenance Specifications, with no credit for such work under those Maintenance Specifications, unless mutually agreed to between the Province and the Contractor;

e) provide traffic control in accordance with the Maintenance Specification for *Highway Traffic Control*;

f) close sections of a Highway, as approved in writing by the Province, and provide detours of up to a maximum additional travel length of 3.5 kilometres, where necessary;

g) patrol effected Highways in accordance with the Maintenance Specification for *Highway Patrol*.

Note: Refer to Section H of the Introduction to these Maintenance Specifications.

### 3.1.1 Performance Time Frames

The Contractor must:

a) inspect immediately, from the time the deficiency was detected by or reported to the Contractor, any potential for damage caused by flooding or washout conditions, and implement traffic control as necessary;

b) when an event of a flood or washout effects the Travelled Lanes, immediately establish at least one through lane for traffic, and commence work to restore the Highway;

c) immediately inform the Province where floods or washouts result in Highway closures;

d) within 2 days of the end of the storm or other event, identify any potential for flooding and/or washout and notify the Province, in writing, with a complete list of the locations;

f) perform flood control and washout response in accordance with the Maximum Response Times indicated in the table below:

| Washout Category | Summer Highway Classification | | | | |
|---|---|---|---|---|---|
| | 1&2 | 3 | 4 | 5 | 6&7 |
| (i) washouts completely cutting a Highway and isolating a community | 45 min | 1 h | 90 min | 150 min | 4 h |
| | | | | | |
| (ii) washouts completely cutting a numbered route or main Highway other than those covered by (i) above | 90 min | 2 h | 3 h | n/a | n/a |
| | | | | | |
| (iii) washouts cutting one or more lanes of a Highway | 4 h | 6 h | 9 h | 15 h | 24 h |

**Legend**
h - hours
min – minutes

### 3.2 Quantified Maintenance Services

Not Applicable to this Maintenance Specification.

### 3.3 Materials

Refer to Section B of the Introduction to these Maintenance Specifications.

## 4. WARRANTY

Not applicable to this Maintenance Specification.

**B.C. MINISTRY OF TRANSPORTATION**

**Maintenance Specification 7-780**

# HIGHWAY INCIDENT AND VANDALISM RESPONSE

## 1. OBJECTIVE

To protect Highway Users from conditions that are unsafe or have the potential to become unsafe; and to restore the movement of traffic.

## 2. GENERAL PERFORMANCE SPECIFICATIONS

### 2.1 Routine Maintenance Services

All services for this Maintenance Specification are Routine.

### 2.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

## 3. DETAILED PERFORMANCE SPECIFICATIONS

### 3.1 Routine Maintenance Services

The Contractor must:

a) provide initial traffic control in accordance with the Maintenance Specification for *Highway Traffic Control*, in response to incidents on the Highway e.g., motor vehicle accidents, spills) until police and/or other authorities arrive at the scene; if no other authorities are required to attend the scene, the Contractor will remain at the scene until normal traffic flow is restored;

b) prepare for and respond to incidents and vandalism on Highways by:

i) securing the area as required to ensure the safety of Highway Users;

ii) communicating incidents involving Highway closures to the Province in accordance with the Maintenance Specification for *Highway Condition Reporting*;

iii) containing spills on Highways in conjunction with and cooperation with regulatory agencies, police authorities and the Province;

iv) removing vehicles from the Travelled Lanes and Shoulders, as necessary (where this service is not provided by others);

v) removing and disposing of cargo and Debris from the Travelled Lanes and Shoulders, to restore traffic flow;

**vi)** documenting all associated costs of removing vehicles, cargo and Debris from the Highway;

vii) completing a Chargeable Maintenance Costs report and forwarding that report to the Province; and

viii) repairing any damage to Highways caused by incidents or vandalism in accordance with the applicable Maintenance Specification, with credit for such work under the applicable Maintenance Specification if the cost of such work is not recovered under Chargeable Maintenance Costs.

ensure the safety of Highway Users in the event of a spill within Rights-of-way involving Dangerous Goods as defined in the Transportation of Dangerous Goods Act and Regulations (TDG) in accordance with the Canutec Emergency Response Guidebook (ERG) by:

i) alerting the Province, police authorities, and Provincial Emergency Program personnel, as required to identify the material and respond to the emergency, and respond as appropriate and in accordance with all applicable laws and regulations;

ii) training field personnel and field supervisors in accordance with all applicable laws and regulations for Dangerous Goods material identification and risk assessment; and

iii) closing and keeping the Highway closed using, at minimum, Guide 111 of the ERG until the hazard and/or material is identified and appropriate actions have been determined and performed in accordance with all applicable guides, laws and regulations;

Note: Transport Canada's Response and Operations Division operates CANUTEC to provide a 24-hour Dangerous Goods reference, data bank and expert assistance service.

d) evacuating the area if an explosion is possible;

e) establishing and recording information as per TDG Regulation Part 8; 8.1- 8.3; and the WCB Act Division 10 – 172; and

f) documenting traffic incidents attended by the Contractor, i.e. taking photographs, diary notes, recording Highway conditions and locations relating to; and delivering such documents to the Province, when requested.

Note: Parties responsible for the incident, their insurers, or agencies which have jurisdiction over the incident are expected to bear all of the costs of vehicle recovery, cleanup, accident investigation and traffic control. Notwithstanding the above, should the Contractor determine that actions undertaken by others, or failed to be undertaken by others, have the potential to present a hazard to Highway Users, the Contractor will take all necessary actions to protect Highway Users and may submit a claim to the Province for cost recovery.

### 3.1.1 Performance Time Frames

The Contractor must:

a) immediately, from the time the incident was detected by or reported to the Contractor, implement traffic control;

b) within 3 days of the date of request by the Province, forward all photographs, documentation and records;

c) repair damage to Highways in accordance with the appropriate Maintenance Specification and their Performance Time Frames; and

d) within one week of the incident or act of vandalism, complete a Chargeable Maintenance Cost report and send photographs of the damage .

## 3.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

### 3.2.1 Performance Time Frames

Not applicable to this Maintenance Specification.

### 3.3 Materials

Refer to Section B of the Introduction.

## 4. WARRANTY

Not applicable to this Maintenance Specification.

**B.C. MINISTRY OF TRANSPORTATION**

**Maintenance Specification Chapter 7-770**

# MUD, EARTH AND ROCK SLIDE RESPONSE

## 1. OBJECTIVE

To safeguard Highway Users and adjacent properties; to restore traffic movement and to repair damage to Highways and Bridges caused by mud, earth and rock slides.

## 2. GENERAL PERFORMANCE SPECIFICATIONS

### 2.1 Routine Maintenance Services

All services for this Maintenance Specification are Routine.

### 2.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

## 3. DETAILED PERFORMANCE SPECIFICATIONS

### 3.1 Routine Maintenance Services

The Contractor must:

a) provide traffic control in accordance with the Maintenance Standard for *Highway Traffic Control,* in response to a mud, earth or rock slide ;

b) provide detours around the effected section of Highway of up to a maximum additional travel length of 3.5 kilometres, where necessary;

c) remove mud, earth or rock deposits effecting the function of the Highway;

d) monitor and patrol areas suspected of being unstable, as directed by the Province;

e) control locations subject to slides exceeding 100 cubic metres of mud, earth or rock. The Province will arrange for a Geotechnical Engineer to investigate the site and the Contractor must perform work in accordance with the recommendations of the Geotechnical Engineer to prevent rockfall from reaching the Shoulder top and Travelled Lanes; and

f) repair any damage to Highway infrastructure resulting from mud, earth and rock slide events in accordance with the appropriate Maintenance Specification, with no credit for such work under those Maintenance Specification, unless mutually agreed to between the Province and the Contractor.

Notes:

1. Slope stability treatment involving rock bolting, wire mesh or geo-fabric installation is not required by this Maintenance Specification.

2. Refer to Section H of the Introduction to these Maintenance Specifications.

### 3.1.1 Performance Time Frames

The Contractor must:

a) inspect immediately, from the time the deficiency was detected by or reported to the Contractor, any potential for damage caused by mud, earth or rock slides, and implement traffic control as necessary;

b) when an event of a mud, earth or rock slide effects the Travelled Lanes, immediately establish at least one through lane for traffic, and commence work to restore the Highway;

c) immediately inform the Province where slides result in Highway closures;

d) within 2 days of the end of the storm or other event, identify any potential for flooding and/or washout and notify the Province, in writing, with a complete list of the locations;

e) control, at times directed by the Province, all known locations that are subject to annual slides of less than 100 cubic metres of mud, earth or rock;

f) control locations subject to slides exceeding 100 cubic metres of mud, earth or rock in accordance with the recommendation of the Geotechnical Engineer;

g) immediately advise the Province in the event of a slide exceeding 100 cubic metres effecting the Highway, or if there are indications of a potential slide of this size or greater; and

h) start repairs in accordance with the maximum response times established in the table below:

| | | **Summer Highway Classification** | | | | |
|---|---|---|---|---|---|---|
| | | **1 & 2** | **3** | **4** | **5** | **6 & 7** |
| (i) | slides completely blocking a Highway and isolating a community | 45 min | 1 h | 90 min | 150 min | 4 h |
| | | | | | | |
| (ii) | slides completely blocking a numbered route or main Highway not included in (i) above | 90 min | 2 h | 3 h | n/a | n/a |
| | | | | | | |
| (iii) | slides blocking only one or more lanes and restricting traffic | 4 h | 6 h | 9 h | 15 h | 24 h |

**Legend**
h – hours
min - minutes

### 3.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

### 3.2.1 Performance Time Frames

Not applicable to this Maintenance Specification.

### 3.3 Materials

Refer to Section B of the Introduction.

## 4. WARRANTY

Not applicable to this Maintenance Specification.

**B.C. MINISTRY OF TRANSPORTATION**

**Maintenance Specification Chapter 5-440**

# SIGN SYSTEM MAINTENANCE

## 1. OBJECTIVE

To regulate and facilitate the safe and orderly movement of traffic.

## 2. GENERAL PERFORMANCE SPECIFICATIONS

### 2.1 Routine Maintenance Services

The Contractor must:

a) clean and repair existing Sign Systems and their components;

b) reset Sign Systems that are accidentally knocked or blown down;

c) relocate Sign Systems and Pickets that need to be removed and re-installed due to seasonal requirements or due to changing needs or conditions; and

d) replace reflectors and Pickets.

### 2.2 Quantified Maintenance Services

The Contractor must:

a) replace or install new Sign Face Overlays, Signs and Sign Systems; and

b) relocate, due to policy changes, Signs and Sign Systems as required by the Province.

## 3. DETAILED PERFORMANCE SPECIFICATIONS

### 3.1 Routine Maintenance Services

The Contractor must:

a) keep all Sign Systems and Pickets clean, legible, adequately reflectorized, erect and correctly located in accordance with the Sign Manuals and the Province's Policy for Highway Signs as outlined in Appendix "A" of this Maintenance Specification, or as otherwise specified by the Province;

b) relocate Sign Systems at Highway locations that are required to be removed and re-installed due to seasonal requirements or due to changing needs or conditions, at those Highway locations determined by the Province;

c) replace reflectors with the same type, size and quality as existing and in accordance with the sign manuals listed in Section J of the Introduction to these Maintenance Specifications;

d) replace Pickets;

e) obtain prior approval from the Province for all re-ordering and design of guide signs and special information signs; and

f) remove, store and be responsible for any illegal or unauthorized Signs or Sign Systems on the Highways, as directed by the Province.

### 3.1.1 Performance Time Frames

a) The following table establishes the maximum time from the time the deficiency was detected by or reported to the Contractor, within which the Contractor must complete the cleaning, resetting, repair, and/or relocation of Sign Systems and Pickets:

| **Type of Sign marking (in accordance with the Sign Manuals)** | **Summer Highway Classification** | | |
|---|---|---|---|
| | **1&2** | **3&4** | **5,6&7** |
| (i) regulatory and warning | 24 h | 24 h | 24 h |
| | | | |
| (ii) school and pedestrian | 24 h | 2 d | 3 d |
| | | | |
| (iii) delineators and Pickets | 24 h | 2 d | 3 d |
| | | | |
| (iv) parking and stopping | 24 h | 2 d | 3 d |
| | | | |
| | | | |
| (vii) direction (guide) | 2 d | 3 d | 7 d |

| Type of Sign marking (in accordance with the Sign Manuals) | Summer Highway Classification | | |
|---|---|---|---|
| | 1&2 | 3&4 | 5,6&7 |
| | | | |
| (viii) information | 2 d | 3 d | 7 d |
| | | | |
| (ix) service and attraction | 2 d | 3 d | 7 d |
| | | | |
| (x) all other Signs | 7 d | 7 d | 7 d |

**Legend**
d – days

The Contractor must:

b) notwithstanding 3.1.1 a), make temporary repairs to any regulatory or warning Sign that is determined to be a Damaged Sign as described in Appendix A of this Maintenance Specification or if any stop or yield Sign is missing; and initiate installation of temporary signage or provide traffic control in accordance with the Maintenance Specification for *Highway Traffic Control* immediately, from the time the deficiency was detected by or reported to the Contractor;

c) touch up or re-paint all Sign and delineator posts when the surface is discoloured or damaged and re-paint all wood posts a minimum of once every three years;

d) relocate Sign Systems and Pickets required to be removed and reinstalled due to seasonal requirements or changing needs or conditions within 7 days from receiving direction from the Province;

e) replace surface reflectors within 10 days from the time the deficiency was detected by or reported to the Contractor, where more than 25 percent of the reflectors along any continuous 500-metre section of Highway are missing, damaged or have lost their reflectivity;

f) replace surface reflectors within 30 days from the time the deficiency was detected by or reported to the Contractor, where less than 25 percent of the reflectors along any continuous 500-metre section of Highway are missing, damaged or have lost their reflectivity; and

g) replace Guardrail and animal reflectors within 30 days from the time the deficiency was detected by or reported to the Contractor, where more than 25 percent of the reflectors along any continuous 500-metre section of Highway are missing, damaged or have lost their reflectivity.

### 3.2 Quantified Maintenance Services

The Contractor must:

a) replace or install new Sign Face Overlays, Signs and Sign Systems; and

b) relocate Signs and Sign Systems as required by the Province because of policy changes.

Note: The Contractor will not mount Signs on poles or structures without the prior approval of the Province and/or the owner of the poles or structures.

#### 3.2.1 Performance Time Frames

The Contractor must:

a) replace or install new regulatory, warning or school and pedestrian Sign Face Overlays, Signs and/or Sign Systems within 24 hours from receiving direction from the Province;

b) order, replace or install new guide or information Sign Face Overlays, Signs and/or Sign Systems as follows:

   i) order within 24 hours of receiving direction from the Province; and

   ii) install within 24 hours of delivery.

c) install delineators and all other Sign Face Overlays, Signs and/or Sign Systems within 7 days of receiving direction from the Province; and

d) plan to perform all required Sign Face Overlays, Signs and Sign System deficiencies within the Contract Year to the limit of the identified quantities. Where identified work exceeds the available quantities the Contractor must ensure repairs are identified and carried out in order of priority to ensure safety and to protect the infrastructure.

## 3.3 Materials

The Contractor must ensure that:

a) Sign Face Overlays, Signs and Sign Systems must be as specified in the Specifications for Standard Highway Sign Materials, Fabrication and Supply; and in the Sign Pattern Manual;

b) metal posts and battens are made of perforated, Galvanized steel square tubing or of other material as approved in writing by the Province;

c) all wooden posts and battens are pressure-treated wood S4S, with dimensions, colour and shape as specified in the Standard Specifications for Highway Construction;

d) metal or concrete posts for delineators are as specified in the Sign Manuals and that plastic or fiberglass delineator posts are in accordance with the Standard Specifications for Highway Construction;

e) oil-base, solid colour stain or oil-base exterior paint, compatible primer paint and standard paint colours are as specified in the Sign Manuals, with all materials meeting the CGSB specifications as to quality, coverage and colour in accordance with the Standard Specifications for Highway Construction;

f) all hardware is of non-corrosive material to avoid discolouration of Sign and delineator faces;

g) delineator reflectors and reflective sheeting are in accordance with the Sign Manuals;

h) concrete and other materials used for production and fabrication of Sign bases are in accordance with the Sign Manuals, Standard Specifications for Highway Construction or as otherwise approved in writing by the Province;

i) Pickets, animal reflectors and other materials are as approved in writing by the Province; and

j) Guardrail reflectors are as specified in the Standard Specifications for Highway Construction.

## 4. WARRANTY

Not applicable to this Maintenance Specification.

**BC MINISTRY OF TRANSPORTATION**

**Maintenance Specification**

**SIGN SYSTEM MAINTENANCE**

# APPENDIX "A"

## Policy for Highway Signs

Poorly maintained Signs and other Sign Systems reduce Highway safety and spoil the appearance of an otherwise well maintained Highway. To be respected by Highway Users and to be useful and effective, Sign Systems must be correctly used and correctly placed.

Effective Signing requires:

a) selection of the correct Sign System for a particular situation;
b) correct location of the Sign System; and
c) ongoing maintenance to ensure that the Sign and its post(s) are in good condition.

