MAINTENANCE MANUAL

Maintenance Office
Construction and Operations Branch
Ministry of Transportation

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Ontario

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INTRODUCTION

MAINTENANCE MANUAL

The Maintenance Manual is the Ministry's governing document for addressing inspection, maintenance and repair activities for summer and winter highway maintenance operations. It provides a province-wide reference of MTO's current maintenance standards, practices and technologies.

The manual reflects significant field input, past MTO experience, experience of other jurisdictions and well established Ministry practices across the province. It contains approved Maintenance Quality Standards (MQS's) and Maintenance Best Practices (MBP's) as well as sections on Environmental Protection (EP's) and Occupational Health and Safety Hazards (OHSH's).

MAINTENANCE QUALITY STANDARDS

The Maintenance Quality Standards contained in this manual specify the Ministry's minimum maintenance operational standards. MQS's specify the remedial work, response times and service levels required to address infrastructure defects and the safety of the motoring public. The Maintenance Quality Standards include requirements for inspection, emergency response, preventive and corrective maintenance and temporary/permanent repairs to the Provincial Highway System.

Every attempt will be made to meet the levels of service in the MQS's with the resources that are available. However, when a number of defects are detected at the same time, and exceed the operational capabilities, sound judgement will be used to evaluate the situation and address the defects on a priority basis.

Highway maintenance is a continuing activity that requires planning and scheduling. Maintenance Quality Standards shall be used to plan, schedule and budget maintenance activities.

MAINTENANCE BEST PRACTICES

Maintenance Best Practices have been developed to assist operations staff in the delivery of their maintenance program. MBP's are guidelines that represent the Ministry's experience and expertise in the effective delivery of the maintenance program. MBP's describe the materials and equipment that can be used to achieve the MQS's. Flexibility in the use of MBP's has been incorporated in the best practices to address Regional and geographical differences. Flexibility in operational differences shall be limited and monitored to ensure optimum operational efficiency and quality for those activities.

ENVIRONMENTAL PROTECTION

The Ministry has a legal responsibility to protect the environment and to comply with the requirements of environmental legislation during maintenance work, whether the work is being performed by Ministry staff or by its contractors. The Ministry and/or its contractors could be charged for non-compliance with legislation or for causing or permitting an impact to the environment.

To assist in meeting these legal responsibilities, the Maintenance Manual contains a section on Environmental Protection. This section of the manual provides guidance for environmental protection based on practical experience and on the requirements of legislation as they apply to routine maintenance operations. The Environmental Protection Section also references other applicable Ministry environmental policies. All MQS's and MBP's refer to the Environmental Protection Section. A matrix, which demonstrates the link between the MBP's and Environmental Protection provisions, resides at the front of the section. Users should consult the matrix to determine if any Environmental Protection provisions pertain to the maintenance operations being undertaken in accordance with the MQS's and MBP's.

Please note that the direction on environmental protection within this section has been included to provide greater clarity with respect to the requirements of environmental legislation. This does not relieve MTO staff or contractors from being familiar with and in compliance with the specific requirements of environmental legislation and will not prevent charges under the respective Acts and Regulations where an environmental impact results from an operation. The directions provided will need to be tailored to meet the needs of each specific location and operation.

OCCUPATIONAL HEALTH AND SAFETY HAZARDS

The Ministry has developed Occupational Health and Safety policies and guidelines to fulfill the Ministry's obligations as an employer under the Occupational Health and Safety Act (OHSA). These policies and guidelines ensure all reasonable precautions are taken for the protection of worker safety. To provide general guidance to the user, the Occupational Health and Safety Hazard (OHSH) Section of this manual references Ministry policies/guidelines, relevant legislation and other applicable resources.

For maintenance operations performed by contractors, the user should refer to the Ministry's "Occupational Health and Safety Contractor Liability Guideline for Non-Construction Work/Services". Maintenance work is generally classified as non-construction work for the purpose of compliance with the Occupational Health and Safety Act and the Ministry continues to retain the status of an employer when contracting for these services. The guideline provides information on managing the Ministry's liability as an employer under the OHSA when contracting for non-construction work.

All MBP's refer to the Occupational Health and Safety Hazard Section. A matrix, which demonstrates the link between the MBP's and the applicable Occupational Health and Safety Hazard reference, resides at the front of the OHSH Section. Users should consult the matrix to determine whether there is any direction contained in the Occupational Health and Safety Hazard Section that pertains to the maintenance operations being undertaken in accordance with the MQS's and MBP's.

Please note that the direction provided on OHSH's within this manual has been included to provide greater clarity with respect to the requirements of OHS legislation. This does not relieve MTO staff or contractors from being familiar with, and working in compliance with, the specific requirements of the OHS legislation and will not prevent charges under the OHS Act where a contravention results during the operation. The directions provided will need to be tailored to meet the needs of each specific work operation.

DEFINITIONS

Throughout the Maintenance Manual, whenever the first letter of the following words is capitalised, the following definitions shall apply. If the first letter is not capitalized the word will assume the dictionary meaning:

Address or Addressed: means the initiation of an activity that will reduce or remove the Hazardous condition.

Detect or Detected or Detection: means observed or having been informed.

District or District Office: means the local MTO office responsible for the co-ordination and delivery of the maintenance services. In the case of Central Region, District Office means the Central Region Office.

DFO or D.F.O.: means the Federal Department of Fisheries and Oceans

EP: means Environmental Protection

Hazard or Hazardous: means a condition within the Highway that is causing an unsafe condition to the public.

Highway or Right-of-Way: means a common and public highway any part of which is intended for, or used by, the general public for the passage of vehicles and includes the area between the lateral property lines thereof.

Immediate or Immediately: means as soon as possible after Detection and no later than 2 hours from the time of Detection. If more than one activity requires Immediate action at the same time, the work shall be completed giving priority to the highest degree of Hazard.

MBP: means Maintenance Best Practice.

MNR or M.N.R.: means the Ontario Ministry of Natural Resources.

MOE or M.O.E.: means the Ontario Ministry of Environment.

MQS: means Maintenance Quality Standard.

MTO or M.T.O. or Ministry: means the Ministry of Transportation (Ontario).

OHSH: means Occupational Health and Safety Hazards.

OPP or O.P.P.: means the Ontario Provincial Police.

OTM: means Ontario Traffic Manual.

Region or Regional Office: means the regional office of the MTO responsible for transportation services in the geographic area in which the maintenance activities are taking place. Except in the case of Central Region, a Regional Office is comprised of several Districts.

Report, Reported or Reporting: means verbal and/or written notification within 48 hours of Detection.

Roadside: means that portion of the Highway excluding the Roadway.

Roadway: means that part of the Highway designed or intended for use by vehicular traffic and includes the Shoulders.

Shoulder: means that portion of the Roadway between the edge of the Travelled Portion and the top inside edge of the ditch or fill slope.

Travelled Portion: means all portions of the Roadway excluding the Shoulder.

Utility: means a facility maintained by a municipality, public utility authority or regulated authority and includes sanitary sewer, storm sewer, water, electric, gas, steam, telephone and cable television services.

INTERPRETATION

In order to better understand and interpret this document, the following rules apply:

(a) the words "acceptable", "approval", "authorized", "considered necessary" "directed", "required", "satisfactory", or words of similar nature, shall mean approval of, directed, required, considered necessary or authorized by and acceptable or satisfactory to the Ministry unless the context clearly indicates otherwise;

(b) words denoting the singular include the plural and vice versa and words denoting any gender include all genders, unless the context clearly indicates otherwise;

(c) the word "including" shall mean "including without limitation";

(d) any reference to a statute shall mean the statute in force as at the present date, together with all regulations thereunder, and any reference to a regulation shall mean the regulation in force as at the present date, as the statute or regulation may be amended, consolidated and/or replaced, from time to time, and any successor statute or regulation thereto, unless otherwise expressly provided;

(e) response times indicated in the Maintenance Quality Standards begin from the moment the defect was Detected;

(f) all reference made to defects on the Highway shall also be applicable to rest areas and picnic sites, Truck Inspection Stations, and commuter parking lots;

(g) the division of this document into separate sections, subsections and schedules, the provision of a table of contents and the insertion of headings is for convenience of reference only and shall not affect the interpretation of this document;

(h) words or abbreviations which have well known or trade meanings are used herein in accordance with their recognized meanings.

RELEVANT POLICIES

Maintenance activities can be impacted by various federal and provincial laws and regulations. "**Laws and Regulations**" as defined hereunder includes any and all applicable federal, provincial, or municipal laws, by-laws, codes, orders, rules, regulations or statutes which in the ordinary and usual course of the maintenance of Provincial Highways in the Province of Ontario would be recognized, followed and/or implemented by the Ministry and its agents. The cross-reference matrix appended to this section identifies key legislation of potential application to the Maintenance Quality Standards. The matrix is not intended to be an all inclusive reference and as such does not preclude the need for Ministry staff or their agents to be knowledgeable of and in compliance with all legislation relevant to a given maintenance activity.

There are also many Ministry policies, guidelines and standards that affect the way provincial highway maintenance is to be carried out.

Lists of relevant legislation, policies, guidelines and standards are included as an appendix to this section of the document.

RESPONSIBILITY

It is the responsibility of the District to ensure that all maintenance personnel have knowledge of, and adhere to, the contents of the Maintenance Manual.

The identified defect(s) which is (are) to be Reported to the District or Regional Office must be communicated clearly and directly to a responsible person working at the District or Regional Office. The person accepting the notification of the defect is responsible to either take steps to deal with the defect(s) or to notify another person who is more qualified and able to deal with the defect(s) reported.

HIERARCHY OF DOCUMENTS

In the event of any inconsistency or conflict in the contents of the following documents, such documents shall take precedence and govern in the following order:

a) Maintenance Quality Standards (MQS's)
b) Maintenance Best Practices (MBP's)

INSPECTION

Inspections for the purpose of the Maintenance Quality Standards and Maintenance Best Practices are classified in two types: 1) drive-by inspections; and 2) detailed inspections.

A drive-by inspection is usually a visual inspection and is undertaken from a vehicle while travelling at a safe speed along the highway.

A detailed inspection can be undertaken in a variety of ways, including from a vehicle moving very slowly along the shoulder of the highway, from a parked vehicle, or by an inspector on foot. A detailed inspection can involve more than a visual inspection and may require specialized tools. In some instances, a separate inspection form is required.

DOCUMENTATION AND RECORD KEEPING

Complete and accurate documentation and records for highway maintenance activities shall be kept at all times. The purpose of documentation and record keeping is to provide knowledge and information pertaining to maintenance operations, contract controls, expenditures and possible liability action.

The Patrol Supervisor's Diary and the Maintenance Contract Administrator's Diary are to be used to record all observations and information related to road patrolling, inspections, accidents, incidents of environmental impact and contract monitoring where these activities are not recorded separately on a designated form or record.