In order to meet the requirements of this policy, the Contractor must engage in practices that ensure that all Signs and other Sign Systems are correctly placed, clearly display the necessary messages to ensure the safe and orderly movement of traffic, and meet other safety, aesthetic and economic benefits. This requires that the Contractor carry out its obligations in accordance with this Maintenance Specification in a manner that minimizes the overall deterioration of Signs and other Sign Systems.

The following descriptions of "Sign Deterioration" and "damaged Sign" must be referred to in this Maintenance Specification:

"Sign Deterioration"

Each Sign face will be kept visible and legible under both day and night time conditions. It should be noted that all Signs will gradually deteriorate to a point where the Signs must be Refurbished or replaced. The retro-reflective sheeting of Signs deteriorates from the effects of sunlight, weather, airborne particles, and air pollution. Dirt from road spray, snow and ice removal from the roadway, and air pollution may collect on the Sign sheeting, and, if unchecked, will severely affect the night time visibility of the Sign.

A Sign face is considered to have lost its retro-reflectivity for night time display when the area of limited retro-reflectivity or blotchy reflectiveness exceeds 25% of the Sign face area. A Sign face is also considered to have lost its retro-reflectivity when the

reduced retro-reflectivity, as determined by the Province, overrides the ability of the Sign text, colour, or legend to be effectively presented to the travelling public or other intended audience.

"Damaged Sign"

A Sign is considered to be a damaged Sign where:

a) the Sign is not flat (planar) and properly oriented to the travelling public or other intended audience;

b) either 10 square cm or 1% (whichever is greater) of the Sign face area is damaged, dented, vandalized or otherwise not as new; or

c) in the opinion of the Province, the intended message to the travelling public or other intended audience is unclear or confusing.

Managing Sign and Other Sign Systems Maintenance

The Province does not currently have a comprehensive or consolidated "Sign Maintenance Manual". It is therefore expected that the Contractor will develop an integrated process to accomplish an effective Sign maintenance program.

Contractors will base their program on the contents of the following publication or other sources as approved by the Province:

Maintenance Management of Street and Highway Signs
NCHRP Synthesis 157

ISSN 0547-5570
ISBN 0-309-04910-5

available from:

Transportation Research Board
National Research Council
2101 Constitution Avenue, N.W.
Washington, DC 20418

**B.C. MINISTRY OF TRANSPORTATION**

**Maintenance Specification Chapter 7-800**

# STRUCTURE DAMAGE RESPONSE

## 1. OBJECTIVE

To ensure the safety of Highway Users, to restore all effected structures to their original condition, and to maximize their functional life.

## 2. GENERAL PERFORMANCE SPECIFICATIONS

### 2.1 Routine Maintenance Services

All services for this Maintenance Specification are Routine.

### 2.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

## 3. DETAILED PERFORMANCE SPECIFICATIONS

### 3.1 Routine Maintenance Services

The Contractor must:

a) repair Highway structures to a safe and stable condition in accordance with the specifications referred to in Section B of the Introduction;

b) notify the Province where the safety of Highway Users is effected, so that the Bridge Structural Engineer may make an inspection;

c) mobilize to brace and support the structure;

d) respond immediately if the Bridge Structural Engineer determines that there is risk of structural failure under loading, by doing one of the following, as approved in writing by the Province:

i) restrict allowable loading on the Bridge;

ii) close the Bridge to all vehicular traffic; or

iii) close the Bridge to all use;

iv) construct a detour route of a maximum length of 3.5 km;

e) reinforce all Fracture Critical members with temporary bracing or cables if the Bridge Structural Engineer determines that the structure is sufficiently safe to work on;

f) close any structure with damaged Fracture Critical members to all traffic until repairs have been completed in accordance with the recommendations of the Bridge Structural Engineer;

g) place temporary barrier or railing in accordance with the Maintenance Specification for *Bridge Railing Maintenance,* with no credit for such work under the Maintenance Specification for *Bridge Railing Maintenance*;

h) complete and file a Chargeable Maintenance Costs report as applicable;

i) take and forward photographs of the damage to the Province with the Chargeable Maintenance Costs report; and

j) repair any damage to the structure in accordance with the applicable Maintenance Specifications, with no credit for such work under those Maintenance Specifications, unless mutually agreed to between the Province and the Contractor.

Note: Refer to Section H of the Introduction to these Maintenance Specifications.

### 3.1.1 Performance Time Frames

The Contractor must:

a) immediately, from the time the damage was detected by or reported to the Contractor, notify the Province of any damage to any structure, so that the Bridge Structural Engineer may make an inspection;

b) start installation of temporary barriers or railing placements within 24 hours, from the time the damage was detected by or reported to the Contractor; and

c) perform all other required repairs in accordance with the applicable Maintenance Specification and their respective Performance Time Frames.

### 3.2 Quantified Maintenance Services

Not applicable to this Maintenance Specification.

### 3.2.1 Performance Time Frames

Not applicable to this Maintenance Specification.

### 3.3 Materials

Refer to Section B of the Introduction to these Maintenance Specifications**.**

## 4. WARRANTY

Not applicable to this Maintenance Specification.

# GUARDRAIL MAINTENANCE AND REPLACEMENT

## POLICY

THE INDIANA DEPARTMENT OF TRANSPORTATION WILL MAINTAIN ALL GUARDRAIL IN SUCH A MANNER AS TO ASSURE THAT IT WILL FUNCTION AS DESIGNED.

## PROCEDURES

In order to establish a uniform program for the maintenance and replacement of guardrail, the following procedures are established.

1. Each district shall have a program to assure that guardrail damage to the point of being nonfunctional is repaired in a timely manner to reduce the exposure to the traveling public. The process shall consist of an initial response, within 24 hours of notification that damage exists, to clean up and delineate the area with approved traffic control devices. Permanent repairs of the damaged guardrail should be performed within five (5) working days. Damage that doesn't affect the function of the guardrail and is not hazardous may be scheduled for repairs as a routine maintenance activity.

2. Recommendations for future improvements programs should be made for frequently damaged areas. A periodic review of the guardrail standards and the department's "Roadside Design Guide" SHALL BE CONDUCTED. Based on these guidelines, a determination may be made to eliminate or add guardrail. Where more then 50% damage is incurred at an installation, consideration shall be given to upgrade the entire installation if the damage shall normally include all approaches to a bridge or culvert. This could be four runs, one on each corner. An installation could be a single run of guardrail in a high fill. The use of impact attenuators should be considered when applicable. Where less than 50% damage is incurred at an installation, repair in kind shall be accomplished.

3. The district shall stockpile spare parts for each type of guardrail that its crews maintain.

4. The district shall be responsible to see that a guardrail specialist is trained and responsible for the coordination of a parts inventory, the review of standards, and prompt repair procedures.

5. Each district and/or subdistrict is encouraged to establish communication with all appropriate police agencies in order to assure prompt notification of damages. In addition, the subdistrict shall review their roads on a periodic basis (at least once a year). The guardrail shall be reviewed for damage, deterioration, and breaks in the continuity of the guardrail. A list of locations needed attention, beyond the capabilities of the subdistrict, will be submitted to the district for appropriate action.

COMMENTS

In step No. 4 the designated guardrail specialist should be trained in the criteria of the guardrail repair policy, the latest design criteria and be capable of giving directions and assistance to the subdistricts in this activity. In districts that have any open ended guardrail repair contract, the assigned Project Engineer/Supervisor should be knowledgeable of the latest in guardrail design and installation.

In step No. 5 the periodic examination is intended to be at least once a year preferable twice a year. Deteriorated guardrail means that the present installation is not functioning as it was originally designed.

APPROVED:_____8-24-98
Timothy D. Bertram, Chief Date
Operation Support Division

# IMPACT ATTENUATOR MAINTENANCE

## POLICY

**THE INDIANA DEPARTMENT OF TRANSPORTAION WILL MAINTAIN ALL IMPACT ATTENUATORS IN SUCH A MANNER AS TO ASSURE THAT THEY WILL FUNCTION AS DESIGNATED. ANY DAMAGE OR DETERIORATED PARTS WILL BE REPLACED IN AS SHORT A TIME AS POSSIBLE.**

## PROCEDURES

In order to establish a uniform program for the maintenance of Impact Attenuators the following procedures are established.

1. Each District shall have a program to assure that all deteriorated and damaged attenuator parts are replaced in a timely manner to reduce the exposure to the traveling public. The process shall consist of an initial response, within 24 hours of notification that damage exists, to clean up and delineate the area with approved traffic control devices. Permanent repairs of the damaged attenuator shall be performed within five (5) working days. Parts of the attenuator that have deteriorated to the point of being non-functional are to be replaced with the same promptness as those damaged by traffic.

2. The Operations Engineer is to be in charge of the program, and will be responsible to see that qualified personnel are training and for the coordination of reports, reporting parts inventory, and prompt repair procedures. Repairs should be made by district personnel unless the ground support steel is damaged, then a contractor should be called in.

3. Each District shall have on file the construction plans for each installation, and shall maintain a log for each installation location indicating all damage, date and time of repairs, itemized list of replacement parts, and costs of repairs.

4. Each District shall establish communications with all appropriate police agencies in order to assure prompt notification of damage. In addition, a program of making periodic attenuator maintenance checks is to be instigated. These checks shall be made by trained personnel using an appropriate checklist.

5. Each District shall maintain a spare parts inventory. The size of this inventory should be based on past damage experience where practical, but in no case should it be less than a complete set of spare parts for each type of installation in the district. It is essential that all parts be recorded as they are used.

**NOTE:**

1. Damaged V-A-T units shall be replaced with C-A-T units by means of an item on the guardrail repair contract.

Approved_____8-24-98
Timothy D. Bertram, Chief Date
Operations Support Division

# Kansas DOT
# Maintenance Management System
# Maintenance Activity Priorities

Priorities for maintenance work activities are established to determine the actual work to be performed when planned maintenance and operations resources are for any reason unavailable to be applied to planned work.

All maintenance work activities may be grouped into the following priority classifications.

Priority I: Work that is required to protect the safety of the traveling public and to correct, alleviate, direct users around or warn them of the known serious hazards.

Priority II: Work that is required to protect the investment that has been made in the transportation system through a cost effective combination of preventive maintenance activity and early correction of physical defects.

Priority III: Work that is required to maintain the operating characteristics of the transportation system at an adequate level of service and safety.

Priority IV: Work over and above that in Priorities I, II, and III required to fully attain the desired level of service of the transportation system, and also to enhance the comfort convenience and aesthetic enjoyment of the users of the system.

The following general priority designations for specific maintenance activities represent the average work requirements that may be anticipated under the respective activity descriptions. Priority levels may ascend or descend in accordance with individual situation characteristics. Activities are listed according to ascending Activity Numbers within priority levels.

## PRIORITY I

- Hand or machine patching concrete or bituminous pavement – 414 and 424 -.
- Signs and Markers –511- (regulatory, warning, and other signs and markers essential to the safety of the traveling public.
- Striping –512- (initial pavement striping)
- Longitudinal Barriers –514- (damage repair at the hazardous locations).
- Markings –515- (initial pavement markings).
- Traffic Control Services – Other –519- (temporary traffic control for localized emergencies or hazardous conditions and impact attenuators).
- Snow and Ice Control –521-
- Lighting –522- (traffic signals, flashing beacons and other lighting essential to the safety of the traveling public).
- Litter Pickup –526- (roadway hazards).
- Emergency Operations –611-
- Detours –613- (initial striping and marking, regulatory and warning signs and markers etc.)

## PRIORITY II

(Listed by sub-priority classes, in descending order of priority, A, B, C, D)

IIA.
- Concrete Pavement -413-.
- Bituminous Pavement Overlay -421-.
- Bituminous Shoulders -431- (all work except dilute seal).
- Rock Shoulders -433-.
- Turf Shoulders -434-.
- Bridges -481-.
- Detours (roadway maintenance) -613-.

IIB.
- Crack or Joint sealing – Concrete -411-.
- Dilute Seal – Traveled Way -422-.
- Crack Sealing – Bituminous -425-.
- Bituminous Traveled Way Maintenance - Other -429- (Slurry seal).
- Bituminous Shoulders - 431- (Dilute seal).
- Markings -515- (routine marking program).

IIC.
- Relief Slots -412-.
- Sideroads and Entrances -435-.
- Drainage -461-.
- Longitudinal Barriers -514- (damage repair at other than hazardous locations and routine maintenance).
- Lighting -522- (other than traffic signals, flashing beacons, etc.).
- Motor Services – Other -529-.
- Equipment Maintenance -751-.
- Building Maintenance -811-.
- Land Maintenance -812-.

## PRIORITY III

- Roadside and Landscape -471-.
- Mowing -472-.
- Bridge Cleaning -482-.
- Signs and Markers -511- (other than regulatory and warning).
- Longitudinal Barriers -514- (new installation and removal of unwarranted barriers).
- Markings -515- (aircraft speed check, permanent markers, etc.).
- Rest Areas -523-.
- Motorist Services – Other -529- (removal of abandoned vehicles, brooming roadways, removing and disposing of dead animals).
- Detours -613- (signs, markers, striping and markings in accordance with associated activities in the sub-priority class).

## PRIORITY IV

- Spraying -473-.
- Fencing -525-.
- Litter Pickup (roadside) -526-.
- Motorist Service Other -529- (motor carrier stations, historical and R/W markers).

## ACTIVITIES NOT PRIORITIZED

- Concrete Traveled Way Maintenance – Other -419-.
- Bituminous Traveled Way Maintenance – Other -429-. (except slurry seal).
- Shoulders – Other -439-.
- Training -711-.
- Meeting -712-.
- Leave -713-.
- Administration -731-.
- Blade Mixing -741-.
- Plant Mixing -742-.
- Pugmill Mixing -743-.
- Commercial Bituminous Mix Handling -744 -.

# Maryland DOT
# Draft
## 1/28/03

## Revised Response Guidelines
## After Hours Signal Emergencies and Malfunctions

After normal working hours response to traffic control signal, intersection control beacon and warning beacon emergencies and malfunctions will be performed in the following manner:

- Traffic control signal timing calls will be verified via remote computer reporting capability, if available.
  -- If verified, the traffic control signal will be placed on fixed time operation until the next regular shift. This next regular shift will subsequently respond on-site to perform any needed repairs.
  -- If unable to verify, immediate on-site response will perform any needed repairs.
  -- If repairs require contractual assistance, these repairs will be scheduled at the earliest possible date through bidding or area-wide contracts.

- On flashing operation calls will not be responded upon from 12 a.m. until 6 a.m.
  -- Calls received on Monday through Friday will be responded to on-site by the next regular shift to perform any needed repairs.
  -- Calls received on either Sunday or Saturday will be responded on-site by beeper personnel from 6 a.m. to 12 a.m.

- Lamp outage calls will not be responded upon from Monday to Friday, 12 a.m. until 6 a.m., and all day on Sunday and Saturday.

- Complete outage calls received will be verified via remote computer reporting capability, if available.
  -- If verified, immediate response will be made on-site to perform any needed repairs.
  -- If unable to verify, police will be requested to verify the call before any response on-site to perform any needed repairs.

- Cabinet knockdowns will be placed back into full color operation. Ancillary repairs to detection and interconnection may be accomplished by the end of next regular shift.
  -- If repairs require contractual assistance, these repairs will be scheduled at the earliest possible date through bidding or area-wide contracts.

# SNOW AND ICE CONTROL

5-791.300

## 5-791.301 INTRODUCTION

The removal of snow and ice from the trunk highways in Minnesota is one of the most important jobs confronting maintenance personnel during the winter season. Putting a priority on snow and ice removal prevents a complete shutdown of highway transportation, especially during severe snow and ice storms. Minnesota motorists have invested large sums of money in Mn/DOT trunk highways; therefore, they expect to travel on well-maintained roadways throughout the year. Mn/DOT realizes that a large segment of our economy is based on highway transportation and we must utilize reasonable means to minimize hazards, slippery road surfaces, costly delays, and abnormal energy usage to the highway user.

Safety for the motorist and serviceability of trunk highways are the primary considerations of Mn/DOT. Snow and ice removal operations must be carried on so as to provide reasonable safety for the public as well as for employees.

Effective snow and ice control is achieved through planning, preparation, and execution of good tactical procedures. This chapter outlines elements that affect those three functions.

## 5-791.305 GUIDELINES STATEMENT

Mn/DOT is committed to providing the traveling public with the level of service for snow and ice control that is described in the operation guidelines of this manual. The purpose of the guidelines is to promote statewide continuity and uniformity in the winter maintenance of the trunk highway system. The recommended levels of service should be interpreted as standard operating procedures. In certain situations, however, the Area Maintenance Engineers will exercise judgement where maintenance requirements differ from the guidelines.

The Area Maintenance Engineer will determine actual snow plow routes using the guidelines in this manual to establish the most efficient routes. In order to do this, consideration must be given to many factors not accounted for in this guide. These factors include: personnel abilities and capabilities, physical location of personnel, equipment dependability, location of truck station, terrain, the plowing of information centers and rest areas, plowing left shoulders adjacent to concrete median barriers, and plowing frontage roads. In addition, Area Maintenance Engineers must take into account overtime pay and other provisions in Mn/DOT's union contracts, availability of equipment and availability of additional staff for maintenance work during the winter months. The level of service for snow and ice control is directly related to personnel, overtime, equipment, materials and desired condition of driving surface. If any factor varies, the others must be adjusted accordingly.

Prior to establishing the guidelines, surveys of the public were conducted to determine whether we were providing an acceptable level of snow and ice removal. Surveys conducted in 1994 and 1996 covered year round maintenance operations and a 1999 survey covered snow and ice operations exclusively. Results of the surveys indicate the following:

> Snow and ice removal continues to be a high priority to the public. Our current level of maintenance effort is satisfactory. The 1999 survey attempted to identify drivers comfort and acceptance of six different service levels of snow and ice removal immediately after a snow event and at approximately 9 and 15 hours after the event. Only two levels (1. Driving lanes bare with centerline and edgelines showing and 2. Driving lanes bare with centerline and edge lines covered) had a high level of acceptance with drivers in most scenarios. The survey also recommended that Mn/DOT achieve the second level on all routes prior to removing snow and ice from the centerlines and edgelines. This is because of the relatively high level of satisfaction with the top two levels of service and the small difference in driver satisfaction between the top two levels of service.

## 5-791.310 OPERATION GUIDELINES

The Area Maintenance Engineers have developed these operation guidelines. Approval was obtained using the Mn/DOT Manual Approval Process which involves both District/Division and Central Office Staff. Suggestion for changes to the guidelines can be referred to the Maintenance Operations Support Engineer in the Office of Maintenance.

These guidelines apply only to mainline roadways, interchanges (includes High Occupancy Vehicle (HOV) Bypasses and Collector Distributor Roads), HOV Lanes and Bus Shoulders. Frontage roads, rest areas, and other clean-up operations are not included (See Section 5-791.312 for Clean-up Operations Priorities).

A. Classifications

Priorities are assigned to the trunk highway system according to traffic volumes. Five different volume ranges have been established as noted in Table 1, 5-791.310.

The most recent Mn/DOT Traffic Flow Map available contains the Average Annual Daily Traffic (AADT) for each segment of roadway. However, in urban areas local traffic flow maps and counts may be used. The actual procedures for evaluating the classification of roadway segments is provided in Section 5-791.315 A.

When the road classifications are studied in detail, many roads will have short segments of different classifications over their length. Providing different maintenance priorities to short segments of the same roadway is unpractical for our maintenance personnel. Therefore, the Area Maintenance Engineer must make adjustments in actual field operations to assure continuity throughout the Maintenance Area and at the boundaries with other areas.

B. Operational Guidelines

Snow and Ice removal from the roadway is an emergency operation and normally takes precedence over other work. This means that the roadway should be cleared of snow and ice as rapidly as possible.

Snow and ice removal operations begin when conditions, or forecasted conditions, will result in the loss of “bare lanes”. Bare lanes are defined as: driving lanes will be free of ice and snow between the outer edges of the wheel paths and have no greater than 1 inch accumulation on the center of the roadway (See Figure 1, 5-791.310). Snow and ice removal operations are to continue throughout the event to reach and maintain bare lanes. This should continue as long as adequate visibility permits and reasonable results are obtained. Once bare lanes have been obtained and maintained, clean-up operations can be started. The goal of MnDOT’s snow and ice removal operations is to obtain bare pavement (See Figure 3, 5-791.310).

Bare Lane Regain Time or “Regain Time” is the time from the end of the event until bare lanes are obtained. It is also called the Bare Lane Indicator (See Figure 2, 5-791.310). The Bare Lane description is the same for all routes. The Target Regain Time is dependent on the classification of roadway (See Table 1, 5-791.310). It is the operator’s responsibility to record the Event End and Bare Lane Regained date and time. The Area Maintenance Engineer will designate an individual to record the Event Start and Loss of Bare Lane date and time. See the Maintenance Business Planning, Indicator Collection Field Manual for definitions and forms for recording information.

The Area Maintenance Engineer or designee may determine that a change in level of service is appropriate based on traffic volume and roadway conditions. Some conditions that could cause exceptions to the guidelines are:

- Limited visibility, which would make operations hazardous to personnel.
- Continued service to avoid snow compaction problems.
- Breaks between shifts during off peak hours to reduce operational costs.
- Extremely cold temperatures (< -20˚F)

During winter storms a winter maintenance schedule requiring staggered work hours may be employed in order to provide the level of service recommended. Each Maintenance Area/District/Division will develop a schedule of effort necessary to achieve Target Regain Times. This scheduled effort will continue through Priority A clean-up operations (See Section 5-791.312).

**Table 1, 5-791.310**
**BARE LANE INDICATOR GUIDELINES**

| Classification | AADT | Target Regain Time | Bare Lane Description |
|---|---|---|---|
| Super Commuter | Over 30,000 | 1-3 hrs. | Bare Lanes are defined the same for all classifications as follows:<br><br>All driving lanes are free of snow and ice between the outer edges of the wheel paths and have less than 1 inch of accumulation on the center of the roadway (See Figure 1, 5-791.310, Bare Lanes – Indicator Value). This is the condition at which most drivers feel safe and comfortable when driving at posted speeds.<br><br>The Bare Lane Regained date and time should be logged when this condition is obtained. |
| Urban Commuter | 10,000 – 30,000 | 2-5 hrs. | |
| Rural Commuter | 2,000 – 10,000 | 4-9 hrs. | |
| Primary | 800 – 2,000 | 6-12 hrs. | |
| Secondary | Under 800 | 9-36 hrs. | |

**Figure 1, 5-791.310, BARE LANES – INDICATOR VALUE**

**Figure 2, 5-791.310, BARE LANE INDICATOR**

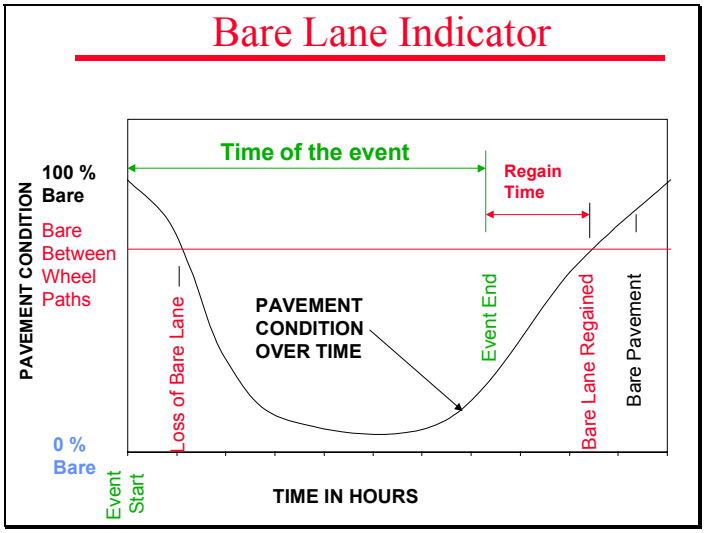



**Figure 3, 5-791.310, BARE PAVEMENT**

## 5-791.312 CLEAN-UP OPERATION PRIORITIES

Clean-up operations may start as soon as bare lanes have been obtained and maintained and the event has subsided unless adverse weather warrants a change. Based upon past experiences, the efficiency of workers and equipment reliability decreases significantly during adverse weather conditions (Ex. Temperature below –20 degrees F, Freezing Rain, etc.).

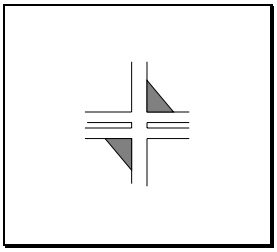
All safety features along the roadway shall be cleaned up as soon as possible so they function properly. Priority A clean-up will be completed according to the schedule referenced in section 5-791.310, B. Operational Guidelines.

### CLEAN-UP PRIORITIES:

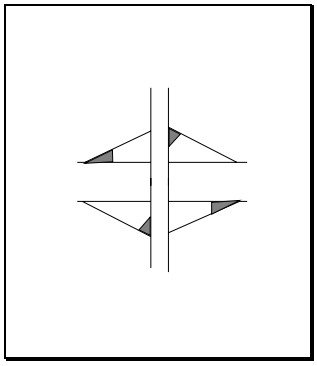
Priority A – (1) Remove compacted snow from impact attenuators, bridge crash rails, Jersey barriers, plate beams or similar types when it averages 2/3 the height of the barrier.

(2) Sight distance clean-up as shown on the following four examples will be accomplished at the same time as mainline operations. Each maintenance area may designate other intersections for sight distance clean-up if the conditions warrant prompt attention.

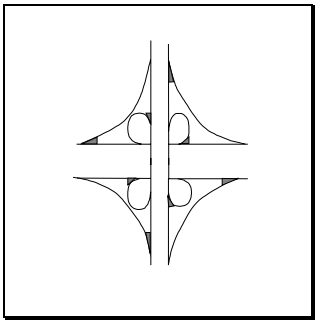
a. 4-Lane with 2-Lane (Unsignalized)



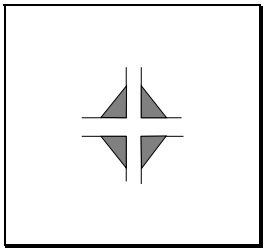
b. Diamond (Unsignalized)



c. Cloverleaf



d. 2-Lane Trunk Highway to Trunk Highway Intersection (Unsignalized)



(3) If inadequate snow storage exists such that the flow of traffic is impeded, then the operations of removing snow by plowing or hauling should be conducted on the same schedule as mainline operations.

Note: For Priority A Clean-up, crews will continue working the same schedule as the mainline, but the schedule may be adjusted for traffic safety.

Priority B – (1) If the previous four examples are signalized or are non T.H. at-grade intersecting roadways, clean-up will be done during the normal work schedule.

(2) The clearing of full width shoulders and cable guardrail will be accomplished during the normal work schedule.

Priority C - Drift prevention for future storms will be accomplished during the normal work schedule.

Priority D - Regaining snow storage space for future storms will be done during the normal work schedule

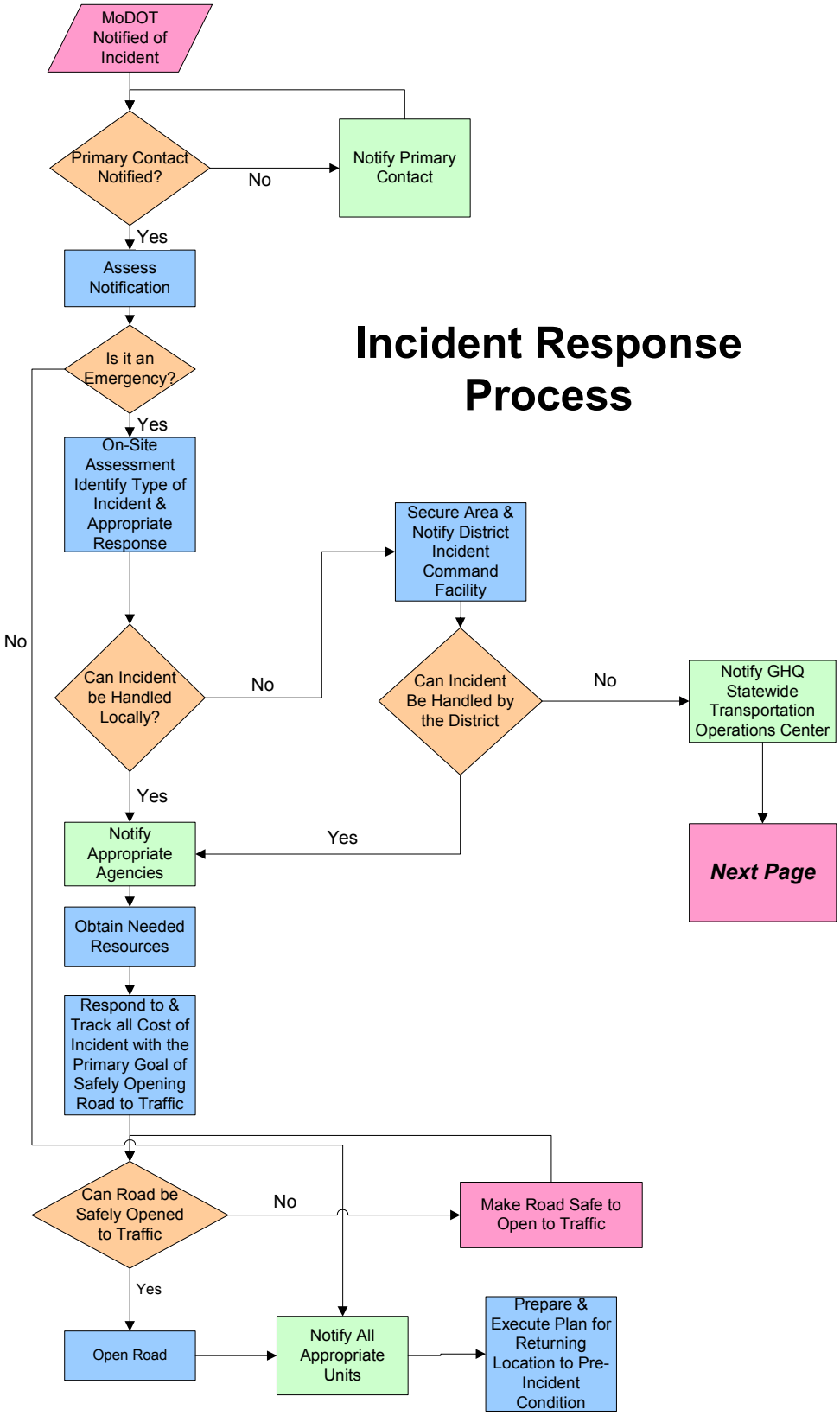
# Missouri DOT
# RESPONSE
# PHASE

The incident response phase occurs immediately before, during or directly after an incident occurs, and takes place in several distinct areas:

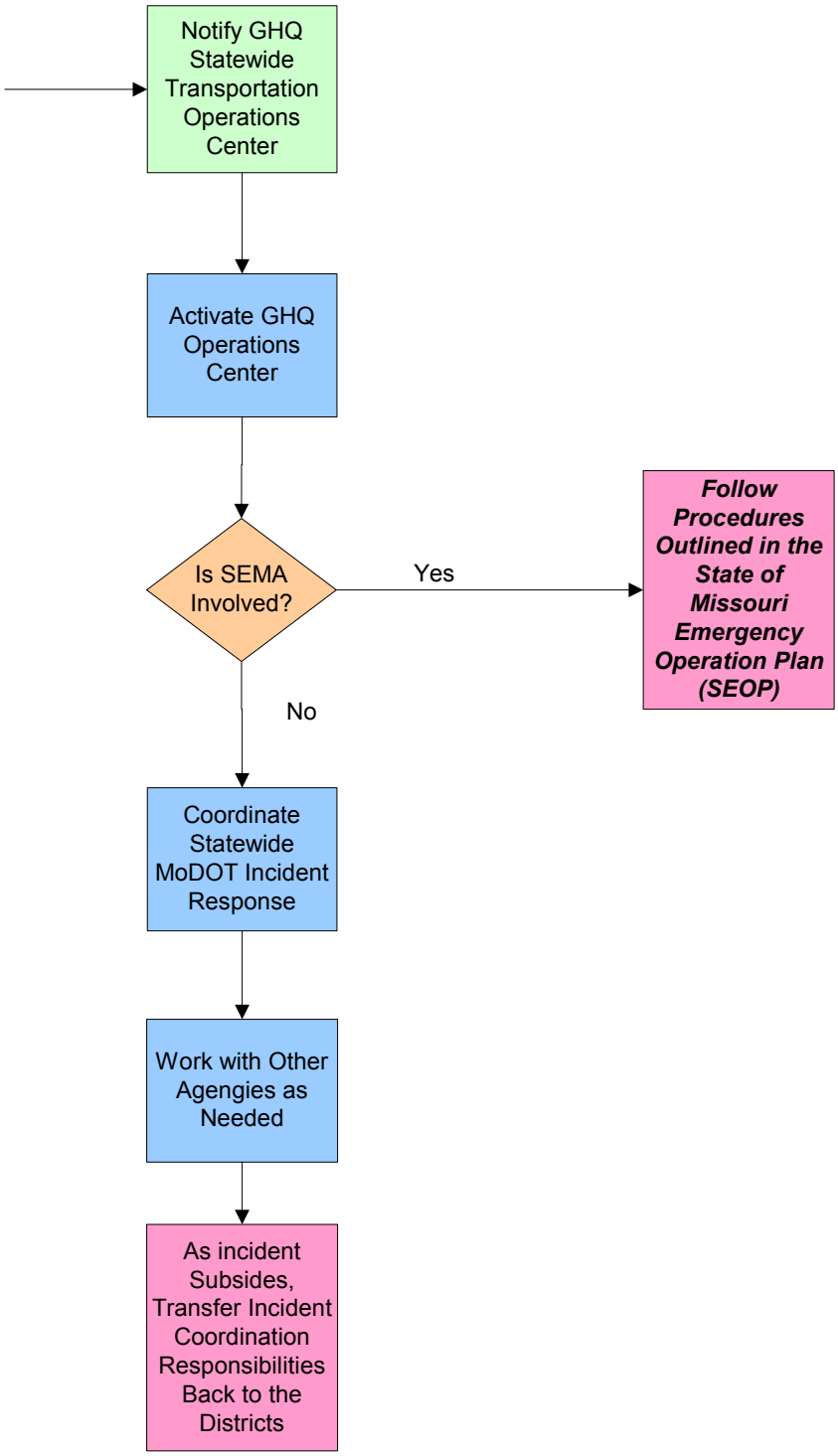
1. Response Flow Charts
2. Incident Notification
3. Prioritizing Incident Response
4. Initial Response and Incident Assessment
5. Expanding Incident Command
6. Transfer of Incident Command

The flow charts on the following pages show the steps that should be taken in the incident response process.