CLASSIFICATION OF HIGHWAYS

WINTER OPERATIONS

For winter operations, the following classification of Highways applies:

	SOUTHERN ONTARIO	NORTHERN ONTARIO
Class 1	10,000 WADT	10,000 WADT
Class 2	10,000 –2,000 WADT	10,000-1,500 WADT
Class 3	2,000 - 1,000 WADT	1,500- 800 WADT
Class 4	1,000 – 500 WADT	800- 400 WADT
Class 5	500 WADT	400 WADT

OTHER OPERATIONS

For all other maintenance operations, the following classification of Highways applies:

	SOUTHERN ONTARIO	NORTHERN ONTARIO
Class 1	10,000 AADT	10,000 AADT
Class 2	10,000 –2,000 AADT	10,000-1,500 AADT
Class 3	2,000 - 1,000 AADT	1,500- 800 AADT
Class 4	1,000 – 500 AADT	800- 400 AADT
Class 5	500 AADT	400 AADT

Northern Ontario includes all Highways within the MTO Districts of Thunder Bay, Sault Ste. Marie, Sudbury and New Liskeard as well as Highways in Huntsville and Bancroft Districts north of the MNDM/MTO boundary defined as the southern Muskoka and Nipissing District Boundaries.

AADT is the Annual Average Daily Traffic count.

WADT is the Winter Average Daily Traffic count

APPENDIX A

Key Legislation

FEDERAL:

Canada Wildlife Act (Canada)
The purpose of this Act is to respect wildlife in Canada through:

- measures for the conservation of wildlife;
- establishment of facilities or the construction, maintenance and operation of works for wildlife research, conservation and interpretation; and
- protection of any species of wildlife in danger of extinction.

Canadian Environmental Protection Act, 1999 (Canada)

- The purpose of this Act is to contribute to sustainable development through pollution prevention and the protection of the environment and human health.

Fisheries Act (Canada)
The purpose of this Act is to establish controls for the:

- proper management and control of the sea-coast and inland fisheries;
- conservation and protection of fish;
- catching, loading, landing, handling, transporting, possession and disposal of fish;
- operation of fishing vessels and the use of fishing gear and equipment;
- issue, suspension and cancellation of licences and leases and the terms and conditions under which a licence and lease may be issued;
- prevention of the obstruction and pollution of any waters frequented by fish; and
- conservation and protection of spawning grounds.

Migratory Birds Convention Act, 1994 (Canada)
The purpose of this Act is to ensure the protection of migratory birds in Canada and the United States and to restrict the killing, capturing, taking or removal of migratory birds and nests.

Pest Control Products Act (Canada)
The purpose of this Act is to regulate the use of substances that have a pest control use. The Act also regulates other substances, such as formulations, adjuvants and contaminants that are contained in pest control products.

Transportation of Dangerous Goods Act, 1992 (Canada)
The purpose of this Act is to promote public safety in the transportation of dangerous goods so as not to endanger life, health, property or the environment.

PROVINCIAL:

Aggregate Resources Act (Ontario)
The purpose of this Act is to:

- provide for the management of the aggregate resources of Ontario;
- control and regulate aggregate operations on Crown and private lands;
- require the rehabilitation of land from which aggregate has been excavated; and
- minimize adverse impact on the environment in respect of aggregate operations.

Bridges Act (Ontario)
The purpose of this Act is to control and regulate the building, placement, construction, rebuilding, replacement or altering of a bridge or other structure over or across any river, stream, or part thereof.

Building Code Act, 1992 (Ontario)
The purpose of this Act is to enforce the Ontario Building Code and control the construction, maintenance and operation of buildings including sewage systems.

Cemeteries Act (Ontario)
The purpose of this Act is to control burial sites and the opening, registration and closing of cemeteries and crematoria.

Conservation Authorities Act (Ontario)
The purpose of this Act is to provide control of watershed areas within Ontario. The Act sets out requirements for the establishment of Conservation Authorities and their control of flood potential, water control structures, land development and watershed protection and preservation in terms of:

- use of lands and works;
- fees and permits for occupancy and use; and
- control of traffic, signs, animals and fires.

Dangerous Goods Transportation Act (Ontario)
The purpose of this Act is to promote public safety in the transportation of dangerous goods. Any person who handles, offers for transport or transports dangerous goods as identified by the legislation, must do so in a manner which complies with the requirements of the Act, so as not to endanger life, health, property or the environment.

***Drainage Act* (Ontario)**
The purpose of this Act is to control drainage works. Drainage works include:

- a drain constructed by any means, including the improving of a natural watercourse;
- works necessary to regulate the water table or water level within or on any lands; and
- regulating the level of the waters of a drain, reservoir, lake or pond, and includes a dam, embankment, wall, protective works or any combination thereof.

Endangered Species Act (Ontario)
The purpose of this Act is to provide for the conservation, protection, restoration and propagation of species of fauna and flora of the Province of Ontario that are threatened with extinction.

Environmental Protection Act (Ontario)
The purpose of this Act is to provide for the protection and conservation of the natural environment.

Fish and Wildlife Conservation Act, 1997 (Ontario)
The purpose of this Act is to protect and preserve fish and wildlife.

Fire Prevention and Protection Act, 1997 (Ontario)
The purpose of this Act is to prevent fires, provide education on fire safety and protect public safety and property with adequate response to fires, rescues and emergencies.

Forest Fires Prevention Act (Ontario)
The purpose of this Act is to prevent, control and extinguish fires in a forest or woodland area.

Highway Traffic Act (Ontario)
The purpose of this Act is to regulate all matters relating to highway traffic within Ontario, including:

- permitting and licensing;
- garages and storage;
- equipment, weight, load and dimensions;
- rate of speed and rules of the road;
- suspensions, records and reporting of accidents and convictions; and
- procedure, arrests and penalties.

Labour Relations Act, 1995 (Ontario)
The purpose of this Act is to:

- facilitate collective bargaining between employers and trade unions that are the freely-designated representatives of the employees;
- recognize the importance of workplace parties adapting to change;
- promote flexibility, productivity and employee involvement in the workplace;
- encourage communication between employers and employees in the workplace;
- recognize the importance of economic growth as the foundation for mutually beneficial relations amongst employers, employees and trade unions;
- encourage co-operative participation of employers and trade unions in resolving workplace issues; and
- promote the expeditious resolution of workplace disputes.

Lakes and Rivers Improvement Act (Ontario)
The purpose of this Act is to provide for:

- the management, protection, preservation and use of the waters of the lakes and rivers of Ontario and the land under them;
- the protection and equitable exercise of public rights in or over the waters of the lakes and rivers of Ontario;
- the protection of the interests of riparian owners;
- the management, perpetuation and use of the fish, wildlife and other natural resources dependent on the lakes and rivers;
- the protection of the natural amenities of the lakes and rivers and their shores and banks; and
- the protection of persons and of property by ensuring that dams are suitably located, constructed, operated and maintained and are of an appropriate nature.

Municipal Act, 2001 (Ontario)
The purpose of this Act is to:

- regulate and control the formation, erection, alteration of boundaries and dissolution of municipalities;
- establish the composition and size and of municipal councils, boards of control and staffing of municipal corporations;
- identify procedures for the investigation of municipal matters; and
- define the authority of municipalities.

Ontario Heritage Act (Ontario)
The purpose of this Act is to provide policies, priorities and programs for the conservation, protection and preservation of the heritage of Ontario.

Occupational Health and Safety Act (Ontario) & Regulations
The purpose of this Act is to provide a framework and the tools to make Ontario workplaces safe and healthy. The Act sets out the rights and duties of all parties in the workplace, establishes procedures for dealing with workplace hazards, and provides for enforcement where compliance has not been achieved.

Ontario Water Resources Act (Ontario)
The purpose of this Act is to control the collection, production, transmission, treatment, storage, supply and distribution of water or sewage.

Pesticides Act (Ontario) and Regulation 914
The purpose of this Act is to control the sale, application, storage and handling of pesticides.

Public Transportation and Highway Improvement Act (Ontario)
The purpose of this Act is to provide for the designation, assumption, construction, extension, alteration, maintenance and operation of public roads within Ontario including:

- land acquisition, highways and other works;
- controlled access highways, secondary highways, tertiary roads;
- resource and industrial roads;
- county roads and roads in unorganized municipalities; and
- rapid transit construction and public transit.

Public Service Work on Highways Act (Ontario)
The purpose of this Act is to provide for cost-sharing of utilities relocation necessitated by constructing, reconstructing, changing, altering or improving King's Highways.

Public Utilities Act (Ontario)
The purpose of this Act is to provide for the acquisition, establishment, maintenance and operation of waterworks. It also provides for the expropriation of land, waters and water privileges and the right to divert any lake, river, pond, spring or stream of water, within or without the municipality, as may be considered necessary for waterworks purposes, or for protecting the waterworks or preserving the purity of the water supply.

Public Lands Act (Ontario)
The purpose of this Act is to:

- control the sale and disposition of public lands and forests;
- set aside and designate public lands;
- require and approve land use plans;
- define public right of passage;
- define public and private forest roads;
- establish cutting rights of settlers, reservation of trees & payment of Crown dues; and
- define the construction of dams.

Technical Standards and Safety Act, 2000 (Ontario), Regulation 217/01 Liquid Fuels, and Liquid Fuels Handling Code
The purpose of this Act is to enhance public safety in Ontario by providing for the efficient and flexible administration of technical standards with respect to matters involving among other things, hydrocarbon fuels, as referred to in the regulations. The Liquid Fuels Regulation and Liquid Fuels Handling Code regulate the design, construction, installation, repair, maintenance, modification, service, use or disposal of equipment associated with gasoline and associated products, the handling and use of gasoline and associated products, as well as the licensing, registration and certification of facilities, equipment and contractors.

Weed Control Act (Ontario) and Regulation 1096
The purpose of this Act is to control certain, specific weeds in Ontario. The Act designates 23 weeds as being "noxious". In addition, a municipality may, by by-law, designate any other plant as a "noxious" weed within its jurisdiction.

Wilderness Areas Act (Ontario)
The purpose of this Act is to provide for:

- the preservation of areas as may be in their natural state in which research and educational activities may be carried on;
- the protection of the flora and fauna;
- the improvement of the area, having regard to its historical, aesthetic, scientific or recreational value; and
- or for such other purposes as may be prescribed.

Key Ministry Policies, Guidelines and Standards

Maintenance Policies
Maintenance Policies are issued by the Ministry's Maintenance Office to establish, revise and clarify policies on maintenance and operational issues for maintenance operations staff. Maintenance Policies may temporarily replace, supplement or complement Maintenance Quality Standards (MQS) and Maintenance Best Practices (MBP).

Ontario Traffic Manual
This manual supercedes the Manual of Uniform Traffic Control Devices (MUTCD) and is to be used for any maintenance operation on, or adjacent to the Highway. The Ontario Traffic Manual (OTM) provides policy and guidance on the full range of traffic control devices and their application. The OTM consists of 22 separately bound "Books".

Ontario Provincial Standard Drawings (OPSD)
This manual contains standard engineering drawings for every aspect of the Highway infrastructure. Reference to this manual will be required in order to re-establish the infrastructure component to its designed state, for example, to repair Shoulder cross-fall or to replace guide rail.