# Incident Response Process



# Incident Response Process (Cont.)



## 2. Incident Notification:

When notification of an incident is received, it is important that adequate information is obtained that will allow the first responder to provide adequate equipment, personnel and materials to effectively respond to the specific incident situation.

The following form provides the who, what, when and where of the incident being reported and also documents the action taken and when the incident was reported cleared.

**STANDARD QUESTIONS TO BE ANSWERED**
**WHEN NOTIFIED OF AN INCIDENT**

**WHO:**

- ✓ Person Reporting Incident_____ Phone # _____
- ✓ Address _____
- ✓ Who Else has been Notified _____

**WHERE**:

- ✓ County _____ Route _____
- ✓ Direction _____
- ✓ Exact Location _____
- ✓ Part of Roadway Affected _____

**WHEN:**

- ✓ When Reported: Date _____Time _____

**WHAT:**

- ✓ Notification Priority Number _____
- ✓ Incident Situation (What Happened) _____

  _____

  _____

  _____
- ✓ What Resources are Needed _____
- ✓ Number of Injuries _____ Is an Ambulance Needed _____
- ✓ Type of Injuries _____
- ✓ Number of Vehicles Involved _____
- ✓ Type of Vehicles Involved _____
- ✓ Number of Lanes Affected _____
- ✓ MoDOT Equipment Involved _____
- ✓ Hazardous Materials Involved _____

**ACTION TAKEN** (Repairs Performed) _____

_____

_____

_____

**INCIDENT REPORTED CLEARED :** Date_____ Time_____

(Repairs Complete / Road Open)

## 3. Prioritizing Incident Response:

Once the incident situation has been evaluated, a determination should be made on the response priority of the incident based on established priority levels.

**PRIORITY 1:** Urgent. Respond as soon as possible (day or night, weekends or holidays), suspending other lower priority work, if necessary. May represent an immediate hazard to the public.

**PRIORITY 2:** Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.

**PRIORITY 3:** Repair should be accomplished with a higher urgency than routine maintenance.

**PRIORITY 4:** Not urgent. Normally considered routine maintenance.

The following priority listing has been established as a guideline for districts to use when responding to incidents. Deviations from these response priorities should be documented with reasons for not following the established guidelines. Individual responders must be allowed to exercise discretion and good judgment, based on existing conditions and circumstances surrounding the incident.

An incident may require response at all four priority levels with only a portion of the work being emergency in nature. EXAMPLE: A large accident with significant structural damage to a bridge, a light pole knocked down off the roadway, a guide sign knocked down and damage to landscape plantings.

| | PRIORITY 1 | PRIORITY 2 | PRIORITY 3 | PRIORITY 4 |
|---|---|---|---|---|
| **PRIORITIES ARE GUILDELINES AND MAY BE UPGRADED IF PRIMARY CONTACT DEEMS NECESSARY** | **Urgent. Respond as soon as possible (day or night, weekends, or holidays) suspending other lower priority work if necessary. May represent immediate hazard to the public.** | **Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.** | **Repair should be accomplished with higher urgency than routine maintenance.** | **Not urgent. Normally considered routine maintenance.** |
| **LANE CLOSURE NOTIFICATION/ APPROVAL REQUIRED **** | **NO** | **NO** | **YES** | **YES** |
| | | | | |
| **ATTENUATORS** | | | | |
| ACCIDENT DAMAGE | | Emergency Repair | Permanent Replacement | |
| **BRIDGE** | | | | |
| AIRCRAFT WARNING LIGHTS INOPERATIVE | | X | | |
| APPROACH SLAB SETTLEMENT | | More than 2” | | 2” or Less |
| EXPANSION DEVICE DEFECTIVE | Creating a Traffic Hazard | | Does Not Create a Hazard to Traffic | |
| HANDRAIL | Destroyed | | | Bent |
| NAVIGATION LIGHTS NOT OPERATIONAL | | X | | |
| STRUCTURAL DAMAGE | Tears, Loss of Section or Misalignment of Structural Members | | Paint Scrapes, Minor Bends, Minor Misalignment | |
| **DRAINAGE** | | | | |
| DRAINAGE – CROSSROAD/ENTRANCE | Not Draining - Flooding Roadway | Not Draining - Flooding Private Property | | |
| PAVEMENT PONDING | | Severe | Moderate | |
| SHOULDER PONDING | | | X | |
| STREAM CHANNEL EROSION | | Scour Critical Structures | | Non Scour Critical Structures |
| STREAM CHANNEL RESTRICTION | | Scour Critical Structures | | Non Scour Critical Structures |
| **FLASHERS** | | | | |
| BROKEN LENS | | | | X |
| BULB OUT | X | | | |
| FLASHER MALFUNCTION | X | | | |
| KNOCKDOWN DAMAGE | On Roadway | Not On Roadway | | |

** NHS Routes and all Other Routes With ADT of 1700 or Greater

| | PRIORITY 1 | PRIORITY 2 | PRIORITY 3 | PRIORITY 4 |
|---|---|---|---|---|
| **PRIORITIES ARE GUILDELINES AND MAY BE UPGRADED IF PRIMARY CONTACT DEEMS NECESSARY** | **Urgent. Respond as soon as possible (day or night, weekends, or holidays) suspending other lower priority work if necessary. May represent immediate hazard to the public.** | **Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.** | **Repair should be accomplished with higher urgency than routine maintenance.** | **Not urgent. Normally considered routine maintenance.** |
| **LANE CLOSURE NOTIFICATION/ APPROVAL REQUIRED **** | **NO** | **NO** | **YES** | **YES** |
| POWER OUTAGE | | X | | |
| WIRING DAMAGE | | X | | |
| **LIGHTING** | | | | |
| FIXTURE KNOCKDOWN | On Roadway | On Shoulder | | |
| FIXTURE MALFUNCTION | | | X | |
| POWER OUTAGE | | | X | |
| STRUCTURE DAMAGE | | X | | |
| WIRING MALFUNCTION | | | X | |
| **PAVEMENT MARKING** | | | | |
| IMPROPER STRIPING | | | | See Traffic Manual |
| LACK OF STRIPE OR PAVEMENT MARKING | | | See Traffic Manual | |
| **PAVEMENT SURFACE** | | | | |
| BLOW-UPS (Pavement Explosions) | Emergency Repair | | Permanent Replacement | |
| DEBRIS ON ROADWAY | X | | | |
| DEAD ANIMALS (Obstructing Traffic) | X | | | |
| LOOSE AGGREGATE | | | X | |
| MEDIAN BARRIER DAMAGE | | Emergency Repair | Permanent Repair | |
| MUD ON PAVEMENT | | X | | |
| POTHOLES | Greater than 4” Deep | 2” Deep to 4” Deep | Less than 2” Deep (7500 ADT & Above) | Less than 2” Deep (Less than 7500 ADT) |
| RESURFACING FAILURES (Level Course or Sealcoat) | X | | | |
| PAVEMENT RUTS | | Greater than 4” Deep | 4” Deep or Less | |

** NHS Routes and all Other Routes With ADT of 1700 or Greater

| | PRIORITY 1 | PRIORITY 2 | PRIORITY 3 | PRIORITY 4 |
|---|---|---|---|---|
| **PRIORITIES ARE GUILDELINES AND MAY BE UPGRADED IF PRIMARY CONTACT DEEMS NECESSARY** | **Urgent. Respond as soon as possible (day or night, weekends, or holidays) suspending other lower priority work if necessary. May represent immediate hazard to the public.** | **Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.** | **Repair should be accomplished with higher urgency than routine maintenance.** | **Not urgent. Normally considered routine maintenance.** |
| **LANE CLOSURE NOTIFICATION/ APPROVAL REQUIRED **** | **NO** | **NO** | **YES** | **YES** |
| PAVEMENT EDGE DROPOFF | | Greater than **4**" | 2" to 4" | Less than 2" |
| ASPHALT BLEEDING | Slick Pavement | | | |
| SPALLED AREAS | | Greater than 2" Deep and 7500 ADT or Less | Greater than 2" Deep & Less than 7500 ADT or Less than 2" Deep and 7500 ADT or Greater | Less than 2" Deep and Less than 7500 ADT |
| WATER OVER PAVEMENT (FLOOD) | X | | | |
| **RADIO** | | | | |
| AIRCRAFT WARNING LIGHTS INOPERATIVE | | X | | |
| **ROADSIDES** | | | | |
| DEAD TREES | Down – On Roadway | Possible Damage to Private Property | Possible Damage to Roadway | |
| PESTICIDES (Over-Spray or Runoff) | | | X | |
| ROCK (Loose on Bluff) | | | X | |
| SIGHT DISTANCE (Trees or Vegetation) | X | | | |
| SILTING (From Right of Way Onto Private Property) | | | | X |
| **SHOULDERS** | | | | |
| BREAK-UP | | | | X |
| EROSION | | | | X |
| GUARDRAIL DAMAGE | | Emergency Repair | Permanent Replacement | |
| LOW SHOULDER | | Greater than 2" | | 2" or Less |
| MUDDY | | | | X |

** NHS Routes and all Other Routes With ADT of 1700 or Greater

| | PRIORITY 1 | PRIORITY 2 | PRIORITY 3 | PRIORITY 4 |
|---|---|---|---|---|
| **PRIORITIES ARE GUILDELINES AND MAY BE UPGRADED IF PRIMARY CONTACT DEEMS NECESSARY** | **Urgent. Respond as soon as possible (day or night, weekends, or holidays) suspending other lower priority work if necessary. May represent immediate hazard to the public.** | **Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.** | **Repair should be accomplished with higher urgency than routine maintenance.** | **Not urgent. Normally considered routine maintenance.** |
| **LANE CLOSURE NOTIFICATION/ APPROVAL REQUIRED **** | **NO** | **NO** | **YES** | **YES** |
| POTHOLES *(See Pavement Surface Potholes)* | | | | |
| **SIGNALS** | | | | |
| BROKEN LENS | | Single Indication, Single Face | Single Indication, Multiple Face | |
| BULB OUT (Single Indication, Single Face) | Red | | All Others | |
| BULB OUT (Single Indication, Multiple Face) | Red | | All Others | |
| CONTROLLER DAMAGE | | X | | |
| CONTROLLER MALFUNCTION | X | | | |
| DETECTOR & LOOP MALFUNCTION | | Single Turn Lane | Dual Lane | |
| INTERCONNECTION MALFUNCTION | | | X | |
| SIGNAL DARK | X | | | |
| SIGNAL HEAD DAMAGE | | X | | |
| SIGNAL SUPPORT DAMAGE | In Roadway | Not in Roadway | | |
| VISIBILITY (Weeds, Trees, Etc.) | X | | | |
| WIRING DAMAGE | | X | | |
| **SIGNING** | | | | |
| BARRICADES (Permanent) | | X | | |
| DAMAGED OR MISSING ROADSIDE DELINEATORS | | | | X |

** NHS Routes and all Other Routes With ADT of 1700 or Greater

| | PRIORITY 1 | PRIORITY 2 | PRIORITY 3 | PRIORITY 4 |
|---|---|---|---|---|
| **PRIORITIES ARE GUILDELINES AND MAY BE UPGRADED IF PRIMARY CONTACT DEEMS NECESSARY** | **Urgent. Respond as soon as possible (day or night, weekends, or holidays) suspending other lower priority work if necessary. May represent immediate hazard to the public.** | **Repair should be accomplished as soon as practical during normal working hours, but only after Priority 1 repairs are completed.** | **Repair should be accomplished with higher urgency than routine maintenance.** | **Not urgent. Normally considered routine maintenance.** |
| **LANE CLOSURE NOTIFICATION/ APPROVAL REQUIRED **** | **NO** | **NO** | **YES** | **YES** |
| EXPRESSWAY/FREEWAY SIGNS * | | X | | |
| GUIDE SIGNS * | | | X | |
| INFORMATION SIGNS * | | | X | |
| OBJECT MARKERS | | X | | |
| REGULATORY SIGNS * | Critical, i.e.; Stop, Yield, Do Not Enter, Wrong Way, One Way | All Others | | |
| SCHOOL SIGNS * | | | X | |
| SIGN LIGHTING MALFUNCTION | | | X | |
| SIGN TRUSS STRUCTURE DAMAGE | Creating a Traffic Hazard | | Not a Traffic Hazard | |
| VISIBILITY (Weeds, Trees, etc.) | Involving Regulatory Signs or Signals | All Others | | |
| WARNING SIGNS * | | X | | |
| **TRAFFIC CONTROL IN WORK ZONES** | | | | |
| FLAGPERSON IMPROPERLY POSITIONED | X | | | |
| FLASHING ARROW INOPERATIVE | X | | | |
| TRAFFIC CHANNELIZER MISALIGNMENT (Obstructing traffic or affecting proper guidance) | X | | | |
| FLASHING LIGNTS NOT OPERATING | X | | | |
| SIGNS IMPROPERLY INSTALLED, MISSING OR DAMAGED | X | | | |

* Damage that makes the sign ineffective.

** NHS Routes and all Other Routes With ADT of 1700 or Greater

## 4. Initial Response and Incident Assessment:

Initially, the Incident Commander will be the Senior First Responder to arrive at the incident location. This person could be someone from another agency (law enforcement, fire, EMS, etc.) or could be a MoDOT employee, depending on the incident situation.

The first responsibility of a MoDOT employee as First Responder is to evaluate the incident situation and use the First Responder Checklist as a guideline for obtaining important information about the incident that can be used to determine what agencies and resources are needed to effectively respond to the situation.

## FIRST RESPONDER CHECKLIST

1. What is the nature of the incident?

2. What is the exact location, including direction and lanes blocked?

3. What is needed to stabilize the incident and make the area safe?

4. What hazards are present?

    a. Are there injuries? Number and severity? Persons trapped?

    b. What hazards exist for response personnel and the public?

    c. Is there fire or haz-mat potential?

    d. Do warnings need to be issued?

    e. Is evacuation required?

2. Who needs to be contacted?

    a. What response agencies/organizations need to be contacted? (Fire, EMS, Haz-Mat, DNR, Health, etc.)

    b. What level of Motorist Information is needed?

3. What level of traffic control is needed?

    a. Does the highway need to be closed?

    b. Can traffic be detoured over another route?

4. What resources are needed?

    a. Where will they come from?

    b. How long will it take to get them?

    c. What is the best direction to approach from and park?

5. What are possible contingencies?

    a. Consider what could happen. Because emergency events are unplanned and involve danger, risk and confusion, ***any possible developments*** must be considered, in addition to the current situation.

## 5. Expanding Incident Command:

After evaluating the incident situation and determining the response priority of the incident, the First Responder must decide whether the incident can be handled without assistance or if the ICS organization should be expanded.

The First Responder will base the decision to expand (or contract) the ICS organization on three major incident priorities:

- **Safety**. The First Responder's first priority is ***always*** their own safety, the safety of other incident responders and the safety of the traveling public.

- **Incident Stability**. The First Responder is responsible for determining the strategy that will ***minimize*** the effect that the incident may have on the surrounding area and ***maximize*** the response effort, while using resources efficiently.

- **Property Conservation**. The First Responder is responsible for minimizing damage to property, while achieving the incident response objectives.

As incidents grow, the First Responder may delegate authority for performing certain activities to others. When expansion of the ICS organization is required, the district Incident Commander will establish the other Command Staff positions and activate additional General Staff sections as needed. The section chiefs then have the authority to expand or contract their operations as the demands of the incident increase or decrease.

## 6. Transfer of Incident Command:

As additional responders arrive at the incident location, command will transfer on the basis of who has primary authority for overall control of the incident. If a MoDOT employee is the first to arrive at a traffic accident, command will transfer from MoDOT when law enforcement personnel arrive. For hazardous materials incidents, command will transfer to DNR when their personnel arrive. As incidents grow in size or become more complex, the responsible division or agency may assign a more highly qualified Incident Commander.

**MoDOT as Lead Agency**.

For incidents where MoDOT is the lead agency involved, such as flooding and ice storms, as the incident becomes more complex, transfer of command will be from the Senior First Responder at the incident site to the appropriate field supervisor, then to the Area Engineer, and finally to district incident command. Field command personnel and district incident command must function together and work toward the same goals, but their responsibilities are at different levels. Field command personnel are responsible for on-scene response activities and district incident command is responsible for district-wide coordination and resource management.