Ontario Provincial Standard Specifications (OPSS)
This manual contains the written specifications for roadway material, construction and maintenance methods.

Designated Sources for Materials (DSM)
This manual provides the sources for materials and products that meet the Ministry's requirements. Only those sources listed shall be used for the material or product contained

in the manual.

MTO Interpretive Bulletin "Patrol Response to Non-MTO Spills
This document sets out the procedures to be followed by MTO Patrol staff in the event of a non-Ministry spill on MTO Highways.

Roadside Safety Manual (RSM)
The RSM incorporates the Ministry's current standards, policies, practices and expertise in the areas of roadside safety, including barriers, energy attenuators and light poles. Its primary purpose is to provide the tools to produce safe, cost-effective designs for dealing with roadside hazards.

MTO/MNR/DFO "Fisheries Protocol"
This document is a protocol agreement between MTO and MNR for protecting fisheries resources on provincial highway undertakings. It clarifies the legislative requirements of the federal Fisheries Act that apply to the development and maintenance of provincial highways and establishes standard requirements and a consistent approach for the two ministries to follow in order to protect fish habitat.

MOE/MTO "Protocol for the Management of Excess Materials in Road Construction and Maintenance"
This document is a protocol agreement between MTO and MOE developed to encourage maximum application of the 3Rs hierarchy of waste management (reduce, reuse and recycle) during road construction and maintenance. It contains management conditions designed to enable environmentally acceptable reuse and recycling of excess bituminous pavement, Portland cement concrete, swamp material, natural wood/vegetation/grubbing materials, road sweepings and catch basin clean-out material.

Archaeological Protocol
This protocol is intended to clarify the legislative requirements of the Ontario Heritage Act and the Environmental Assessment Act as these pertain to the role of MTO in archaeological matters. The protocol defines general archaeological requirements to be applied to all MTO undertakings.

Ontario Structure Inspection Manual (OSIM)
The manual used for bridge inspections in Ontario since 1985. The most recent revision incorporates a "severity and extent" philosophy to estimate bridge needs and costs. Part 1 consists of technical information including procedural guidelines. Part 2 contains detailed visual inspections including Condition State Tables, Suspected Performance Deficiency Tables, element lists, quantity calculation tables and maintenance needs tables.

MTO Sign Support Manual
The purpose of this document is to assist MTO staff and others in the procurement and erection of all types of sign supports and for preparing contract documents.

MTO Sign Support Inspection Guidelines
This document identifies and describes the inventory, inspection and repair procedures for

overhead sign support structures. The guidelines also describe procedures for determining the need for maintenance work, repair work and the urgency for this work.

MTO Safety Practices for Structural Inspection

The purpose of this document is to provide direction and assistance to MTO staff and others who conduct inspections of structures.

MTO Bailey Bridge Manual

This manual describes types of Bailey bridges and their uses, the various components, the design, erection and dismantling techniques, the estimation of components required for a bridge and a discussion of possible future alternative bridges.

MTO King's Highway Guide Signing Policy Manual

The purpose of this manual is to set out the policy for the planning, installation and maintenance of signs of the King's Highway. The manual covers the use of all forms of information signs, including Guide Signs and Highway Markers.

MTO Logo Sign System Policy Manual

The purpose of this document is to set out policy for the planning, installation and maintenance of the Ministry's Logo Sign System for business identification and directional information for qualified business services on freeways and staged freeways.

MTO Tourism-Oriented Direction Signing Policy (TODS) Manual

The purpose of this document is to set out policy for the planning, installation and maintenance of the new provincial-oriented directional signing (TODS) system.

MTO Drainage Management Manual

This manual integrates drainage and hydrology practices within highway planning and design. The manual describes drainage management practices, sets out generic design considerations and standards of practice, is a benchmark for expected design quality and provides a variety of design techniques.

MTO Oil/Water Separator Interim Field Guide for Patrol Yards Working Draft

This document is an owner's guide for maintenance staff. It is a tool to effectively operate and maintain the oil/water separator at Ministry Patrol Yards.

Interim Guidelines for Bacteriological Testing of Non-Municipal Water at MTO Sites

The purpose of this document is to provide minimum interim direction on testing water where MTO provides non-municipal water to the public. This document distinguishes between drinking uses of water (potable) and recreational uses of water (washing).

MTO Sand Domes Inspection Manual (SDIM)

The purpose of this document is to aid in the inspection and maintenance of Fitzpatrick Type Sand Domes. The inspection manual can also be applied to other similar timber dome structures.

MTO Pavement Design and Rehabilitation Manual

This document incorporates the Ministry's current practices and expertise in the areas of pavement design, rehabilitation and management. The manual provides a set of guidelines and procedures that assist in providing cost-effective pavement design and uniform direction in the preservation of pavement infrastructure.

MTO Manual for the Condition Rating of Flexible Pavements

This document provides methods to evaluate the surface condition of flexible pavements based on riding quality and distress manifestations. Distress manifestations are categorized to provide uniformity in reporting and interpretation. The manual describes probable causes of distress manifestations as well as possible remedial measures.

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-101 Concrete Pavement Surfaces	MQS-102 Asphalt Pavement Surfaces	MQS-103 Surface Treated Surfaces	MQS-104 Gravel Surfaces	MQS-201 Gravel Shoulders	MQS-202 Hard Surface Shoulders
Canada Wildlife Act (Canada)						
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)		X	X	X	X	
Migratory Birds Convention Act, 1994 (Canada)					X	
Pest Control Products Act (Canada)						
Transportation of Dangerous Goods Act, 1992 (Canada)			X	X	X	
Aggregate Resources Act (Ontario)	X	X		X	X	X
Bridges Act (Ontario)						
Cemeteries Act (Ontario)						
Conservation Authorities Act (Ontario)						
Dangerous Goods Transportation Act (Ontario)			X	X	X	
Drainage Act (Ontario)						
Endangered Species Act (Ontario)						
Environmental Protection Act (Ontario)		X	X	X	X	
Fish and Wildlife Conservation Act, 1997 (Ontario)						
Fire Prevention and Protection Act, 1997 (Ontario)						
Forest Fires Prevention Act (Ontario)						
Highway Traffic Act (Ontario)						
Labour Relations Act, 1995 (Ontario)						
Lakes and Rivers Improvement Act (Ontario)		X	X	X	X	
Municipal Act, 2001 (Ontario)						
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	X
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)						
Ontario Water Resources Act (Ontario)		X	X	X	X	X
Pesticides Act (Ontario) and Regulation 914						
Provincial Parks Act (Ontario)						
Public Lands Act (Ontario)						
Public Service Work on Highways Act (Ontario)						
Public Transportation and Highway Improvement Act (Ontario)						
Public Utilities Act (Ontario)						
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						
Weed Control Act (Ontario) and Regulation 1096						
Wilderness Areas Act (Ontario)						

APPENDIX B

NOTE: This matrix is not intended to be an all inclusive reference and as such does not preclude the need for Ministry staff or its agents to be knowledgeable of and in compliance with all legislation relevant to any maintenance activity

CROSS-REFERENCE MATRIX FOR: MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION	MQS-303 Hard Surface Cleaning	MQS-305 Fences	MQS-320 Weed Control	MQS-321 Tree Control	MQS-322 Tree and Shrub Maintenance	MQS-323 Ground Cover Rehabilitation
Canada Wildlife Act (Canada)		X	X	X	X	X
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)	X		X		X	X
Migratory Birds Convention Act, 1994 (Canada)		X	X	X	X	X
Pest Control Products Act (Canada)			X		X	
Transportation of Dangerous Goods Act, 1992 (Canada)	X		X		X	
Aggregate Resources Act (Ontario)						
Bridges Act (Ontario)						
Cemeteries Act (Ontario)		X				
Conservation Authorities Act (Ontario)						
Dangerous Goods Transportation Act (Ontario)	X		X		X	X
Drainage Act (Ontario)						
Endangered Species Act (Ontario)		X	X	X	X	
Environmental Protection Act (Ontario)	X		X		X	
Fish and Wildlife Conservation Act, 1997 (Ontario)		X	X	X	X	X
Fire Prevention and Protection Act, 1997 (Ontario)			X	X	X	
Forest Fires Prevention Act (Ontario)			X	X	X	
Highway Traffic Act (Ontario)						
Labour Relations Act, 1995 (Ontario)						
Lakes and Rivers Improvement Act (Ontario)	X		X		X	X
Municipal Act, 2001 (Ontario)						
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	X
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)		X				X
Ontario Water Resources Act (Ontario)	X		X		X	X
Pesticides Act (Ontario) and Regulation 914			X		X	
Provincial Parks Act (Ontario)						
Public Lands Act (Ontario)						
Public Service Work on Highways Act (Ontario)						
Public Transportation and Highway Improvement Act (Ontario)						
Public Utilities Act (Ontario)						

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CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-303 Hard Surface Cleaning	MQS-305 Fences	MQS-320 Weed Control	MQS-321 Tree Control	MQS-322 Tree and Shrub Maintenance	MQS-323 Ground Cover Rehabilitation
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						
Weed Control Act (Ontario) and Regulation 1096			X			X
Wilderness Areas Act (Ontario)		X	X	X	X	X

NOTE: This matrix is not intended to be an all inclusive reference and as such does not preclude the need for Ministry staff or its agents to be knowledgeable of and in compliance with all legislation relevant to any maintenance activity

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-324 Brush Control	MQS-325 Rest Area/Picnic Site Maintenance	MQS-326 Grass Control	MQS-331 Debris Control	MQS-395 Road Patrol	MQS-396 Facilities
Canada Wildlife Act (Canada)	X	X	X		X	X
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)	X	X	X			
Migratory Birds Convention Act, 1994 (Canada)	X	X	X		X	X
Pest Control Products Act (Canada)	X	X	X		X	X
Transportation of Dangerous Goods Act, 1992 (Canada)	X	X	X	X	X	
Aggregate Resources Act (Ontario)					X	
Bridges Act (Ontario)					X	
Cemeteries Act (Ontario)						
Conservation Authorities Act (Ontario)		X			X	
Dangerous Goods Transportation Act (Ontario)	X	X	X	X	X	
Drainage Act (Ontario)					X	X
Endangered Species Act (Ontario)	X		X		X	X
Environmental Protection Act (Ontario)	X				X	X
Fish and Wildlife Conservation Act, 1997 (Ontario)	X	X	X	X		X

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CROSS-REFERENCE MATRIX FOR: MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION	MQS-324 Brush Control	MQS-325 Rest Area/Picnic Site Maintenance	MQS-326 Grass Control	MQS-331 Debris Control	MQS-395 Road Patrol	MQS-396 Facilities
Fire Prevention and Protection Act, 1997 (Ontario)	X					X
Forest Fires Prevention Act (Ontario)	X				X	X
Highway Traffic Act (Ontario)					X	
Labour Relations Act, 1995 (Ontario)					X	
Lakes and Rivers Improvement Act (Ontario)						
Municipal Act, 2001 (Ontario)					X	
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	
Ontario Building Code Act, 1992						X
Ontario Heritage Act (Ontario)						
Ontario Water Resources Act (Ontario)						X
Pesticides Act (Ontario) and Regulation 914	X	X	X		X	
Provincial Parks Act (Ontario)		X			X	
Public Lands Act (Ontario)					X	X
Public Service Work on Highways Act (Ontario)					X	X
Public Transportation and Highway Improvement Act (Ontario)					X	
Public Utilities Act (Ontario)					X	X
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						X
Weed Control Act (Ontario) and Regulation 1096	X	X			X	
Wilderness Areas Act (Ontario)	X	X	X		X	X