If it is determined that available resources will be sufficient to address the situation, field command personnel make the necessary arrangements to secure the needed resources, and provide the appropriate field supervisors and district incident command with incident assessment information and what actions are being taken to address the incident.

If, in the judgment of field command personnel, additional support and resources from outside the area are needed to overcome the incident situation, the district incident command facility should be activated. This will allow the district to track problems and coordinate additional resources such as providing additional personnel and equipment from other areas, requesting help from other districts, hiring of outside help, purchasing materials, leasing specialized equipment, assigning district specialized equipment, etc.

Once the district incident command facility is activated, the district should contact the Central Office Statewide Operations Center and advise them of the current incident situation and what actions the district has taken to address the incident. This will allow Central Office to monitor the situation and be prepared to provide any needed assistance in coordinating the incident response.

**Multi-district or Statewide Incident**.

If the incident escalates to a multi-district or statewide situation, the Central Office Statewide Operations Center should assess the incident situation to determine if additional resources can be provided or if coordination of the incident response should be transferred to the Central Office Statewide Operations Center. If transferred, the operations center will work with all districts to coordinate MoDOT's efforts statewide, determine the most effective location and distribution of equipment, materials, personnel, supplies and facilities necessary to manage MoDOT's response, and coordinate MoDOT's response with the efforts of other agencies and SEMA, when appropriate.

## DECLARED STATE OF EMERGENCY

In the event of a major emergency, and the Governor declares a "State of Emergency" for all or part of Missouri, the provisions of the State Emergency Operations Plan (SEOP) will be implemented and the State Emergency Management Agency (SEMA) will fully or partially activate the State Emergency Operations Center (SEOC), depending on the emergency classification. MoDOT's Incident Response Plan will automatically be activated, which will establish and provide staffing to the SEOC, MoDOT Central Office Statewide Operations Center and MoDOT District Incident Command Facilities.

For specific information concerning the emergency roles and responsibilities of state government officials, departments and private organizations, refer to the **State Emergency Operations Plan**. Provisions of the plan can be viewed by going to MoDOT's Internet home page and accessing the Missouri State Government Home Page link and choosing SEMA (under "Departments").

Under the plan, MoDOT has primary responsibility for the Transportation function in the SEOP, and support responsibilities for fourteen other disaster response functions. Under the Transportation function, MoDOT is responsible for:

- Maintaining the capability of the transportation network to move emergency equipment, supplies and response personnel to a disaster site.
- Provide the necessary transportation support for evacuating the general population to safety.
- Monitoring of all transportation systems and providing damage assessment.
- Working with SEMA to advise the public of changed route designations due to existing or expected conditions.
- Coordinating with adjoining states to facilitate the movement of transportation through or around a disaster site.
- Providing emergency traffic barriers and signs to assist law enforcement in controlling admittance to restricted areas, damaged or otherwise.

**Responsibilities of MoDOT Officials During a Declared "State of Emergency":**

- **MoDOT Director**: The Director will go to the Governor's office, proceed as directed by the Governor, and be the liaison between the Governor's Office and MoDOT. **Backup to the Director** is the Chief Engineer.

  ***In the event of an emergency when the Governor does not declare a State of Emergency and SEMA does not activate the SEOC, the MoDOT Director may activate whatever emergency measures determined to be necessary.***

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- **Chief Engineer:** The Chief Engineer is to be at the MoDOT Central Office ICC and direct MoDOT activities in general. **Backup to the Chief Engineer** is the Director of Project Development.

- **Director of Operations:** The Director of Operations shall go to the SEOC at the SEMA and National Guard Headquarters on Militia Drive east of Jefferson City. Duties include being the liaison between MoDOT and SEMA, the Adjutant General's Office, other state agencies, others that are in the SEOC and others that are working through SEMA. **Backups to the Director of Operations** are the State Project Operations Engineer and the State Traffic Engineer.

- **State Maintenance Engineer:** The State Maintenance Engineer will work in the Maintenance office at 2211 St. Mary's Boulevard, directing maintenance in Central Office and in the districts, if telephones and/or radios work. When the SEOC is activated, the State Maintenance Engineer may go to that location and work there in order to communicate with others. **Backups to the State Maintenance Engineer** are the State Bridge Maintenance Engineer, the Supervising Bridge Inspection Engineer and a Technical Support Engineer.

- **MoDOT District Engineers:** The District Engineers are to direct the incident response activities of their respective districts and are to be located within their District Incident Command Facilities to be ready to respond when called upon to provide statewide assistance as needed. **Backups to the District Engineers** are the Assistant District Engineers.

- **State Bridge Maintenance Engineer:** The State Bridge Maintenance Engineer will work in the Bridge Maintenance office in the Central Office on St. Mary's Boulevard, or at the SEOC if directed to go there. The State Bridge Maintenance Engineer will direct bridge inspectors if they are needed to inspect bridges on priority routes, over the Mississippi and Missouri Rivers and other bridges, and will also direct bridge repair crews if they are needed to repair damaged bridges. **Backup to the State Bridge Maintenance Engineer** is the Supervising Bridge Inspection Engineer.

- **Director of General Services:** The Director of General Services is to report to the Central Office at 2211 St. Mary's Boulevard and direct the General Services Division's emergency operations. These operations will include supplying pilots for the Multi-Modal Division's airplane as they fly into affected areas of the state, providing vehicles from the MoDOT HQ Garage Annex, providing supplies from the HQ Distribution Center, checking MoDOT facilities, and other duties as directed. **Backups to the Director of General Services** are the Support Services Manager and the Fleet Manager.

- **Director of Public Information and Outreach:** If the Director of Public Information and Outreach doesn't go with the MoDOT Director to the Governor's Office or to the SEOC, the Director of Public Information and Outreach will work in the MoDOT Central Office ICC, directing public information and outreach and the customer service representatives, supplying photographers for the Multi-Modal Division's airplanes as they fly into affected areas of the state, having photo lab develop photographs and reproduce videos. **Backup to the Director of Public Information and Outreach** is the Assistant Public Information and Outreach Director. The public information and outreach representative in Operations will work at the SEOC, and will coordinate with the MoDOT Director of Operations and the SEMA communications and public

information representatives to help issue news updates to the news media, government officials and others. **The Backup person or persons** will be designated as needed.

***All public announcements must be cleared through the Joint Information Center at the SEOC to ensure the public and others receive accurate and consistent information.***

- **Public Information and Outreach Customer Service Center:** The customer service representatives are to staff the Customer Service Center in Central Office to handle incoming calls requesting information and assistance, being careful to issue only the news that has been approved by SEMA's Joint Information Center. **Backup persons** will be called to replace them and help as needed.

- **Other MoDOT Unit Directors and Division Heads:** Other MoDOT unit directors and division heads will work in their respective offices until called upon and directed to provide assistance as needed. **Backups** will be as designated by them.

DRAFT

Program Update Instructions: August, 2004

**ATTACHMENT 1**

# MAINTENANCE AND OPERATIONS FIRST GUIDANCE

**Prepared by the Operations Division in conjunction with the 2004 Multi-year Program Update, August 2004**

## MAINTENANCE AND OPERATIONS FIRST GUIDANCE

A well-maintained infrastructure is vital to the transportation system mobility, reliability, safety, and the economic competitiveness of New York State. In an effort to improve the infrastructure and transportation services, the Department has adopted a Maintenance and Operations First approach to be incorporated in this Program Update Cycle. The Maintenance and Operations First strategy provides a focus on maintenance and operations with an emphasis on systems management, operations management, response maintenance, preventive maintenance and design modification (corrective) maintenance. The concept of operations and management requires common terms and definitions. These terms have been defined to provide a common understanding by those managing, installing, and operating transportation systems and may be found in Appendix A. These terms may change current perceptions.

Systems management, operations management, response maintenance, preventive maintenance and design modification (corrective) maintenance have been defined for the highway and bridge assets owned, maintained and operated by the Department with guidance on treatments and services in this document. These assets include, but are not limited to pavement, structures, guide rail, lighting, overhead sign structures, traffic signals, signs, Intelligent Transportation Systems (ITS) elements, pavement markings, and culverts. The Maintenance and Operations First approach goes beyond the traditional asset management approach that focuses mainly on physical assets and instead, also deals with services (such as transportation management center (TMC) operations and Highway Emergency Local Patrol (Help)) and systems (such as Advanced Traffic Management Systems (ATMS) systems). A key element in this new approach is recognition that ITS operations and traveler information services is considered as integral to the strategy. That is, these activities are essential to maintaining the maximum availability of the capacity, mobility, reliability, and safety of the system. For example, a HELP truck response, and resultant quicker clearance of an incident, is critical to timely restoration (maintenance) of the normally available highway capacity.

Another consideration for this update cycle are state owned facilities such as rest areas, park and ride lots, Republic Airport, Adirondack Railroad, transportation management centers (TMCs), residency and regional crew facilities, equipment management shops, etc. Each of these facilities have physical components which need to be maintained and should be included in repair and replacement cycles for the elements which exist on each of these facilities, such as pavement, pavement markings, signs, ITS Equipment, etc.

Through the update process, each Region will develop a capital program to bring and maintain the State's Transportation system to a state of good repair and effective operation. A state of good repair for the transportation system assumes the asset or service fulfills its function as designed and meets current standards. It is important to begin to shift from our traditional thinking of projects as being location-centric and to begin to develop asset-based and corridor-based projects. Examples of these include guide rail or culvert preventive maintenance, repair and replacement projects that may include many locations across a residency, a region or a corridor. Effective system operation involves investment in cost effective strategies activities to achieve Priority Result Areas (PRAs).

A state of good repair for pavements is defined as reversing the steep downward trend in the average surface rating by restoring a 12 year paving cycle over the life of the program. A state of good repair for bridges is defined as maintaining current overall conditions. Similar states of repair are defined in guidance included in this document for other transportation assets. A state of good repair for operations includes appropriate response times to restore system capacity, reliability and safety and manage the system effectively when it has been impacted. Many of the activities or treatments included in this guidance are eligible for federal-aid; see Attachment 5 Federal-aid eligibility guidance of the program update instructions for more details.

## BACKGROUND

The Maintenance and Operations First approach began with an analysis completed on existing pavement and bridge conditions. This analysis is located in Appendix B of this document.

Pavement and bridge conditions are slipping and budget levels are expected to be tight. Progress has been made during the previous program period as shown by the decrease in pavements rated poor plus fair and the increase in the average surface rating. However, over the past few years condition levels have begun to worsen. Department records show the paving cycle for State highways has increased dramatically since 1999 from 12 years to 20 years with the biggest decline in single-course overlays. According to maintenance records, the number of lane miles crack-sealed has decreased significantly.

Maintenance treatments applied at appropriate condition levels will extend the service life of a pavement structure. Preventive maintenance treatments such as crack sealing, and ditch cleaning will slow the deterioration process for pavements in good condition by keeping water out of the pavement structure. Corrective maintenance such as single-course overlays and surface treatments will seal the cracks, rejuvenate the asphalt and restore the ride for pavements rated 6 or 7. Pavement treatments are clearly described in the guidance section of this document.

Statewide bridge condition trends since 1994 indicate progress has been made, especially in terms of the number of deficient bridges. The concern, however, is that over the past few years, the rate of improvement has slowed, and in 2004 for the first time since the late 1980s, bridge conditions actually slipped slightly. Of further concern is that condition measured in percent of deficient deck area has gained little ground over time suggesting that the larger and more expensive to treat bridges still need significant work.

Given this scenario, an aggressive and strong preventive maintenance (PM) program is needed to slow the deterioration process for all assets.

The Department has also been moving towards an increased AOperations@ role on the State=s transportation system evolving to meet the demands on New York State's transportation system.

Over the past few years, Public or customer expectations have been documented through a series of surveys conducted by the Federal Highway Administration. Less than half of the public is satisfied with the quality of the traffic flow on the nation=s highway (AManaging Our Congested Streets and Highways@, Publication No. FHWA-OP-01-018). The respondents identified high traffic volumes, roadwork, accidents, and traffic signals as the major causes of highway travel delay. Congestion was on the top of the list for transportation issues affecting communities across the country.

To mitigate the impacts of congestion, the public expects the State to operate the system efficiently while balancing the impacts to the environment and implementing the most cost effective measures. This strategy is a balanced approach to integrate our infrastructure investments, infrastructure maintenance and the operation of that infrastructure.

## MAINTENANCE AND OPERATIONS FIRST STRATEGY IMPLEMENTATION

Tables 1 and 2 summarize the preventive maintenance, design modification (corrective) maintenance, response maintenance, and operations activities that should be targeted during this program update. The region must prioritize projects or activities based on region-specific conditions and maintenance needs. For all regions, the first priority is preservation of assets on trade and intercity corridors. A list of these corridors is given in attachment 4 of these instructions.

Specific guidance on infrastructure maintenance and operations activities is now provided. A contact list to address specific questions is located in Appendix C.

## MAINTENANCE

Signs (ground mounted), pavement markings (paint only), and lighting are also listed for the sake of completeness, although these activities are fully funded out of the Transportation Maintenance Division (TMD) and Traffic Engineering and Highway Safety Division (TE&HS) operating budgets.

### Pavement Maintenance Guidance

Pavement degradation is caused by three reasons: improper design for the load carried, deterioration of subbase due to saturation, and environmental aging. Pavement preventive and design modification (corrective) maintenance does not correct under-designed pavement structures, but these activities can slow deterioration caused by environmental aging. As pavements age, cracks develop allowing water to infiltrate the pavement structure. This water can then strip asphaltic materials from hot mix asphalt pavements and also lead to base failures for both Hot Mix Asphalt and Portland cement Concrete Pavements. The ultimate goal of pavement maintenance is to seal water out of the pavement structure. This is accomplished in different ways depending on the type, age, and condition of the respective pavements.

*Hot Mix Asphalt Surfaced Pavements*

<u>Crack Sealing</u>

Crack sealing should be performed on pavements in relatively new condition. The cracks should be single, and well defined. The pavement sufficiency score will typically be 7 or 8 in this case. Often, these type cracks will appear as early as two to four years after pavement overlays and/or reconstruction, depending on the original treatment and other environmental factors.

Single Course Overlays including Liquid Asphalt Treatments

When a pavement has been crack sealed two or more times and the surface has begun to develop secondary and tertiary cracking, crack sealing is contraindicated. In this case a surface treatment covering the whole pavement is necessary. Usually this requires a single course hot mix overlay. On some lower volume pavements, chip seal can be an economical alternative to a single course hot mix overlay. Typical sufficiency scores will be in the 6 to 7 range for these treatments. In certain cases, such as when the presence of road hardware or curbs makes the addition of 40 mm of surface thickness impractical, liquid asphalt treatments such as microsurfacing or paver placed surface treatment may be desired. Warrants for these surface treatments include low severity cracking and infrequent corrugations, settlements, heaves, or slippage cracks.

As indicated in the footnote to Table 1, single course overlays should not exceed 70% of total resurfacings in each Region. Total resurfacings should place each Region on a 12 year paving cycle.

*Portland Cement Concrete Surfaced Pavements*

Crack Sealing and Joint Resealing

Portland Cement Concrete Pavements typically do not age in quite the same manner as Hot Mix Asphalt Surfaced Pavements, but what does happen is that cracks develop either due to freeze-thaw cycles or due to loading. Joint sealing material does age and eventually wears out. The typical life of the silicone sealants and the compression seals commonly used in the past is about eight years. These pavements should be sealed regularly to keep water out of the subgrade and from corroding load transfer devices.

Shoulder Treatments

Usually constructed of hot mix asphalt, shoulders abutting Portland Cement Concrete Pavements deteriorate in the same manner as Hot Mix Asphalt

Pavements. If they are not sealed on a regular basis, water infiltrates the subgrade and leads to serious degradation of the shoulder and possibly the adjacent pavement.

All Pavements

Drainage

Closed drainage systems and ditches should be cleaned out on a 10 year cycle. Failure to do that will lead to flooding in the case of closed systems and flooding and subgrade saturation in the case of ditches. Both scenarios will lead to pavement degradation.

**Bridge Maintenance Guidance**

Preventive or "cyclical" maintenance activities and selection criteria are well established. TMD has tracked annual cyclical maintenance efforts and compared accomplishments to the average annualized need using bridge inventory data. Specific guidance for bridge cyclical maintenance is given as follows:

| Cyclical Activity | Selection Criteria | Cycle |
|---|---|---|
| Bridge Washing | All functional structures, priority to structures over highways | 2 years |
| Deck Sealing | Concrete wearing surfaces (Present wearing surface codes 02, 03, 06, 12, 22, 32, 42, 45, 52 in RC15 of BDMS ) rated ≥ 5.0 on structures rated 4.5 to 7. | 4 years |
| Bearing Lubrication | Steel bearings (Bearing codes 02, 03, 04, 05, 06, 07, 22, 52,5 3, 64 in RC15 of BDMS) on structures rated 4.5 to 7 | 4 years |
| Bridge Painting | Painted Structures (Coating Types 1, 2, or 3 in RC15 of BDMS) on structures rated 4.5 to 7. | 12 years |
| Deck Overlay | Wearing surfaces (Present Wearing Surface codes 04, 14, 24, 34, 44, 54, 64 in RC15 of BDMS ) on structures rated 4.5 to 7. | 12 years |

Two corrective maintenance initiatives which are new to the traditional "5-7" program are also eligible for maintenance and operations first funding. Both target deficient elements on "good" bridges. The "vertical down" initiative focuses on improving the substructure condition index of the bridge population. The "joint" initiative aims at preventing contamination of the substructure elements by ensuring a water tight seal at the joint. Both initiatives are performance-based and can be tracked using bi-annual inspection data. Candidates for "vertical down" repair are "good" bridges (with a condition rating between 4.8 and 6.0) with a substructure condition index of 5.0 or less. The substructure condition index is a weighted condition rating of the substructure using only substructure element ratings. This index is calculated on the Bridge Program worksheet which has been supplied to each region.

The "Joint" initiative targets deficient fixed or expansion joints on "good" bridges. Existing joint types, repairable with "maintenance friendly" materials, are selected using bridge inventory and inspection data. TMD develops a list of candidate structures annually. Specific guidance for bridge corrective maintenance is given as follows:

| **Corrective Activity** | **Selection Criteria** | **Objective** |
|---|---|---|
| "5 – 7" Program | Bridges in generally good condition (Condition Rating > 4.8) that have individual structural elements that are deficient (Element Ratings < 5) | Repair the deficient element and thus extend the non-deficient life of the bridge. |
| "Vertical Down" | Structures with average condition rating between 4.8 and 6 with a substructure condition index ≤ 5.0 | Repair deficiencies substructures i.e. bearings, pedestals, bridge seat/pier cap, columns/stems where needed. |
| "Joints" | Structures with average condition rating between 4.8 and 6 with joints (Joint Type codes 07, 11, 12, 13, 15, 16, 17, 18, 21, 22, 27, 28, 29, 30, 31, 32, 33, 34 in RC02 and RC15 of BDMS) rated ≤ 5.0 | Repair deficient joints to prevent water and chlorides from falling onto substructure elements. |

**Culvert Maintenance Guidance**

The Culvert Repair Program uses the Culvert Inventory and Inspection System (CIIS) data base. The system uses a rating scale similar to that used for bridges. Culverts are inspected annually, bi-annually, or every 4 years depending on condition. The CIIS lists large culverts (5' to 20'). Of the 8,192 culverts listed in CIIS, 597 have a General Rating of 3 or less. Most of those have a barrel rating of 3 or less. Improving conditions on these culverts should be a priority.

There are 1,554 culverts rated less than 5.0 for a deficiency level of 19%. It is expected that a similar deficiency level exists for smaller pipes. The inventory of small pipes is estimated to be similar in magnitude to that of large pipes. The repair of small pipes is similar to repair strategies for large pipes.

| Culvert Repair | Objective | Repair Strategies |
|---|---|---|
| Large culverts with an overall condition rating ≤ 3.0 or large culverts with a barrel rating ≤ 3.0 | Repair deficiencies in culvert elements and/or structural condition resulting in a non-deficient asset. | Highway Design Manual Chapter 8 and EI 01-029 |

**Guide Rail Maintenance Guidance**

The entire guide rail system should be inspected annually. Damaged guide rail systems should be repaired as required. The goal is to repair damaged barrier to a functional condition within *2* weeks of discovery on high priority highways, within *3* weeks on medium priority highways, and within *4* weeks on low priority highways. However, specific locations with historically frequent impacts on any highway should be assigned a higher priority in order to reduce the likelihood of a subsequent impact with non-functional barrier. All other defects not requiring extensive work or complete replacement of obsolete systems will be repaired while the work is being done. The goal is to repair impact attenuators within *2* weeks regardless of location or season.

Five percent of the entire system should be replaced/upgraded every year (twenty year cycle).

**Overhead Sign Structures Maintenance Guidance**

The Department is responsible for more than 4000 Overhead Sign Structures through out New York State. Each structure should be inspected on a four year cycle unless conditions warrant a shorter inspection cycle.

Preventive maintenance activities for Overhead Sign Structures include checking the grading around the foundation and clearing weep holes. These actions are critical to providing proper drainage in and around the sign structure to reduce the risk of corrosion that can cause the failure of the structure.

Response maintenance actions include the replacement and/or tightening of components such as nuts, bolts, u-bolts, anchor bolts and cover plates. It would also include the repair of cracked welds and other repair actions required to handle flags produced by the inspections. Replacing missing post caps, chord and truss/arm end caps and wire inlets keeps debris and small animals from entering the structure, which can lead to problems with the drainage system.

**Lighting Maintenance Guidance**

Most highway lighting is maintained through local agreements with municipalities. This applies only to select parkways in Region 10 and Department owned facilities.

All standards and luminaries should be inspected annually including replacement of bulbs and cleaning of photo cells as required. Crews must respond to bulb failures or pole hits/knockdowns in accordance with Department response policy. Standards and luminaries should be on a 25 year replacement cycle.

Table 1 Target Infrastructure Maintenance Activities

| | **Activity** | **Cycle** |
|---|---|---|
| Hot Mix Asphalt Surfaced Pavements | Single-course overlays | see guidance[1] |
| | Liquid Asphalt Treatments | see guidance[1] |
| | Crack-sealing | 4 year |
| Portland Cement Concrete Surfaced Pavements | Joint Resealing | 8 year |
| | Crack Sealing | 4 to 8 year |
| | Shoulder Treatments | see guidance[1] |
| All Pavements | Drainage (Ditch cleaning) | 10 year |
| Bridges | Bridge Washing | 2 year |
| | Bridge Painting | 12 year |
| | Lubricate Bearings | 4 year |
| | Deck Sealing | 4 year |
| | Deck Treatment | 12 year |
| | "5-7" Program<br>• Vertical Down<br>• Joints | see guidance |
| Culverts | Preventive Maintenance | 5 year |
| | Design Modification (Corrective) Maintenance | see guidance |
| | Replace plastic culverts | see guidance |
| | Replace metal culverts | 20 year |
| | Replace concrete culverts | 50 year |

| | | |
|---|---|---|
| Guide rail | Preventive Maintenance<br><br>Design Modification (Corrective) Maintenance<br><br>Replacement Cycle | 2 year<br><br>see guidance<br><br>5% of total system every year |
| Overhead Sign Structures | Preventive Maintenance<br><br>Response Maintenance | Annually<br><br>see guidance |
| Signs[2] (Ground mounted) | Repair<br><br>Design Modification (Corrective) Maintenance | As conditions warrant<br><br>12 yr replacement cycle |
| Pavement Markings[2] (Paint only) | Replace | Annually |
| Lighting[5] | Preventive Maintenance<br><br>Response Maintenance<br><br>Design Modification (Corrective) Maintenance | Annually<br><br>see guidance<br><br>As conditions warrant |

[1] Total resurfacings should result in a 12 year paving cycle. Single-course overlays should not exceed 70% of total resurfacings.
[2] Currently fully funded out of TMD operating budget.
[5] Currently funded through TE&HS Divisions operating budget.

## OPERATIONS

### Signal Maintenance and Operations Guidance

The Department is responsible for the maintenance and operation of over 6000 signals statewide. Signals should be inspected annually including signal installations, testing of controllers/detectors, a check of head vertical clearance, and replacing bulbs (non-LED sites).

Design modification (corrective) maintenance includes periodic replacement of signal components such as heads, loops, and controller replacement/repairs. This may also

include modification to align installed equipment with the current state of the practice (i.e. video detection, wireless communication equipment, closed loop systems, etc.)

- Replacement of Model 179 Controllers – Currently, all Department owned signals utilize Model 179 controllers. This technology is 20-25 year old, parts are increasingly difficult to procure and limited functionality (i.e. cannot be integrated with ITS systems). These devices will be converted to Model 2070 controllers (current national standard) within the next 10 years.

- LED Conversion - The conversion to LED heads has been completed at roughly 2/3 of the NYSDOT maintained signals. There are ~2000 incandescent locations yet to convert. The use of LED bulbs reduces power consumption by 90%, reduces "response" maintenance due to bulb failure (last 5 yrs vs. 1 year for incandescent), and reduces the likelihood of dark signals and associated risk.

- Loop Replacement - Loop replacement is required where existing detection devices have been disturbed by construction activity, is necessary due to pavement overlays, or where any wire breakage has occurred.

- Equipment Life Cycle Replacement – Signal equipment has an expected life span that can be broken into two main components; 1) poles/foundations and 2) signal heads, controllers and hardware.

  1) The desirable design life of a signal system (excluding poles) is 15 years. Currently the statewide average age of signals is about 20 years, with roughly 25% of locations having signals as old as 25-30 years. A 15 year replacement cycle for 6000 signals requires the replacement of 400 signals/year. It may be possible to upgrade the signal equipment (heads, controllers, hardware) if the poles/foundations have an adequate remaining lifespan.

2) The desirable design life for signal poles is 25 years. Many older installations utilize embedded poles rather than concrete footings. These installations are particularly susceptible to corrosion and cannot be easily inspected for structural integrity below grade. The modernization of these signal installations is critical to retain mobility and reliability, reduce high cost "response maintenance" activities, and reduce the possibility of structural failure. For 6000 signals and a pole replacement cycle of 25 years, 240 sites will need to be addressed each year.

Crews must respond to "dark" or "flashing" signals as soon as possible and within timeframe specified in Regional Signal Response Policy. Crews must respond immediately to pole hits or other system disruption/damage (i.e. storm damage) to restore normal operations, inspect equipment for damage and make emergency repairs.

**Intelligent Transportation Systems (ITS) Maintenance and Operations Guidance**

All ITS systems and services need to be maintained in good working order and replaced or upgraded on appropriate replacement cycles. Any enhancements to ITS systems should be in accordance with ITS Strategic plans. Any additional operational costs need to be identified and accounted for prior to the expansion of ITS systems.

The Department is responsible for the operation of the State's transportation system as well as its physical condition. Intelligent Transportation Systems (ITS) include physical assets and services (TMC operations, HELP, traveler information) and systems (such as ATMS systems). These activities are essential to maintaining the maximum availability of the capacity, mobility, reliability, and safety of the system. For example, a HELP truck response results in a quicker clearance of an incident and is critical to timely restoration of the normally available highway capacity.

ITS Operations and management includes the operations of the ITS systems, including TMC operations as well as the provision of services such as HELP and traveler information. This would also include activities related to the management of the ATMS systems in working order, such as efforts related to software maintenance, system

integration, configuration management, software upgrades, network support, etc. These activities are often included in ITS operations contracts.

Preventive, response and design modification (corrective) maintenance activities are largely focused on field infrastructure (ITS devices and systems) which includes replacement of existing systems as they reach their useful physical or technical life. This would also include any consultant effort related to engineering support to assess the impacts of projects on the existing system or to design planned replacement of the system.

ITS devices included are 2070 controllers, loop detectors, video image detectors/closed circuit television (CCTV), ramp meters, variable message signs (VMS), high accuracy radio (HAR), wireline, wireless equipment, computer hardware, and computer software/integration. Specific replacement cycles may be found in Table 2. Equipment failures should be replaced in accordance with Regional Response Policy.

Another consideration for signals and Intelligent Transportation Systems is life cycle replacement costs. The service life for signals and ITS equipment and systems need to be considered carefully. These life cycles are likely to be shorter than for other infrastructure (i.e. pavements or bridges) due to changes in technology or improved software/automation systems.

Table 2 Target Operations Maintenance Activities

| | Activity | Cycle |
|---|---|---|
| Signals | Preventive Maintenance[3]<br><br>Response Maintenance[3]<br><br>Design modification<br>(Corrective) Maintenance<br>• Loop Replacement[3]<br>• 2070 Conversion[3]<br>• LED Conversion[3]<br>• 15 yr Signal Equipment replacement cycle<br>• 25 yr Pole replacement cycle | Annually<br><br>see guidance<br><br>see guidance<br><br>• As warranted<br>• Convert over 10 years<br>• As soon as practical<br>• 7% of total system replacement/year (400)<br><br>• 4% of total system replacement/year (240) |
| Intelligent Transportation Systems [4] | Preventive Maintenance<br><br>Response Maintenance<br><br>Design Modification<br>(Corrective) Maintenance<br>Loop Detectors<br>Video Image detectors/CCTV<br>Ramp Meters<br>VMS (permanent)<br>HAR<br>Wireline<br>Computer Hardware<br>Computer Software/ Integration<br><br>Operations[3] | Annually<br><br>See guidance<br><br>See guidance<br><br>5 yr<br>10 yr<br>5 yr<br>20 yr<br>20 yr<br>20 yr<br>5 yr<br>5 – 20 years<br><br>As conditions warrant |

[3] This activity is currently funded through TE&HS operating budget as well as capital funds.
[4] Estimated Service Life for key ITS Freeway Management System Components as presented in USDOT's Freeway Management Handbook, 1997.

Program Update Instructions: August, 2004

# APPENDIX A DEFINITIONS

The concept of operations and management requires common terms and definitions. These terms have been defined to provide a common understanding by those managing, installing, and operating transportation systems.

The following definitions should be used in the context of the program update instructions.[1]

**Management** – the allocation of necessary resources for the proper functioning of the system.

**Operations** – all actions necessary for the proper functioning of a system, such as information gathering, synthesis, and dissemination to equipment, other agencies, and the traveling public, including those previously associated with response, preventive, and design modification (corrective) maintenance.

**Response maintenance** – actions performed on an as-needed basis. This is also known as demand maintenance, emergency maintenance, incident response and accident response. It is required when the system breaks down or malfunctions. Upon notification, the responsible agency is expected to dispatch an assessment and/or a response team to secure the site, diagnose the problem, mobilize the response, and record work accomplishment.

**Preventive maintenance** – actions performed on a regularly scheduled basis using a set of procedures to preserve the intended working condition of the system and extend its service life.

**Design modification maintenance** – actions invoked to correct a problem, to accommodate changes in prevailing conditions, or to update installations to the current state-of-the practice. This has also been known as corrective maintenance.

Program Update Instructions: August, 2004

[1] Definitions based on: Traffic Control System Operations, *James M. Giblin/Walter H. Kraft*, Chapter 1, Page 9. "Definitions."

## APPENDIX B Maintenance and Operations First Background

CURRENT PAVEMENT CONDITIONS

Figure 1 and Figure 2 show statewide pavement condition trends since 1994. Good progress has been made over this time period as shown by the decrease in pavements rated poor plus fair and the increase in the average surface rating. However, over the past few years pavement condition levels have begun to worsen. Most disturbingly is the precipitous drop in the average surface rating from 7.05 in 2000 to 6.86 in 2003. The magnitude of this decline is masked when assessing the trend in the traditional measures of pavements rated poor or pavements rated poor plus fair.

Figure 1. Statewide Trend in Percent Poor and Fair Pavement Since 1994.

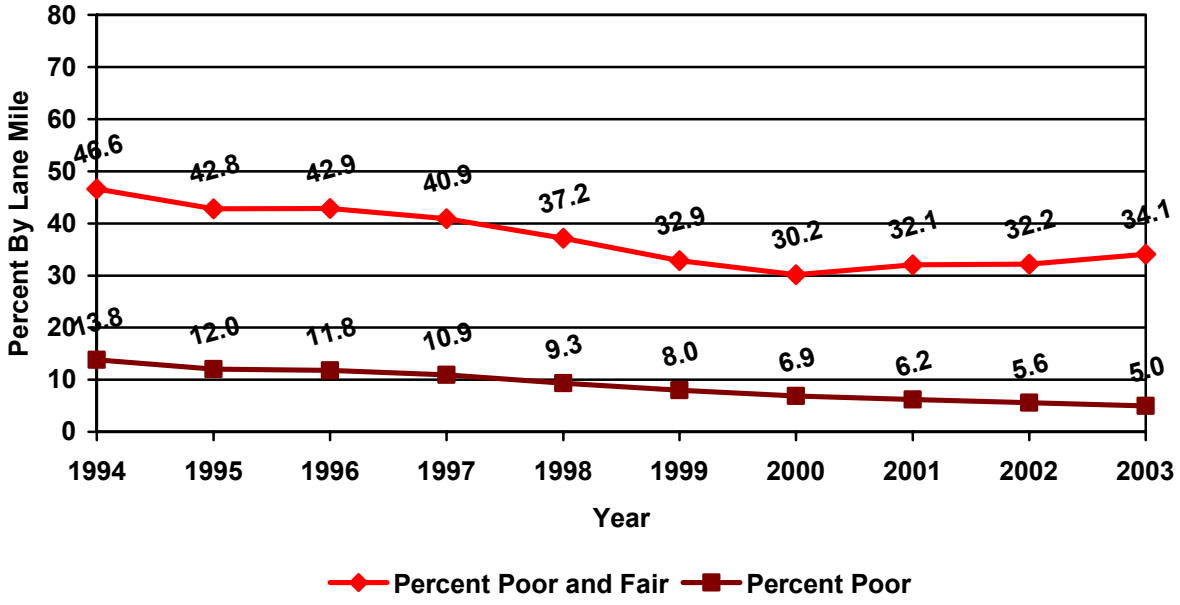


Figure 2. Statewide Trend in Average Condition Rating Since 1994.