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CROSS-REFERENCE MATRIX FOR: MAINTENANCE QUALITY STANDARDS &	MQS-501	MQS-502	MQS-503	MQS-504	MQS-505	MQS-551

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	Ditches	Culverts	Curb and Gutter	Catchbasins, Maintenance Access Points, Ditch Inlets and Outfalls	Subdrain Systems	Bridge Maintenance Inspection
Canada Wildlife Act (Canada)	X	X		X		
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)	X	X		X		
Migratory Birds Convention Act, 1994 (Canada)	X	X		X		X
Pest Control Products Act (Canada)						
Transportation of Dangerous Goods Act, 1992 (Canada)						
Aggregate Resources Act (Ontario)	X	X		X		
Bridges Act (Ontario)	X					
Cemeteries Act (Ontario)	X	X		X		
Conservation Authorities Act (Ontario)	X	X		X		
Dangerous Goods Transportation Act (Ontario)						
Drainage Act (Ontario)	X	X	X	X		
Endangered Species Act (Ontario)	X	X		X		
Environmental Protection Act (Ontario)						
Fish and Wildlife Conservation Act, 1997 (Ontario)	X	X		X		
Fire Prevention and Protection Act, 1997 (Ontario)						
Forest Fires Prevention Act (Ontario)						
Highway Traffic Act (Ontario)						X
Labour Relations Act, 1995 (Ontario)						
Lakes and Rivers Improvement Act (Ontario)	X	X		X		
Municipal Act, 2001 (Ontario)						
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X		X
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)	X	X		X		
Ontario Water Resources Act (Ontario)	X	X		X		
Pesticides Act (Ontario) and Regulation 914						
Provincial Parks Act (Ontario)						
Public Lands Act (Ontario)						
Public Service Work on Highways Act (Ontario)						
Public Transportation and Highway Improvement Act (Ontario)						X
Public Utilities Act (Ontario)						
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						
Weed Control Act (Ontario) and Regulation 1096						
Wilderness Areas Act (Ontario)	X	X		X		

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CROSS-REFERENCE MATRIX FOR: MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION	MQS-552 Structure Cleaning	MQS-553 Bridge Surfaces	MQS-555 Obstruction to Waterflow at Bridges	MQS-556 Expansion Joints/Bearings	MQS-557 Erosion Control at Bridges	MQS-558 Modular Bridges
Canada Wildlife Act (Canada)	X		X		X	X
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)	X	X	X		X	X
Migratory Birds Convention Act, 1994 (Canada)	X					X
Pest Control Products Act (Canada)						
Transportation of Dangerous Goods Act, 1992 (Canada)						
Aggregate Resources Act (Ontario)						
Bridges Act (Ontario)						X
Cemeteries Act (Ontario)						
Conservation Authorities Act (Ontario)			X			
Dangerous Goods Transportation Act (Ontario)						
Drainage Act (Ontario)			X		X	
Endangered Species Act (Ontario)	X		X		X	X
Environmental Protection Act (Ontario)	X					
Fish and Wildlife Conservation Act, 1997 (Ontario)	X		X		X	X
Fire Prevention and Protection Act, 1997 (Ontario)						
Forest Fires Prevention Act (Ontario)						
Highway Traffic Act (Ontario)						
Labour Relations Act, 1995 (Ontario)						
Lakes and Rivers Improvement Act (Ontario)	X		X		X	X
Municipal Act, 2001 (Ontario)						
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	X
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)						
Ontario Water Resources Act (Ontario)	X		X		X	X
Pesticides Act (Ontario) and Regulation 914						
Provincial Parks Act (Ontario)						
Public Lands Act (Ontario)						
Public Service Work on Highways Act (Ontario)						
Public Transportation and Highway Improvement Act (Ontario)	X	X	X	X	X	
Public Utilities Act (Ontario)						
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						
Weed Control Act (Ontario) and Regulation 1096						
Wilderness Areas Act (Ontario)	X		X		X	X

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maintenance activity

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-601 Highway Markings	MQS-604 Signs	MQS-605 Sign Supports	MQS-661 Cable Guide Rail	MQS-662 Steel Beam Guide Rail	MQS-663 Box Beam Guide Rail
Canada Wildlife Act (Canada)						
Canadian Environmental Protection Act, 1999 (Canada)						
Fisheries Act (Canada)	X					
Migratory Birds Convention Act, 1994 (Canada)			X			
Pest Control Products Act (Canada)						
Transportation of Dangerous Goods Act, 1992 (Canada)	X					
Aggregate Resources Act (Ontario)						
Bridges Act (Ontario)						
Cemeteries Act (Ontario)						
Conservation Authorities Act (Ontario)						
Dangerous Goods Transportation Act (Ontario)	X					
Drainage Act (Ontario)						
Endangered Species Act (Ontario)						
Environmental Protection Act (Ontario)	X					
Fish and Wildlife Conservation Act, 1997 (Ontario)						
Fire Prevention and Protection Act, 1997 (Ontario)						
Forest Fires Prevention Act (Ontario)						
Highway Traffic Act (Ontario)	X		X	X	X	X
Labour Relations Act, 1995 (Ontario)						
Lakes and Rivers Improvement Act (Ontario)	X					
Municipal Act, 2001 (Ontario)						
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	X
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)						
Ontario Water Resources Act (Ontario)	X					
Pesticides Act (Ontario) and Regulation 914						
Provincial Parks Act (Ontario)		X	X			
Public Lands Act (Ontario)						
Public Service Work on Highways Act (Ontario)	X	X	X			
Public Transportation and Highway Improvement Act (Ontario)				X	X	X
Public Utilities Act (Ontario)			X			
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01						
Weed Control Act (Ontario) and Regulation 1096						
Wilderness Areas Act (Ontario)			X			

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CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-664 Energy Absorbing Systems	MQS-665 Concrete Barriers	MQS-701 Winter Maintenance – Level of Service	MQS-702 Winter Maintenance - Operations	MQS-703 Winter Maintenance - Resources	
Canada Wildlife Act (Canada)			X	X	X	
Canadian Environmental Protection Act, 1999 (Canada)			X	X	X	
Fisheries Act (Canada)			X	X	X	
Migratory Birds Convention Act, 1994 (Canada)			X	X	X	
Pest Control Products Act (Canada)						
Transportation of Dangerous Goods Act, 1992 (Canada)			X	X	X	
Aggregate Resources Act (Ontario)			X	X	X	
Bridges Act (Ontario)			X	X	X	
Cemeteries Act (Ontario)						
Conservation Authorities Act (Ontario)			X	X	X	
Dangerous Goods Transportation Act (Ontario)	X	X	X	X	X	
Drainage Act (Ontario)			X	X	X	
Endangered Species Act (Ontario)			X	X	X	
Environmental Protection Act (Ontario)			X	X	X	
Fish and Wildlife Conservation Act, 1997 (Ontario)			X	X	X	
Fire Prevention and Protection Act, 1997 (Ontario)						
Forest Fires Prevention Act (Ontario)						
Highway Traffic Act (Ontario)	X	X	X	X	X	
Labour Relations Act, 1995 (Ontario)			X	X	X	
Lakes and Rivers Improvement Act (Ontario)			X	X	X	
Municipal Act, 2001 (Ontario)			X	X	X	
Occupational Health and Safety Act (Ontario) & Regulations	X	X	X	X	X	
Ontario Building Code Act, 1992						
Ontario Heritage Act (Ontario)						
Ontario Water Resources Act (Ontario)			X	X	X	
Pesticides Act (Ontario) and Regulation 914						
Provincial Parks Act (Ontario)						
Public Lands Act (Ontario)			X	X	X	
Public Service Work on Highways Act (Ontario)			X	X	X	
Public Transportation and Highway Improvement Act (Ontario)	X	X	X	X	X	
Public Utilities Act (Ontario)						

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CROSS-REFERENCE MATRIX FOR:

MAINTENANCE QUALITY STANDARDS & POTENTIAL APPLICATION OF KEY FEDERAL AND PROVINCIAL LEGISLATION

	MQS-664 Energy Absorbing Systems	MQS-665 Concrete Barriers	MQS-701 Winter Maintenance – Level of Service	MQS-702 Winter Maintenance - Operations	MQS-703 Winter Maintenance - Resources	
Technical Standards & Safety Act, 2000 (Ontario) & Reg. 217/01			X	X	X	
Weed Control Act (Ontario) and Regulation 1096						
Wilderness Areas Act (Ontario)						

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MQS-102	Asphalt Pavement Surfaces	
MQS-103	Surface Treated Surfaces	
MQS-104	Gravel Surfaces	
MQS-201	Gravel Shoulders	
MQS-202	Hard Surface Shoulders	
MQS-303	Hard Surface Cleaning	
MQS-305	Fences	
MQS-320	Weed Control	
MQS-321	Tree Control	
MQS-322	Tree and Shrub Maintenance	
MQS-323	Ground Cover Rehabilitation	
MQS-324	Brush Control	
MQS-325	Rest Area/Picnic Site Maintenance	
MQS-326	Grass Control	
MQS-331	Debris Control	
MQS-395	Road Patrol	
MQS-396	Facilities	
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MQS-701	Winter Maintenance - Level of Service	
MQS-702	Winter Maintenance - Operations	
MQS-703	Winter Maintenance - Resources	

For maintenance standards on Traffic Signals and Illumination refer to the "Electrical Engineering Manual"

MQS-101

INTRODUCTION

A concrete pavement surface is a road surface made of a mixture of Portland cement, aggregates and water and is commonly referred to as “rigid pavement”.

Concrete pavement surfaces shall be inspected, and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the concrete surface and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-101
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year’s work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Potholes**

   Potholes are dents or holes in the concrete pavement surface.

   a) Pothole(s) with an area of 0.04m^2 (i.e.200mm x 200mm or 100mm x 400mm) or greater and a depth greater than 50mm shall be repaired within the timeframe specified in Table 101 (defect 1a).

   b) Pothole(s) with an area of 0.04m^2 (i.e.200mm x 200mm or 100mm x 400mm) or greater and a depth from 25mm to 50mm shall be repaired within the timeframe specified in Table 101 (defect 1b).

2. **Joint Failures**

   Joint failure is an excessive breakdown of the concrete adjacent to the joint which may include upward buckling of the concrete slab.

   All joint failures exceeding a differential of 50mm vertically shall be Reported to the District Office and maintenance staff shall provide adequate safety notification.

3. **Distortions**

   Distortions are any deviations of the concrete pavement surface from its original profile. These defects usually take the shape of a bump or depression and are noticeable in a moving vehicle.