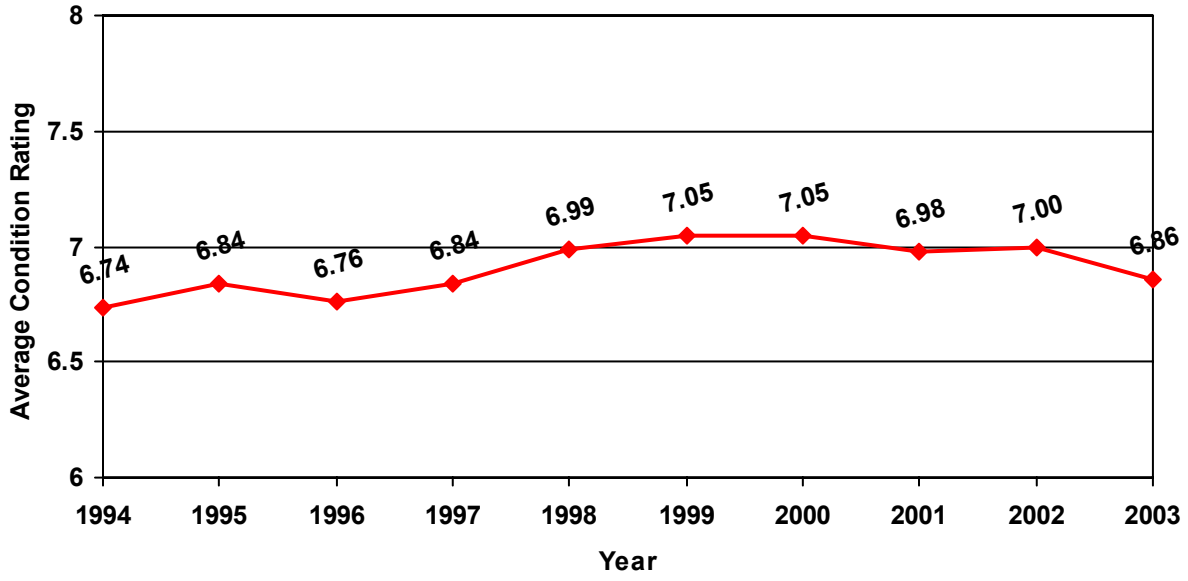
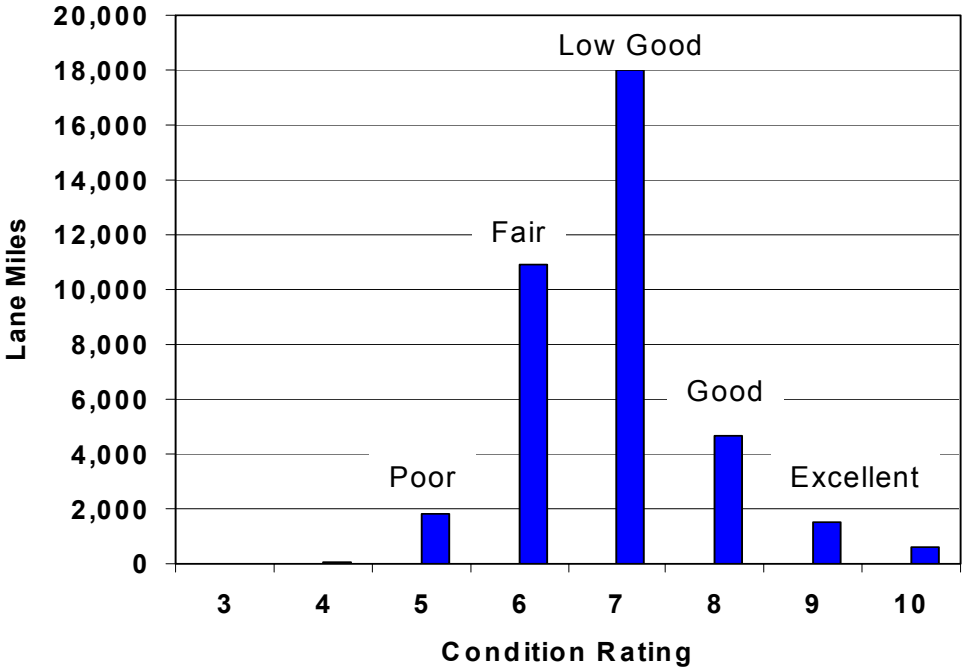



Figure 3 shows the actual distribution of 2003 pavement ratings. Note the massive buildup of pavements rated 7. Fully 47.9% of the State Highway System is currently rated in this “low good” range and an incredible 77% of the system is in low good to fair condition. Left untreated, this universe of pavements will continue to deteriorate; low goods will slip into the fair range and fair pavements will slip into the poor range.

Preventive maintenance treatments such as crack sealing, and ditching will slow the deterioration process for pavements in good condition by keeping water out of the pavement structure. Design modification (corrective) maintenance such as single-course overlays and surface treatments will seal the cracks, rejuvenate the asphalt and restore the ride for pavements rated 6 or 7.

As already mentioned, maintenance treatments applied at appropriate condition levels will extend the service life of a pavement structure. It is equally well documented that when budgets are tight, maintenance funding should increase not decrease. Department records indicate the paving cycle for State highways has increased dramatically since 1999 from 12 years to 20 years with the biggest decline in single-course overlays.

Figure 3. Distribution of 2003 Pavement Ratings.




According to maintenance records, the number of lane miles crack-sealed has also decreased significantly. Furthermore, the Department is currently on a 1,000 year cycle for the cleaning of ditches and other drainage structures. These preventive maintenance activities are often neglected but are vital to sustaining the service life of a pavement structure. Drainage systems must be maintained and routinely cleaned in order to provide effective runoff during routine weather events.

## CURRENT BRIDGE CONDITIONS

Figure 4 shows statewide bridge condition trends since 1994. As with pavements, good progress has been made, especially in terms of the number of deficient bridges. The concern, however, is that over the past few years, the rate of improvement has slowed, and in 2004 for the first time since the late 1980s, bridge conditions actually slipped slightly. Of further concern is that condition measured in percent of deficient deck area has gained little ground over time suggesting that the larger and more expensive to treat bridges still need significant work.

Figure 4. Statewide Bridge Condition Trend Since 1994.

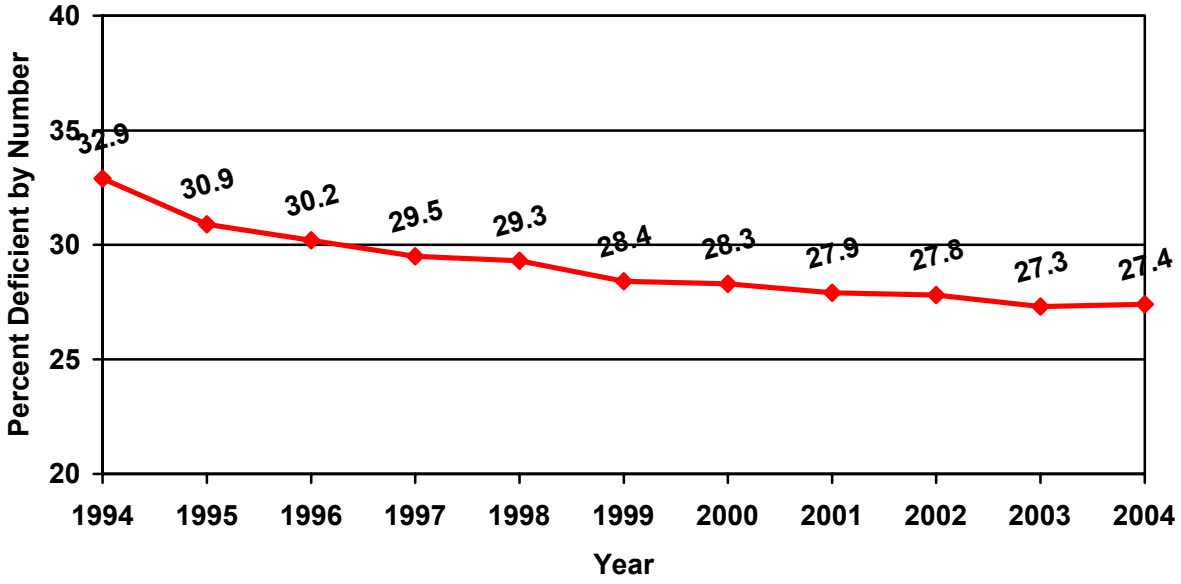



Figure 5 shows the distribution of bridge condition ratings. Notice the buildup of bridges just above the 5 level. Preventive and design modification (corrective) maintenance actions are needed to keep these bridges from deteriorating and entering the deficiency range. Bridge preventive or "cyclical" maintenance targets treatments applied at regular intervals to counter accelerated deterioration caused by environmental factors.

Bridge design modification (corrective) maintenance actions target specific bridge element deficiencies. Historically called the "5 to 7" program, these treatments such as bearing replacement, and spall repair improve the overall structural integrity of the bridge and thus provide a positive effect on the condition rating. Figure 6 shows the benefit of the Department's corrective maintenance program. As can be seen from this figure, corrective maintenance significantly extends bridge service life. With approximately 27% of the bridge population at condition ratings between 5.0 and 5.5, an aggressive corrective maintenance program is needed to prevent these bridges from slipping into the deficient category.

Figure 5. Distribution of 2004 State Highway Bridge Condition Ratings.

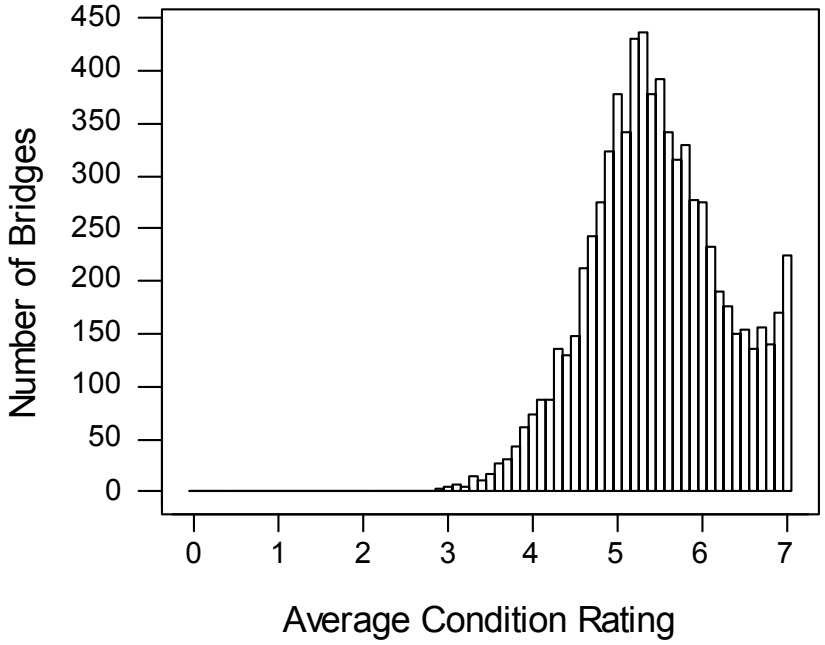
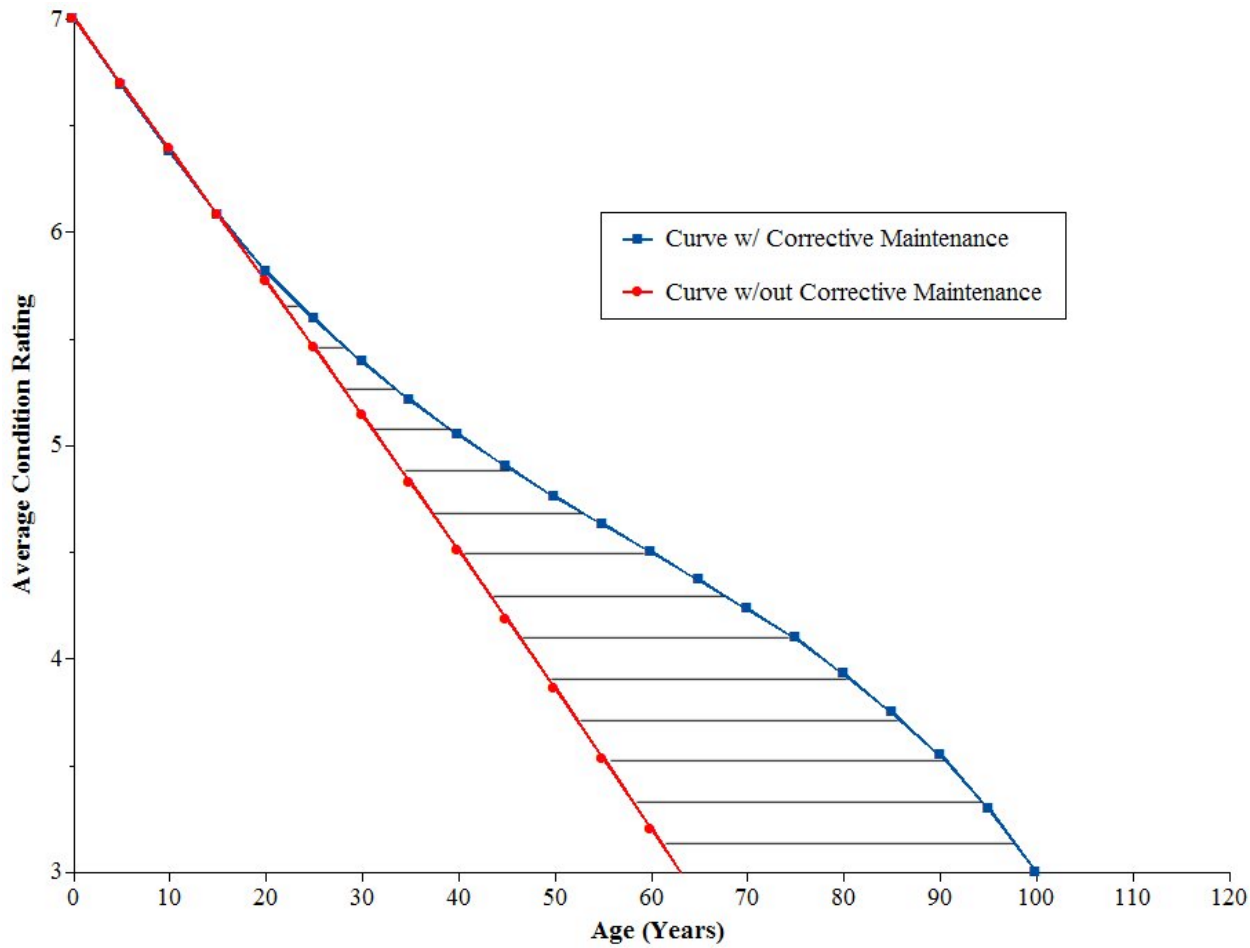


Figure 6. Benefit of Department's Bridge Corrective Maintenance Program.




CURRENT SIGNAL CONDITIONS

Preventive maintenance (PM) on traffic signals is recommended at 1 year intervals, however the actual maintenance interval is often much longer. In order to maintain the reliability of these signals (and more importantly the mobility and reliability of the transportation network), a focus needs to be placed on routine PM for the 6000 signals operated and maintained by the Department. There is further need for upgrading obsolete signal components, such as the Model 179 controllers, and install elements consistent with the current state of the practice.

## APPENDIX C Contact List

| Activity | Contact | Phone Number |
|---|---|---|
| **Pavement Maintenance** | Ed Denehy | (518) 457-6914 |
| **Drainage** | Rick McKeon | (518) 457-6912 |
| **Bridge Maintenance** | Keith McCarty<br>Pete Weykamp | (518) 457-4550<br>(518) 457-8485 |
| **Culverts** | Pete Weykamp | (518) 457-8485 |
| **Guide rail** | Rick McKeon | (518) 457-6912 |
| **Overhead Sign Structures** | Mike Crislip | (518) 457-4552 |
| **Signs** | Rick McKeon | (518) 457-6912 |
| **Pavement** | Rick McKeon | (518) 457-6912 |
| **Lighting** | Guillermo Ramos | (518) 457-1273 |
| **Signals** | Guillermo Ramos | (518) 457-2452 |
| **Intelligent Transportation Systems (ITS)** | Ed Roberts | (518) 457-1944 |

Program Update Instructions: August, 2004

# Nova Scotia Winter Maintenance Standards

## ••••••••••••••••104/105/106 SNOW AND ICE CONTROL

### GENERAL

1. The Operations Supervisor is responsible for ensuring that highways are maintained in accordance with these Winter Maintenance Standards.