   Bumps and depressions with a vertical differential of more than 50mm over 3m shall be Reported to the District Office.

   Bumps and depressions of the concrete pavement surface at any bridge approach shall be Reported to the District Office.

4. **Water Ponding**

   Water ponding is the collection of water on the Travelled Portion.
   Ponding caused by high gravel shoulders shall be repaired within the timeframe specified in Table 101 (defect 4). Ponding caused by concrete pavement surface depressions shall be Reported to the District Office.

Shoulder and concrete pavement surface drainage distresses shall be repaired within the timeframe specified in Table 101 (defect 4) on a severity and priority basis.

5. **Cracking**

Cracks can be categorized as follows:

a) Longitudinal cracks are generally parallel to the centre line, and sometimes extend completely through the slab.

b) Transverse cracks are generally at right angles to the centre line of the Travelled Portion.

c) Diagonal cracks form angles, other than transverse, with the centre line of the Travelled Portion.

d) Corner cracks usually form a triangle with a transverse joint or a crack either at the centre line or at the edge of the Travelled Portion.

Cracks or ravelled areas more than 40mm wide at joints shall be Reported to the District Office.

6. **Asphalt Shoulder-Concrete Pavement Surface Joint**

Cracks wider than 40mm shall be Reported to the District Office.

7. **Joint Sealant Loss**

Transverse or longitudinal joint sealant that is being squeezed or pulled out of the joint shall be cut away and removed when Detected. Any occurrence of joint sealant loss shall be Reported to the District Office.

8. **Scaling/Ravelling**

Scaling/ravelling is the progressive deterioration of and the loss of fine aggregates from the concrete pavement surface. Any occurrence of scaling/ravelling shall be Reported to the District Office.

9. **Polished Surface**

A polished surface usually has a glossy appearance. This condition shall be Reported to the District Office.

10. **Spalling**

Spalling is typically the break-up of the pavement at a joint or crack, resulting in fragments with feathered edges. Any occurrence of spalling shall be Reported to the District Office.

TABLE 101

DEFECT	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5
1(a)	3 days	3 days	3 days	7 days	NA
1(b)	7 days	7 days	7 days	14 days	NA
2	Report to District Office				
3	Report to District Office				
4	7 days	7 days	7 days	14 days	NA
5	Report to District Office				
6	Report to District Office				
7	Report to District Office				
8	Report to District Office				
9	Report to District Office				
10	Report to District Office				

MQS-102

INTRODUCTION

An asphalt pavement consists of a mixture of heated asphalt cement and aggregate, commonly referred to as “hot mix”. This hot mix is placed on a prepared base using a mechanical spreader or grader and compacted.

A cold mix pavement is made of materials similar to those used in hot mix, but they are mixed cold, usually spread manually by grader or mechanical spreader and compacted.

These surfaces are commonly known as flexible pavements.

Asphalt pavement surfaces shall be inspected and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the asphalt pavement and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-102
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year’s work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Potholes**

   Potholes are dents or holes in the pavement surface.

   a) Pothole(s) with an area of 0.04m^2 (i.e. 200mm x 200mm or 100mm x 400mm) or greater and a depth greater than 50mm shall be repaired within the timeframe specified in Table 102 (defect 1a).

   b) Pothole(s) with an area of 0.04m^2 (i.e. 200mm x 200mm or 100mm x 400mm) or greater and a depth from 25mm to 50mm shall be repaired within the timeframe specified in Table 102 (defect 1b).

2. **Distortion**

   Distortions are any deviations of the pavement surface from its original shape other than that described for rippling and shoving. These defects usually take the shape of a bump or depression and are noticeable in a moving vehicle.

   Bumps or depressions with a vertical depth differential of 50mm or more over a 3m length shall be Reported to the District Office.

   Bumps or depressions of the asphalt pavement surface at bridge approaches shall be Reported to the District Office.

3. **Water Ponding**

   Water ponding is the collection of water on the Travelled Portion.

   Ponding caused by high gravel shoulders shall be corrected within the timeframe specified in Table 102 (defect 3). Ponding caused by pavement surface depressions shall be Reported to the District Office.

   Shoulder and surface drainage distresses shall be repaired within the timeframe specified in Table 102 (defect 3) on severity and priority basis.

4. **Cracking**

Cracks can be categorized as follows:

a) Longitudinal cracks are generally along the centre line or parallel to it.
b) Transverse cracks are generally at right angles to the Roadway centre line.
c) Edge cracks are parallel to and within 300mm from the pavement edge. They can be straight or crescent shaped in a wave formation.
d) Alligator cracks are inter-connected cracks forming a series of small blocks resembling an alligator's skin or chicken wire.
e) Map cracks are a combination of longitudinal and transverse cracks that run randomly and are interconnected with each other.

All cracks that are 40mm or wider shall be Reported to the District Office.

5. **Wheel Track Rutting**

Wheel track rutting is dishing developed in the wheel tracks.

Any occurrence of rutting greater than 25mm deep shall be Reported to the District Office.

6. **Rippling and Shoving**

Rippling and shoving is a regular wavy or "washboard" effect running across the pavement, or an unevenness of the pavement due to movement of the surface mat.

Any occurrence of rippling or shoving shall be Reported to the District Office.

7. **Ravelling**

Ravelling is the progressive loss of pavement material from the surface downward, leaving a course texture of “pock marks” on the pavement surface.

Any occurrence of ravelling shall be Reported to the District Office.

8. **Polished or Flushed Surfaces**

A polished surface usually has a glossy appearance and a flushed surface has excess asphalt cement on the pavement surface. These conditions shall be Reported to the District Office.

9. **Pavement Edge Surface Loss (broken edge of pavement)**

Pavement edge surface loss is the loss of pavement surface adjacent to the gravel Shoulder. Pavement edge surface loss which extends more than 100mm inward from the edge of pavement shall be repaired within the timeframe specified in Table 102 (defect 9) to maintain a straight and consistent edge of pavement.

In addition, pavement edge surface loss extending more than 300mm into the driving lane shall be Reported to the District Office.

TABLE 102

DEFECT	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5
1(a)	3 days	3 days	3 days	7 days	7 days
1(b)	7 days	7 days	7 days	14 days	14 days
2	Report to District Office				
3	7 days	7 days	7 days	14 days	14 days
4	Report to District Office				
5	Report to District Office				
6	Report to District Office				
7	Report to District Office				
8	Report to District Office				
9	7 days	7 days	7 days	14 days	14 days

MQS-103

INTRODUCTION

A surface treated surface consists of one or more applications of asphalt emulsion, followed by the application of aggregate and compaction.

Surface treatments are usually applied to highways which have been primed or surface treated, but can also be applied to hot mix or cold mix surfaces.

Surface treated surfaces shall be inspected and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the surface treated surface and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-103
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Broken-Up Areas**

   Broken-Up Areas are sections where the surface treatment has become severely alligator cracked or potholed.

   Broken-Up Areas that measure $3m^2$ or less shall be repaired within the timeframe specified in Table 103 (defect 1). Areas greater than $3m^2$ shall be Reported to the District Office.

2. **Potholes**

   Potholes are breaks or holes in the surface treated surface.

   Pothole(s) with an area of $0.04m^2$ (i.e. 200mm x 200mm or 100mm x 400mm) or greater or a depth greater than 25mm shall be repaired within the timeframe specified in Table 103 (defect 2).

3. **Distortions**

   Distortions are any deviations of the pavement surface from its original shape. These defects usually take the shape of a bump or depression and are noticeable in a moving vehicle. Bumps or depressions that have a vertical differential of more than 50mm over 3m shall be Reported to the District Office.

4. **Water Ponding**

   Water ponding is the collection of water on the Travelled Portion.
   Ponding caused by high gravel shoulders shall be corrected within the timeframe specified in Table 103 (defect 4). Ponding caused by grade depressions shall be Reported to the District Office.

5. **Corrugations**

   Corrugations are commonly known as “washboarding” and consist of ripples across the surface of the road. Occurrences of corrugations shall be Reported to the District Office.

6. **Soft or Wet Areas**

   Soft or wet areas lack stability due to excess moisture in the subgrade.

   The existence and condition of these areas shall be investigated and Reported to the District Office.

7. **Rocks and Tree Stumps**

   Rocks and tree stumps that protrude through the road surface by more than 25mm shall be removed within the timeframe specified in Table 103 (defect 7).

8. **Polished or Flushed Surfaces**

   A polished surface usually has a glossy appearance and a flushed surface has excess asphalt cement on the surface treated surface. These conditions shall be Reported to the District Office.

9. **Wheel Track Rutting**

   Wheel track rutting is dishing of the surface treated surface in the wheel tracks.

   Occurrences of rutting greater than 25mm deep shall be Reported to the District Office.

10. **Ravelling**

    Ravelling is the progressive loss of aggregate from the surface downward.

    Occurrences of ravelling shall be Reported to the District Office.

11. **Pavement Edge Surface Loss (broken edge of pavement)**

    Pavement edge surface loss is the loss of the surface treated surface adjacent to the gravel Shoulder.

    Pavement edge surface loss which extends more than100mm inward from the edge of the surface treated surface shall be repaired within the timeframes specified in Table 103 (defect 11) to maintain a straight and consistent edge of pavement.

    In addition, pavement edge surface loss extending more than 300mm into the Travelled Portion shall be Reported to the District Office.

TABLE 103

DEFECT	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5
1	NA	NA	7 days	7 days	14 days
2	NA	NA	7 days	7 days	14 days
3	Report to District Office				
4	NA	NA	7 days	14 days	14 days
5	Report to District Office				
6	Report to District Office				
7	NA	NA	14 days	14 days	14 days
8	Report to District Office				
9	Report to District Office				
10	Report to District Office				
11	NA	NA	7 days	7 days	7 days

MQS-104

INTRODUCTION

A gravel surface is constructed with compacted granular material.

Gravel surfaces within the Travelled Portion shall be inspected and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the gravel surface and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-104
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Potholes**

   Potholes are dents or holes in the gravel surface.

   When the frequency or severity of potholes requires the road patroller to reduce their driving speed by more than 10 km/h from the posted speed, potholes shall be repaired within 7 days.

2. **Distortions**

   Distortions are any deviations of the gravel surface from its original profile. These defects usually take the shape of a bump or depression and are noticeable in a moving vehicle.

   When the frequency or severity of a depression requires the road patroller to reduce their driving speed by more than 10 km/h from the posted speed, the bumps or depressions shall be repaired within 7 days.

3. **Corrugations**

   Corrugations are commonly known as “washboarding” and appear as ripples across the gravel surface of the road.

   When the frequency or severity of corrugations requires the road patroller to reduce their speed by more than 10 km/h from the posted speed, the corrugations shall be repaired within 7 days.

4. **Rocks**

   Rocks greater than 100mm shall be removed as Detected.

5. **Soft Areas**

   Soft areas are locations that lack stability usually due to excess moisture in the sub-grade.

   Existence of these areas shall be Reported to the District Office.

6. **Sub-grade or Sub-base Exposure**

   All locations where the sub-grade is exposed shall be Reported to the District Office.