2. These Winter Maintenance Standards establish levels of service on Provincial Highways. The following winter maintenance levels of service for snow and ice control are based on road classification and traffic volumes:

**Levels of Service Table**

| LEVEL OF SERVICE | Level 1A | Level 1B | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| Type of Roads | -All 100 Series and -Selected high volume highways | -All Trunks and -Selected highways as per AADT limits | -All Routes and -Selected highways as per AADT limits | -All Local Roads | -All Gravel Roads |
| AADT Limits | > 7,500 | 7,500 - 4,000 | 4,000 - 1,500 | < 1,500 | |

**Winter Levels of Service Descriptions**

| Classification | Description |
|---|---|
| 1A | Essentially Bare Pavement |
| 1B | Essentially Bare Pavement |
| 2 | Centre Line Bare 2.5m to 5.0m |
| 3 | Centre Line Bare 1.5m to 2.5m |
| | |

| | |
|---|---|
| 4 | Snow Packed |

3. While this Maintenance Standard establishes levels of service, it is acknowledged that conditions may occur, which temporarily prevent achieving levels assigned. In such cases, attempts shall be made to keep highways open by utilizing all available equipment.

4. During severe weather conditions, when it becomes evident to the Operations Supervisor that available resources are not sufficient to maintain highways open and passable, the Operations Supervisor shall immediately notify the Area Manager and the RCMP (or local Police force). The Area Manager will determine if the road shall be closed. The Operations Supervisor is required to erect and maintain all road closures and notify all emergency services and issue public advisories.

5. The use of salt in environmentally sensitive areas is strictly prohibited.

6. During storm conditions, plow routes shall be configured to not exceed the following criteria based on effective plow speed of not more than 42 km/h. For plowing calculations, the circuit time is based on the time required including deadheading, to complete all roads with the specific level of service.

**Plow Route Configuration Criteria**

| Level of Service | Circuit Time |
|---|---|
| Level 1A | 3 Hours |
| Level 1B | 4 Hours |
| Level 2 | 6 Hours |
| Level 3 | 8 Hours |
| Level 4 | 12 Hours |

## INSPECTION

1. Winter road patrols shall be carried out by designated personnel to continuously monitor road and weather conditions as required. Inspection by road patrols shall cover all routinely observed road conditions, in addition to ensuring that winter levels of service are maintained

2. The Operations Supervisor is to follow the Department road reporting protocol regarding

normal winter road condition reporting. The Operations Supervisor (or other authorized personnel) shall submit regular scheduled road reports to the Department's central road reporting office three times per day (6am,12pm,4pm). Any changes in severe weather or road conditions, which occur between specified reporting periods, should be reported immediately to the Department's road reporting office.

3. The Operations Supervisor (or other authorized personnel) shall keep accurate and legible daily logs. The log shall consist of the following information:

- Temperature every hour.
- Type and amount of precipitation every hour.
- Dispatch, loading and end times for all vehicles.
- Operators on duty.
- Start and stop of storm event.
- Type of activity being performed (plowing, salting, sanding)
- Vehicle breakdowns or accidents
- Emergency calls to the dispatch
- Amount of material loaded (salt and sand)
- Supervisor in charge.

CONDITIONS

A. From the time unfavorable road conditions occur and winter equipment is required, the Operations Supervisor has a maximum of one (1) hour to have the required equipment working in the assigned areas of responsibility. For the safety of the public, it is essential that the response time is kept to a minimum.

B. The Operations Supervisor shall deploy winter maintenance operations prior to the accumulation of the specified snow depth if the roads are hazardous, slippery or ice or slush is developing.

C. Levels of Service

I. Level 1A - Essentially Bare Pavement

The defined level of service for Level 1A is essentially bare pavement, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within eight (8) hours. This level of service applies to 100 Series highways and other selected high volume highways with an average daily traffic volume greater than 7,500 vehicles per day. To achieve this level of service, the Operations Supervisor shall remove snow and apply deicer as described in these

Maintenance Standards.

The use of deicer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.
Sand shall not normally be applied on Level 1A highways. Sand shall only be applied to Level 1A highways during severe cold weather when extremely slippery conditions exist.

A summary of Level 1A service is shown in the Levels of Service Summary Table.

II. Level 1B - Essentially Bare Pavement

The defined level of service for Level 1B is essentially bare pavement, and is the objective to be reached, as soon as possible after the storm has ended or abated, normally within twelve (12) hours . This level of service applies to all Trunk highways and other selected highways with an average daily traffic volume between 7,500 and 4,000 vehicles per day. To achieve this level of service, the Operations Supervisor shall remove snow and apply deicer as described in these Maintenance Standards.

The use of deicer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

Sand is to be applied to all roads or sections of a road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas is strictly prohibited.

Sanding of environmentally sensitive areas shall take place at the beginning of a storm and shall be discontinued after 50mm of snowfall accumulation. Sanding will normally resume after a snowfall.

A summary of Level 1B service is shown in the Levels of Service Summary Table.

III. Level 2 - Centre Line Bare 2.5m to 5.0m

The defined level of service for Level 2 is a minimum centre line bare condition of 2.5m to 5.0m wide, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within twelve (12) hours and be maintained until conditions permit baring the pavement full width. This level of service applies to all 200 and 300 series Routes and other selected highways with an average daily traffic volume between 4,000 and 1,500 vehicles per day. To

achieve this level of service, the Operations Supervisor shall remove snow and apply deicer as described in these Maintenance Standards.

The use of deicer is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

Sand is to be applied to all roads or sections of a road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas is strictly prohibited.

Sanding of environmentally sensitive areas shall take place at the beginning of a storm and shall be discontinued after 50mm of snowfall accumulation. Sanding will normally resume after a snowfall.

A summary of Level 2 service is shown in the Levels of Service Summary Table**.**

IV. Level 3 - Centre Line Bare 1.5m to 2.5m

The defined level of service for Level 3 is a minimum centre line bare condition of 1.5m to 2.5m wide, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within twenty four (24) hours, and be maintained until conditions permit baring the pavement full width. This level of service applies to all Local paved roads with an average daily traffic volume of less than1,500 vehicles per day. To achieve this level of service, the Operations Supervisor shall remove snow and apply deicer or sand as described in these Maintenance Standards

The use of deicer or sand is to be controlled, in terms of both quantity and frequency, to meet the specified level of service.

Sand is to be applied to all local roads or sections of a local road designated as being in environmentally sensitive areas. The use of salt in environmentally sensitive areas is strictly prohibited.

The application of deicer or sand will normally take place after a snowfall.

The application of deicer or sand may be applied at the beginning of a storm to hills, turns, intersections or railway crossings or where geographically conditions require.

A summary of Level 3 service is shown in the Levels of Service Summary Table.

## V. Level 4 - Snow Packed

This level of service requires that the road surface be maintained in a snow packed condition as soon as possible after the storm has ended or abated normally within twenty four (24) hours. This level of service applies only to local gravel roads. To achieve this level of service the Operations Supervisor shall remove snow and apply sand as described in these Maintenance Standards

Gravel roads shall only have sand or other approved abrasives applied. The use of salt or other deicers on gravel roads is strictly prohibited.

The use of sand or other approved abrasives is to be limited, in terms of both quantity and frequency, and normally applied only to hills, turns, intersections and railway crossings after a storm has ended. Level areas will not normally be sanded unless severe slippery conditions exist. Urban areas may require the full length of the road be sanded.

A snow packed surface is described as a smooth, hard, good driving surface with satisfactory friction with shoulders that are free of loose snow. During warming trends it may be more efficient and economical to bare the surface than to try to maintain a snow packed condition.

The Operations Supervisor shall ice blade all snow packed surfaces that have washboarded, rutted, potholed or exhibit signs of developing slipperiness or where slipperiness has developed, especially due to rain or in rain conditions.

A summary of Level 4 service is shown in the Levels of Service Summary Table.

## Levels of Service Summary Table

| LEVEL OF SERVICE | Level 1A | Level 1B | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|---|
| Type of Road | - All 100 Series<br>- Selected high volume highways | - All Trunks<br>- Selected highways as per AADT limits | - All Routes<br>- Selected highways as per AADT limits | - All Local Paved Roads | - All Gravel Roads |
| AADT Limits | > 7,500 | 7,500 - 4,000 | 4,000 - 1,500 | < 1,500 | |
| **Primary objective** | Essentially Bare Pavement*[1] | Essentially Bare Pavement*[1] | Centre Line Bare 2.5m to 5.0m | Centre Line Bare 1.2m to 2.5m | Snow Packed |
| Time to meet primary objective after end of storm, not exceeding | 8 hrs | 12 hrs | 12 hrs | 24 hrs | 24 hrs |
| **Salting**<br>- Application of salt | Beginning of storm and during as required | Beginning of storm and during as required | Beginning of storm and after | Beginning of storm where required and after | N/A |
| Max. Application Rate (Rate based on 2-Lane Road) | 125 kg/CL km | 125 kg/CL km | 110 kg/CL km | 85 kg/CL km | N/A |
| **Plowing**<br>- Begin plowing when snow accumulation | ≤ 25mm | ≤ 25mm | ≤ 50mm | During storm as required | During storm as required |
| - Max allowable accumulation | ≤ 75mm | ≤ 100mm | ≤ 150mm | ≤ 200mm | ≤ 200mm |
| **Sanding**<br>-Application of sand | - Not normally sanded<br>- Sand only during severe cold with slippery conditions | Beginning of storm for environmentally sensitive areas or during severe cold with slippery conditions | Beginning of storm for environmentally sensitive areas or during severe cold with slippery conditions | - Beginning of storm where required and after<br>- For environmentally sensitive areas<br>- Slippery conditions when required | - After storm<br>- For environmentally sensitive areas<br>- Slippery conditions when required |
| Max. Application Rate (Rate based on 2-Lane Road) | N/A | 800 kg/CL km | 800 kg/CL km | 500 kg/CL km | 500 kg/CL km |

*[1] At cold temperatures below -10°C in the day and -7°C in the night when deicing methods are no longer effective, with prior approval from the Area Manager, the Operations Supervisor shall use sand or other approved abrasive materials to maintain an even surface free of loose snow with satisfactory friction. A roadway free of snow and ice is considered always to have satisfactory friction. A snow covered roadway has satisfactory friction if permitted vehicles can be driven on it with safety.

## ACCOMPLISHMENTS

Winter snow and ice control shall be recorded under the following activity numbers:

| Activity No. | Description | ACCOMPLISHMENTS |
|---|---|---|
| 104 | Plowing | Machine Hours |
| 105 | Salting | tonnes |
| 106 | Sanding | tonnes |

NOTE:

- When a vehicle is plowing but not dispensing salt it is considered to be plowing.
- If a vehicle is dispensing salt or sand it is considered to be salting or sanding regardless of weather the plow is down or not.

**Established Response Processes - The Ohio Department of Transportation**

A highway maintenance program involves the systematic process of planning, implementing, measuring, and making improvements with highway maintenance. County Managers are responsible for the inspection of all conditions within the entire highway system in their county on a bi-weekly basis. Inspections should be documented and filed as a reference for planning and prioritizing maintenance activities , and to provide as evidence to the Court of Claims when requested as part of an investigative report. Decisions are based on the cost effective use of limited resources to improve efficiency and protect the investment in the State's existing transportation infrastructure.

Responding to roadway deficiencies in a timely manner is proper protocol at ODOT. Timely can be defined as relative to the severity or priority and nature of the problem. A stop-sign for instance would require immediate attention and response. Reactionary maintenance involves activities undertaken to correct defects and extend the life of the pavement until such a time that a proper rehabilitation or reconstruction project may be undertaken. Reactive maintenance is frequently performed on a failing pavement. It is a stopgap measure that keeps the road at an acceptable serviceability, and is seldom cost-effective but necessary to keep the highway system safe for the traveling public.

Culvert failure results in costly emergency replacements, flooding problems, and hazardous conditions for motorists. Remedial repairs are more cost effective than full replacement when deficient conditions are detected early. Culvert conditions on a route can be used as a planning tool for the County Manager to ensure deficient structures are replaced prior to road resurfacing, to forecast project costs by knowing the condition of large culverts that require work in conjunction with other projects, and to supply feedback for design and specification.

The inspection and sharing of information related to highway conditions are everyone's responsibility. All ODOT maintenance personnel performing maintenance task or ODOT inspectors administering construction projects are obligated to share observed highway conditions with the appropriate managing authority.

The Court of Claims Section is responsible for managing all administrative and judicial claims for money damages which are filed against ODOT in the Court of Claims of Ohio. Administrative claims are those claims seeking $2,500 or less and typically involve damages due to potholes, paint over-spray or debris in the roadway. Judicial claims are claims more than $2,500 and typically involve wrongful death, personal injury or contract claims. While the court of claims coordinator and staff handle all administrative claims in-house, the Ohio Attorney General's Court of Claims Defense Section ("Defense Section") represents the department in all judicial cases. The Court of Claims Section serves as a liaison between the Defense Section and district personnel who have knowledge regarding a specific claim to facilitate gathering information, thereby assisting the assistant attorneys general to effectively defend the department.

Recently, The Ohio Court of Claims ordered the Ohio Department of Transportation to pay about $5,000 to a half-dozen motorists whose cars were damaged as a result of road hazards, ruling in three of the cases that six hours should be plenty of time for ODOT to respond to reports of potholes and fix them. While it states that ODOT was found liable for a pothole that had existed for six hours and for which ODOT was never contacted directly, ODOT's legal section has adopted the following position: ODOT will settle case if 1 we had notice of a pothole for >24 hrs and did not fix it; 2 the pothole was in existence for >3 days and "somebody" knew about it (therefore we should have known about it);3 there is an area of chronic pothole deficiency and we don't get out and inspect it frequently enough; or 4 we patched an area negligently.

In other cases, the court tagged ODOT for a pavement repair patch that fell apart in less than a week, and for failing to cut down a dead tree which toppled onto a passing vehicle.

The court approved three claims worth a total of $1,426 for motorists whose cars "struck a massive pothole" on Ohio Route 309 between Elida and Lima in Allen County on Dec. 31, 2002. ODOT denied liability based on the fact it had no knowledge of the pothole prior to the accidents. However, evidence showed the pothole was observed at 12:30 p.m., and the first reported accident occurred at 6:30 p.m. "This pothole condition was present for more than six hours prior to plaintiff's damage event," the court of claims said this week. "Sufficient time had elapsed for

(ODOT) to have been aware of the pothole and taken measures to initiate repairs."

Another claim arose from a Dec. 16, 2002 accident on Ohio Route 127 in Butler County when a car struck a pothole and sustained $583 worth of tire and rim damage. ODOT denied liability, noting the pothole had been repaired on Dec. 10. The Court of Claims said there was no evidence that ODOT had constructive notice of the damage-causing pothole. "However, plaintiff has proven (ODOT) negligently maintained the roadway by inadequately patching a roadway defect whereby the patch failed in less than one week," the court said, ordering ODOT pay the vehicle repair bill.

The largest claim of $2,371 was awarded to a motorist who was driving on Ohio Route 247 in Adams County on Aug. 2, 2002 when a limb from a tree planted adjacent to the roadway fell on the car, causing extensive damage. The driver noticed a second tree already had been chopped down, and that the one from which the limb fell was "dry rotted about halfway up and the top was green."

ODOT denied liability, contending the falling tree limb was the result of an "Act of God" due to rain storms in the area. The Court of Claims disagreed, saying evidence shows ODOT either knew or should have known through inspections the dead tree constituted a hazardous condition. "The court concludes (ODOT's) negligence in failing to exercise ordinary care in respect to a dangerous condition along the roadway caused plaintiffs' damage," the decision said.

Civil actions against state agencies of $2,500 or less are determined administratively by the clerk of the Court of Claims, subject to judicial review at the request of either party. Decisions in such cases are not subject to appeal.

ODOT maintains a damage incident report form on its Web site along with a link to the Court of Claims. The department said there were 307 claims filed in 2001 of which 128 were settled, and 306 in 2002 of which 121 were settled. Through May 22, 2003, the agency has paid $78,768 for claims under $2,500.

The Court of Claims Section consists of the Court of Claims Coordinator and Administrative Assistant. Applicable Policies, Directives & Work Rules can be accessed on the Court of Claims
web-page.

Available online:

http://intranet.dot.state.oh.us/ChiefLegal/chief%20legal/court_of_claims_section.htm

Virginia DOT
Virginia Snow Removal Standards

| Accumulation (inches) | Priority 1 Routes<br>Treated/Plowed/Cleared | Priority 2 Routes<br>Chemical Treatment & Plowing During the Storm |
|---|---|---|
| **0-2** | 100% Bare Pavement within 12 hours after end of storm | Completion within12 hours after end of storm |
| **2-4** | 100% Bare Pavement within 12 hours after end of storm | Completion within 18 hours after end of storm |
| **4-8** | 100% Bare Pavement within 24 hours after end of storm | Completion within 36 hours after end of storm |
| **8-12** | 100% Bare Pavement within 24 hours after end of storm | Completion within 48 hours after end of storm |
| **12-18** | 100% Bare Pavement within 36 hours after end of storm | Completion within 48 hours after end of storm |
| **18+** | 100% Bare Pavement within 48 hours after end of storm | Completion within 72 hours after end of storm |
| **Ice or Freezing Rain** | 100% Bare Pavement within 12 hours after end of storm | Completion within 12 hours after end of storm |