7. **Dusty Conditions**

   Dusty road conditions result from the loss of fine particles from the Roadway and may lead to loss of stability of the Roadway.

   When dusty conditions are Detected, dust suppressant shall be applied within 14 days

8. **Crossfall**

   Crossfall is the transverse slope of the Roadway required to ensure proper surface drainage.

   Crossfall shall be maintained; on tangents from 2-4%, and on superelevations within ± 2% of the applicable OPSS and OPSD specifications.

Note:

No work shall take place within 5m of a railway crossing without approval of the railway authority.

INTRODUCTION

Shoulders give lateral support to the Travelled Portion, accommodate run-off of surface water, and provide an area for traffic to pull off the Travelled Portion. A gravel Shoulder is constructed with compacted granular material.

Gravel Shoulders shall be inspected and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the gravel Shoulder and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-201
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Washouts**

   Washouts are the erosion of gravel materials from the Shoulder.

   Washouts measuring greater than or equal to 1.0m^2 and at least 0.3m deep, or washouts within 1.0m of the pavement that are at least 0.5m^2 and 0.3m deep, shall be Addressed Immediately. Washouts less than 1.0m^2 shall be repaired, within the timeframes specified in Table 201 (defect 1).

2. **Drop-off**

   Drop-off is the condition that exists when the Shoulder material is not flush with the surface level of the edge of pavement.

   Drop-off with a depth exceeding 50mm for a length of at least 100m shall be repaired within the timeframes specified in Table 201 (defect 2) or before the drop-off exceeds 75mm. Drop-off in excess of 75mm at any point shall be Addressed Immediately.

3. **Rocks**

   Rocks greater than 100mm in diameter on the surface of gravel Shoulders shall be removed within the timeframes specified in Table 201 (defect 3).

4. **Ruts**

   Ruts in the gravel Shoulder are generally caused by vehicular tires or heavy objects.

   Repairs to remove ruts deeper than 100mm shall be carried out within the timeframes specified in Table 201 (defect 4).

5. **Soft or Wet Areas**

   Soft or wet areas lack stability, usually due to excess moisture in the subgrade.

   If there is an apparent cause for the wet condition, such as blocked drainage, the blockage shall be removed within the timeframes specified in Table 201 (defect 5).

If the cause is not apparent, such as unsuitable aggregate, or water trapped beneath the road surface, the wet condition shall be Reported to the District Office.

6. **Crossfall**

This is the transverse slope of the Shoulder that is necessary to ensure proper drainage of surface water from the Roadway.

When the Shoulder crossfall is not permitting the proper drainage of water, the Shoulders shall be repaired within the timeframes specified in Table 201 (defect 6). If the Shoulder crossfall differs from the design standard by more than 4% it shall be Reported to the District Office.

7. **Dusty Conditions**

Dusty Shoulder conditions result from the loss of fine particle from the gravel Shoulder and may lead to loss of stability of the Shoulder.

When dusty conditions are Detected, dust suppressant shall be applied within 14 days.

8. **Gravel Windrow/Berm**

Gravel windrows/berms are the build-up of gravel at the outside edge of the shoulder, and at guide rail locations. This build-up is usually the result of shoulder grading operations or winter sand.

Gravel windrows and berms that are preventing the flow of water from the Roadway surface to the adjacent ditch shall be removed within the timeframes specified in Table 201 (defect 8).

Note:

No work shall take place within 5m of a railway crossing without approval from the railway authority.

TABLE 201

DEFECT	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5
1	7 days	7 days	7 days	7 days	7 days
2	7 days	7 days	7 days	7 days	7 days
3	As Detected				
4	14 days	14 days	14 days	14 days	14 days
5	14 days	14 days	14 days	14 days	14 days
6	60 days	60 days	60 days	60 days	60 days
7	14 days				
8	ANNUALLY				

MQS-202

INTRODUCTION

Shoulders give lateral support to the Travelled Portion, allow run-off of surface water and provide an area for traffic to pull off the Travelled Portion. A hard surface Shoulder consists of concrete, asphalt or surface treatment.

Hard surface Shoulders shall be inspected, and action taken to remedy defects according to the following standards. Adherence to these standards will not only keep the hard surface Shoulder and underlying structure in good repair but will also extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-202
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Washouts**

   Washouts are the erosion of Shoulder material.

   Washouts measuring greater than or equal to 1.0m^2 and at least 0.3m deep, or washouts within 1.0m of the pavement that are at least 0.5m^2 and 0.3m deep, shall be Addressed Immediately. Other washouts less than 1.0m^2 shall be repaired in 7 days.

2. **Surface Defects**

   Hard-surfaced Shoulders are prone to the same defects as pavements constructed with similar materials. These defects shall be repaired as per Maintenance Quality Standards: MQS-101, MQS-102 and MQS-103.

MQS-303

INTRODUCTION

Hard Surface Cleaning is the removal and disposal of sand, gravel, and debris from hard surfaces.

This is necessary to maintain skid resistance, minimize dusty conditions, reduce the potential for projectiles and to prevent blockage of storm sewers.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-303
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Spring Cleaning**

   All curb and gutter sections, fully paved Shoulders, Roadways at intersections, patrol yards, commuter parking lots, paved commercial entrances and truck inspection stations shall have sand, gravel and debris removed annually by July 1st.

2. **Sand and Gravel Accumulation**

   Accumulations of sand and gravel shall be removed from the Travelled Portion of hard surfaces as required.

3. **Intersection Cleaning**

   Paved areas at intersections other than the Roadway shall be cleaned of sand, gravel, and debris as required during the summer season.

MQS-305

INTRODUCTION

Fences are barriers constructed to control access to and from MTO-owned facilities. Fences owned by the Ministry are maintained to prevent pedestrians, livestock and unauthorized vehicles from gaining access to the right of way.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-305
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Ministry-Owned Fence**

   a) Where sections of Ministry-owned farm or security fence are damaged and pedestrians, livestock and unauthorized vehicles may access the right of way, temporary repairs shall be made Immediately. In the event that livestock gain entry to the Right-of-Way, the owner of the livestock shall be notified and permanent repairs to the fence shall be completed within 14 days.

   b) Damage to Ministry-owned fences in other areas shall be Reported to the District Office.

2. **Non-Ministry-Owned Fences**

   a) Where sections of non-Ministry-owned farm or security fence are damaged and pedestrians, livestock and unauthorized vehicles may access the right of way, temporary repairs shall be made Immediately by the Ministry. The owner of the fence shall be notified to make permanent repairs.

MQS-320

INTRODUCTION

Weed control is the eradication or control of undesirable herbaceous vegetation (including grass) using integrated vegetation management techniques.

Weeds are controlled or eliminated to improve sight distances, provide an unobstructed view of signs and guideposts, adhere to legislation (Weed Control Act and Regulations), improve the roadside landscape and turf cover, prevent erosion and reduce drainage impairment. In Ministry-designated areas, weeds may be controlled for aesthetic purposes. Weed control is also performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-320
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection when vegetation is actively growing (normally in late summer or early fall) to compile a list of defects by November 1st for next year's work plan.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

Shoulder:

For the purposes of this standard, Shoulder also includes areas containing concrete barriers, guide rail, signposts, curb and gutter, rip rap, slope paving, bullnose areas and portions of rest areas/picnic sites.

1. Weeds shall be controlled before they obscure regulatory signs.

2. Weeds shall be controlled before they impair sight visibility as per Table 320.

TABLE 320

Sight Visibility Table						
Posted Speed (km/h)	50	60	70	80	90	100
Minimum Sight Distance (m) *	110	135	160	185	215	245

* Note: Minimum sight distance means a clear line of vision along the road between the driver's eye (either moving/stationary vehicle) and the object to be seen (either moving/stationary). Eye level is measured at 1.05m above road surface.

3. Noxious weeds identified through a weed control order issued under authority of the Weed Control Act shall be controlled as specified in the control order.

4. Noxious weeds identified by MTO as posing a negative economic impact to the horticultural or agricultural use of adjacent lands shall be Reported to the District Office.

Roadside:

For the purposes of this standard, Roadside also includes vegetated medians, portions of rest areas/picnic sites and other Ministry properties.

1. Weeds shall be controlled before they impair sight visibility as per Table 320.

2. Noxious weeds identified through a weed control order issued under authority of the Weed Control Act shall be controlled as specified in the control order.

3. Noxious weeds identified by MTO as posing a negative economic impact to the horticultural or agricultural use of adjacent lands shall be Reported to the District Office.

4. Weeds impeding drainage or contributing to erosion by destroying desirable groundcovers shall be Reported to the District Office.

5. Weeds interfering with desirable vegetation shall be Reported to the District Office.

INTRODUCTION

Tree control is the removal of trees and stumps to ground level and the trimming or removal of branches. Tree control is performed to provide an unobstructed view of signs, control tree disease, minimize the risk of hazard trees falling onto the Roadway and improve the Roadside landscape.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-321
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. Conditions where trees or branches obscure regulatory signs or impede traffic shall be Addressed Immediately.

2. Trees that impair sight distances set out in Table 321 shall be Reported to the District Office.

TABLE 321

Sight Visibility Table						
Posted Speed (km/h)	50	60	70	80	90	100
Minimum Sight Distance (m) *	110	135	160	185	215	245

* Note: Minimum sight distance means a clear line of vision along the road between the driver's eye (either moving/stationary vehicle) and the object to be seen (either moving/stationary). Eye level is measured at 1.05m above road surface.

3. Dead or diseased trees or branches shall be Reported to the District Office.

INTRODUCTION

Tree and shrub maintenance consists of various activities required to keep planted trees and shrubs healthy. Tree and shrub maintenance ensures that environmental commitments are sustained and is performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-322
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspection to identify additional defects not included in the November list of defects.

DEFECTS

Although plant material defects can occur at any time, tree and shrub maintenance can be divided into an establishment period and a perpetual care period. The following defects shall be noted and action taken according to the following standards:

Establishment Period:

The establishment period is a three-year period directly after planting. A higher level of care is required during this period.

1. Trees and shrubs subjected to drought conditions shall be watered before symptoms of drought stress are visible.

2. Trees and shrubs showing inadequate annual growth, poor colour and/or brittleness shall be fertilized in May and June.

3. Weed and grass growth exceeding 35% of the area cover in areas mulched with wood chips shall be eradicated within 30 days.

4. Susceptible trees and shrubs in rodent-prone areas shall be protected from rodent damage before the winter maintenance season commences.

5. Dead, broken, diseased or damaged limbs and branches on trees and shrubs shall be pruned within 30 days.

6. Trees and shrubs showing evidence of pests or disease shall be treated with the appropriate control within 30 days.

7. Trees improperly supported by stakes or guy wires shall be re-staked or re-guyed in accordance with the original design specification within 30 days.

8. Inadequate mulch cover shall be re-applied in accordance with the original design specification within 30 days.

9. Dead or dying trees and shrubs shall be replaced in next year's work plan.

Perpetual Care Period:

The perpetual care period begins after the establishment period and extends for the life of the plant and requires a reduced level of care. The following defects shall be Reported to the District Office:

1. Susceptible trees and shrubs which are in rodent-prone areas;

2. Trees and shrubs damaged by rodents;

3. Dead trees and shrubs in snow hedges;

4. Dead, broken, diseased or damaged limbs and branches on trees and shrubs; and

5. Trees and shrubs showing evidence of pests or disease.

INTRODUCTION

Ground cover rehabilitation consists of re-establishing desirable vegetation in areas where the existing ground cover has died or been removed. Desirable ground covers need to be re-established to reduce erosion potential, satisfy environmental commitments and extend the life and investment of the infrastructure.

Desirable ground covers include, but are not limited to, turfgrasses, wildflowers, prairie grasses and legumes.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-323
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office.

1. Desirable ground cover removed or destroyed and producing a negative environmental effect or Highway infrastructure impact (i.e. the loss of ground cover on a slope adjacent to a watercourse) shall be re-established within 45 days.

2. Desirable ground cover removed or destroyed with no direct negative environmental effect or Highway infrastructure impact (i.e. the loss of ground cover on a median area) shall be Reported to the District Office.

MQS-324

INTRODUCTION

Brush control is the eradication or control of undesirable, naturalized woody vegetation using integrated vegetation management techniques.

Brush is controlled to improve sight distances, provide an unobstructed view of signs, guideposts and animals venturing onto the Roadway, maximize winter sunlight penetration onto the Travelled Portion, improve the Roadside landscape, reduce drainage impairment and prevent erosion. In Ministry-designated areas, brush may be controlled for aesthetic purposes. Brush control is also performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-324
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection when brush is actively growing (normally in late summer or early fall) and a list of defects compiled by November 1st for next year's work plan.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

Shoulder:

For the purposes of this standard, Shoulder also includes areas containing concrete barriers, guide rail, signposts, curb and gutter, rip rap, slope paving, bullnose areas and portions of rest areas/picnic sites.

BRUSH CONTROL

1. Brush shall be controlled before it obscures regulatory signs.

2. Brush shall be controlled before it impairs sight visibility as per Table 324.

TABLE 324

Sight Visibility Table						
Posted Speed (km/h)	50	60	70	80	90	100
Minimum Sight Distance (m) *	110	135	160	185	215	245

* Note: Minimum sight distance means a clear line of vision along the road between the driver's eye (either moving/stationary vehicle) and the object to be seen (either moving/stationary). Eye level is measured at 1.05m above road surface.

3. All other brush of concern shall be Reported to the District Office.

Roadside:

For the purposes of this standard, Roadside also includes vegetated medians and portions of rest areas/picnic sites.

1. Brush shall be controlled before it impairs sight visibility as per Table 324.

2. Brush impeding drainage or contributing to erosion by destroying desirable groundcovers shall be Reported to the District Office.

3. Brush interfering with desirable vegetation shall be Reported to the District Office.

MQS-325

INTRODUCTION

Rest area/picnic site maintenance consists of activities to keep rest areas and picnic sites functional, neat, clean and hygienic for use by the travelling public. Rest areas/picnic sites shall be maintained to applicable health and safety standards. Rest area/picnic site maintenance is also performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-102, 103, 104, 305, 320, 321, 322, 323, 324, 326, 331, 601, 604, 661 and 662
- Maintenance Manual - Maintenance Best Practice MBP-325
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General inspections five times per week during the operating season unless more frequent inspections are required to meet this standard. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. A detailed inspection in early spring to identify additional defects not included in the November list of defects, which require action before the facility can be opened.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

Preparation for Seasonal Opening

Rest areas/picnic sites are closed and not operational for the winter season.

1. Rest areas/picnic sites shall be opened in accordance with local District practice but not later than May 15.

2. Rest areas/picnic sites shall be fully functional, safe, clean and hygienic for season opening.

3. Drinking water shall be tested, and if applicable posted, in accordance with Ministry and provincial guidelines and regulations.

Operating Season

During the operating season, the following maintenance activities shall be undertaken:

1. Privy holding tanks shall be chemically treated weekly to minimize accumulation and odour. Tanks shall be emptied when 75% full.

2. Debris and litter shall be collected and removed from the site when Detected. Waste receptacles shall be emptied as required to maintain adequate waste storage capacity and a clean appearance.

3. Washroom facilities shall be maintained clean, hygienic and adequately stocked with toilet paper, paper towels and hand soap.

4. Damaged washroom facilities, pumps or drinking fountains shall be repaired within 7 days.

5. Drinking water shall be tested, and if applicable posted, in accordance with Ministry and provincial guidelines and regulations.

6. Graffiti shall be Reported to the District Office.

7. Defects in roadways, parking areas, roadway markings, guide rail systems, signs and fencing shall be Reported to the District Office.

8. Turfgrass shall be mowed and trimmed to a height of 50mm within 5 days of reaching a height of 100mm.

9. Desirable vegetation shall be maintained in a healthy condition.

10. Undesirable, dead or diseased vegetation shall be Reported to the District Office.

11. Noxious weeds shall be controlled as per MQS-320.

Preparation for Seasonal Closing

Rest areas/picnic sites are closed and not operational for the winter season.

1. Rest areas/picnic sites shall be closed for the winter season in accordance with local District practice but not earlier than October 15. Seasonal closing shall be completed prior to air temperatures reaching 0°C.

Note:
Rest areas/picnic sites equipped with electrical power, pressurized water systems, septic tank and distributor systems or composting waste facilities require a higher level of treatment for opening and closing procedures. Refer to the appropriate operations manuals for each site.

MQS-326

INTRODUCTION

Grass control is the reduction in the growth of grass by mowing and trimming operations.

Grass control is used to improve sight distances and provide an unobstructed view of signs, improve the Roadside landscape, control noxious weeds (Weed Control Act and Regulations), improve turf cover and reduce drainage impairment. In Ministry-designated areas, grass may be mowed and trimmed for aesthetic purposes. Grass control is also performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-326
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection when vegetation is actively growing (normally in late summer and early fall) and a list of defects compiled by November 1st for the next year's work plan.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below are to be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

Shoulder:

For the purposes of this standard, Shoulder also includes areas containing concrete barriers, guide rail, signposts, curb and gutter, rip rap, slope paving, bullnose areas and portions of rest areas/picnic sites.

1. Grass shall be controlled before it obscures regulatory signs or impairs sight visibility as per Table 326.

TABLE 326

Sight Visibility Table						
Posted Speed (km/h)	50	60	70	80	90	100
Minimum Sight Distance (m) *	110	135	160	185	215	245

* Note: Minimum sight distance means a clear line of vision along the road between the driver's eye (either moving/stationary vehicle) and the object to be seen (either moving/stationary). Eye level is measured at 1.05m above road surface.

Roadside:

For the purposes of this standard, Roadside also includes vegetated medians.

1. Grass shall be mowed and trimmed to a height of 200mm before it impairs sight visibility as per Table 326.

2. When vegetation within 2m of the outside edge of any Shoulder edge reaches 500mm in height, it shall be mowed and trimmed to a height of 200mm for 1 mowing swath width from the outside edge of each Shoulder within 21 days.

3. Grass impeding drainage or contributing to erosion by destroying desirable groundcovers shall be Reported to the District Office.

4. When grass has reached a height of 500mm at Ministry-designated areas, it shall be mowed and trimmed to a height of 200mm within 14 days.

5. Grass interfering with naturalization objectives shall be Reported to the District Office.

MQS-331

INTRODUCTION

Debris control involves the collection and removal of debris from the Highway. Debris consists of, but is not limited to, items such as, rubbish, dead animals, batteries, tires, unlabelled containers and rocks.

The removal of debris is required to prevent damage to vehicles, equipment and property, and to manage environmental, commercial, residential and tourism concerns.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-331
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. Debris on the Travelled Portion of the Roadway shall be removed as Detected.

2. Debris less than 100mm in diameter on the Shoulder shall be removed within 48 hours.

3. Debris greater than 100mm in diameter on the Shoulder shall be removed as Detected.

4. Items within the Highway that may have an impact on public health and environmental safety shall be Addressed Immediately.

5. Debris which is greater than $0.015m^3$ (e.g.: 25cm x 25cm x 25cm) within the Roadside shall be removed within 7 days.

INTRODUCTION

Road patrol is the inspection of the Highway and other Ministry property to identify conditions which may adversely affect the condition of the Highway, the adjacent property and the environment, and to ensure adherence to the Maintenance Quality Standards and policies.

Observations during road patrol permit the proper management and appropriate scheduling of work required to satisfy the Maintenance Quality Standards and extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - All Maintenance Quality Standards
- Maintenance Manual - All Maintenance Best Practices
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Other than during the winter season, road patrols shall be carried out as follows:

Highway Class	Minimum Frequency per Week
1	5 times*
2 and 3	3 times
4 and 5	2 times

*4 times during weeks that include a statutory holiday

In addition to the above stated frequencies, road patrols may be required to cover the following situations:

a) sections of highways experiencing high rates of vandalism;
b) unique, unusual situations such as special events, truck routes;
c) during spring break-ups on highways subject to spring load restrictions;
d) during and after heavy wind or rain events; and
e) emergency call-outs.

All road patrols, road patrol observations and actions taken shall be documented in the Patrol Supervisor's Diary.

QUALITY STANDARD

The following conditions shall be noted and action taken according to the following standards. Other conditions not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Maintenance Quality Standards**

   During road patrolling, defects outlined in the MQS's shall be identified and actions taken in accordance with the MQS's.

2. **Dangerous Goods Vehicle Accidents and Leaks/Spills of Unidentified Materials**

   The primary responsibility for containment, clean up and disposal of spilled material rests with the owner/person having control of the product at the time of the spill.

   The patroller shall be responsible to perform all actions identified in the MTO Interpretative Bulletin "Patrol Response to Non-MTO Spills".

3. **Corridor Control Permits**

   All signs, structures, facilities, activities and vegetation requiring a permit from the Ministry pursuant to the Public Transportation and Highway Improvement Act (PTHIA) shall be monitored to ensure there is a valid permit and the work satisfies the requirements of the permit.

   Any violation shall be Reported to the District Office and the Regional Corridor Management Office. Work being carried out within the Highway by non-Ministry personnel shall be monitored to ensure there is a valid permit and the work satisfies the requirements of the permit. Where work is being done upon the Roadway by a permit holder or authorized utility company, the permit holder or utility company is responsible for all measures required to ensure the safety and control of the travelling public. These measures are set out in the Ontario Traffic Manual (OTM).

   For activities within the Highway requiring a permit, where suitable environmental protection measures are not in place and functioning to prevent the release of contaminated material, the patroller shall Immediately advise the supervisor of the operation and Report the situation to the District Office. If the problem is not Addressed Immediately the operation shall be shut down.

   All unauthorized work within the Highway shall be stopped Immediately.

4. **Unauthorized Signs/Graffiti**

   "Tack" signs (signs tacked to M.T.O. signs) or other forms of unauthorized advertising attached to property or set up within the Highway shall be removed and disposed of properly. Graffiti within the Highway shall be Reported to the District Office.

5. **Authorized Signs**

   Election signs and Canadian Forces Convoy Route markers may be permitted on the Highway under specific conditions. These conditions are outlined in the "Corridor Control and Permits Procedures Manual".

   Special signs may be allowed through permission from the Ministry. The District Office shall have copies of sign permits covering the approval.

6. **Contaminated Property**

   The location and description of any evidence of contaminated property (e.g.: staining on the surface of the ground) shall be Reported to the District Office.

7. **Road Closures**

   The patroller shall contact Central Dispatch regarding all road closures.

MQS-396

INTRODUCTION

Facilities consist of patrol yards, sub-yards and all associated structures where maintenance equipment and materials are stored and maintenance operations are headquartered.

Maintenance operations are to be performed to extend the life and investment of the facilities.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-396
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out and documented as follows:

1. Monthly visual inspections of the grounds, garage/office and storage structures.

2. A detailed annual inspection of the grounds, garage/office and storage structures by a qualified person. A qualified person is defined as a person with valid credentials relating to the structure or component.

3. Additional inspections shall be performed by a qualified person (as defined above in item 2.) under the following conditions:

   a) Accident or vehicle collision with structure
   b) Unusual/severe weather conditions or natural disasters
   c) Where structural integrity or safety issue is suspected.

DEFECTS

All defects shall be identified, recorded on an inspection form and Reported to the District Office**.** The following conditions shall be noted and action taken according to the following standards. **All conditions that are causing a Hazard shall be Addressed Immediately.**

MAINTENANCE

1. Heating/cooling system shall be serviced annually by a qualified service person.

2. Overhead doors shall be serviced annually.

3. All floor drains shall be cleaned monthly or as required during winter operations.

4. The septic tank shall be pumped out at least once every 5 years.

5. Oil/Water separators shall be maintained as per the MTO “Oil/Water Separator Interim Field Guide for Patrol Yards, Working Draft”.

6. Waste oil storage tanks shall be pumped out as required according to usage.

7. Safety routes shall be kept clear and fire extinguishers inspected on a monthly basis.

8. Damage to a framing member or the outer skin (i.e.: plywood, shingles, fabric) shall be Addressed Immediately.

9. All material and fuel storage containers shall be installed and maintained in accordance with Federal and Provincial legislation.

MQS-501

INTRODUCTION

A ditch is an open drainage facility constructed to carry water to an outlet.

Ditches are maintained to accommodate the flow of sub-grade and surface water to an outlet. Maintenance operations are performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-501
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard or damage to other properties shall be Addressed Immediately.**

1. **Obstructions**

   All non-planned obstructions that are stopping, rerouting or reducing the free flow of water and may cause flooding shall be Addressed Immediately.

2. **Ditch Erosion**

a) Damage to ditch lining, if the threat of erosion exists, shall be repaired or controlled within 60 days.

b) Eroded or damaged ditch side-slopes, back-slopes and slope protection shall be repaired within 60 days.

MQS-502

INTRODUCTION

A culvert is a drainage structure designed to allow the passage of surface water under a Roadway, railway or roadside entrance.

Maintenance operations are performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-502
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection of all centre-line and entrance culverts annually and a list of defects compiled by November 1st for the next year's work plan. For culverts with a diameter greater than 700mm inspections shall be recorded on an inspection form and submitted to the District Office.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Concrete Culverts**

   a) Debris and/or other material which is restricting water flow in a culvert shall be removed within 30 days.

   b) The loss or displacement of hand-laid and grouted rip-rap shall be Reported to the District Office.

   c) Scouring around the footings or any undermining of concrete aprons or cut-offs shall be Reported to the District Office.

   d) The condition where the stream bed at a box-culvert (open-footing construction) is found to be lower than the bottom of the culvert (footing) shall be Reported to the District Office.

   e) Washouts or erosion of culvert backfill, which may damage the culvert causing settlement or cracking, shall be repaired within 30 days.

   f) Exposed reinforcing steel shall be Reported to the District Office.

   g) Visible cracks and other evidence of deterioration of the concrete shall be Reported to the District Office.

   h) Broken or damaged bars or grids which have been installed to prevent entry by unauthorized personnel shall be replaced within 14 days. Culvert inlets with bars and grids installed shall be inspected monthly and after severe storms to ensure that debris does not accumulate and cause blockage.

   i) Scouring at inlets or outlets shall be Reported to the District Office.

2. **Metal Culverts/Corrugated Steel Pipe (CSP)**

   a) Debris and/or other material which is restricting water flow in a culvert shall be removed within 30 days.

   b) Deformed ends preventing the free flow of drainage shall be repaired within 30 days.

   c) The loss or displacement of hand-laid and grouted rip-rap shall be Reported to the District Office.

   d) Headwall movement away from the culvert shall be Reported to the District Office.

e) Erosion under or around metal culverts and any change in the shape of culverts over 700mm in diameter shall be Reported to the District Office.

f) Scouring at inlets, outlets or around footings shall be Reported to the District Office.

g) Signs of pipe uplift at inlet or outlet ends shall be Reported to the District Office.

h) Culvert corrosion shall be Reported to the District Office.

3. **Timber Culverts**

a) Debris and/or other material which is restricting water flow in a culvert shall be removed within 30 days.

b) Washouts or erosion under or around the culvert shall be repaired within 30 days.

c) Granular material at the bottom of the culvert which is not level with the sills shall be Reported to the District Office.

d) Bowed centre supports, displaced timbers, and unsound wood shall be Immediately Reported to the District Office.

4. **Plastic Culverts**

a) Debris and/or other material which is restricting water flow in a culvert shall be removed within 30 days.

b) The loss or displacement of hand-laid or grouted rip-rap shall be Reported to the District Office.

c) Erosion of culvert backfill, which may damage the culvert and cause settlement, shall be repaired within 30 days.

d) Signs of pipe ends that are uplifting shall be Reported to the District Office.

e) Deformed ends preventing the free flow of drainage shall be repaired within 30 days.

MQS-503

INTRODUCTION

A curb and gutter is a concrete or asphalt drainage system constructed for the purpose of carrying surface water.

Curbs and gutters are maintained to accommodate efficient drainage of pavement surface water accumulations and to protect side slopes from erosion resulting from unconstrained water spilling over Shoulders and embankments.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-503
- Maintenance Manual - Maintenance Quality Standard MQS-320
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Curb and Gutter**

   Gaps of 50mm or wider between curb and gutter and pavement surface shall be repaired within 30 days. Obstructions which could impede proper drainage shall be removed as Detected.

2. **Erosion**

   Shoulder and embankment areas behind the curb and gutter shall be inspected for erosion and restored to their original profiles by October 1st.

3. **Settlement**

   Settlement around maintenance access points, catchbasins and structure approaches shall be Reported to the District Office.

4. **Vegetation**

   Vegetation impeding drainage shall be Reported to the District Office.

MAINTENANCE QUALITY STANDARD
CATCHBASINS, MAINTENANCE ACCESS POINTS, DITCH INLETS & OUTFALLS

MQS-504

INTRODUCTION

A catchbasin is a receptacle or container to collect surface water and divert it to an underground drainage system.

A drainage maintenance access point (manhole) is a structure having an opening to provide access to underground drainage systems.

A ditch inlet is a structure having an opening to allow run-off from a ditch to be carried to an underground drainage system.

An outfall structure is an end treatment, rip rap or gabion, constructed at a pipe outlet from a storm sewer system, for the purpose of providing a transition between the pipe outlet and a watercourse preventing erosion at the outlet or in the outfall channel.

Catchbasins, drainage maintenance access points, ditch inlets and outfalls are maintained to provide efficient underground drainage of pavement surface water and subdrain accumulations. These drainage systems protect side slopes by carrying water in urban areas or on narrow Highways. Failure to provide free flowing drainage could cause flooding or Roadway subgrade failures.

Maintenance access points, within the Highway, may also be provided for electrical and other utilities.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-503
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection during the cleaning operation and a list of defects compiled by November 1st for the next year's work plan. An inspection form shall be used to record defects identified through detailed inspections.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Cleaning and Obstructions**

   All debris shall be removed from the maintenance access points, catchbasins, ditch inlets and outfalls such that the sump shall never be filled to capacity with debris and/or other material. If the water flow appears to be obstructed, the connecting pipes shall be inspected and impediments removed.

2. **Structure**

   a) All defects in concrete work, all ladder rungs that are broken, missing or badly rusted, and bricking that is crumbling or broken shall be Reported to the District Office.

   b) All missing frames or grates shall be replaced Immediately. All damaged frames and grates shall be replaced within 7 days.

3. **Settlement**

   Depressions and heaving around catchbasins and maintenance access points shall be Reported to the District Office.

4. **Erosion**

   a) Undermining of the sewer outfall structure or bank erosion of the outfall channel shall be Reported to the District Office.

   b) Ditch or stream outfall discharge erosion shall be Reported to the District Office. Erosion repairs and obstruction removal at the stream outfall and ditch, that are reducing the flow capacity, shall be completed by October 1st.

INTRODUCTION

Subdrains are perforated pipes placed in the sub-grade adjacent to or underneath the pavement edge to intercept and collect subgrade water. This water is then discharged into side ditches or other drainage structures.

Subdrain system maintenance is performed to ensure efficient outlet of underground drainage moisture to prevent Roadway subgrade failure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-502
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards during the spring inspection. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Obstructions**

   a) All obstructions that are impeding the flow shall be removed within 30 days.

   b) Missing rodent screens shall be replaced within 60 days.

   c) Buried outlets shall be uncovered by November 1st.

2. **Damage**

   Pipe ends that have been crushed shall be repaired within 30 days.

3. **Settlement**

   Depressions along the subdrain alignment, which may indicate a failure of the pipe, shall be Reported to the District Office.

MQS-551

INTRODUCTION

A bridge is a structure that provides a passageway for vehicles, pedestrians and/or cyclists across an obstruction, gap or facility and that is greater than 3m in span.

Observations made during bridge inspections permit the proper maintenance and appropriate scheduling of work to extend the life and investment of the infrastructure.

This Maintenance Quality Standard does not apply to modular bridges. For modular bridges refer to MQS-558.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-551
- Ontario Structure Inspection Manual (OSIM)
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A maintenance inspection on every structure annually by a qualified person. A qualified person is a person with knowledge of structure maintenance practices and the ability to identify structure defects gained through a minimum of 3 years experience relating to inspection of Highway structures. Inspections shall be recorded on the Bridge Maintenance Inspection Form and submitted to the District Office.

3. A walk-about inspection in the spring and fall to identify erosion problems, obstruction to waterflow, and other general defects.

4. Additional inspection of a structure by a qualified person (as defined in item 2 above) under the following conditions:

    a) accident or vehicle collision with structure;
    b) unusual/severe weather conditions or natural disasters;
    c) where a structural integrity or safety issue is suspected; and/or
    d) flooding/ice jams.

DEFECTS

All defects shall be identified and noted on the Bridge Maintenance Inspection Form. Photographs shall be taken of defects where it is suspected that the defect may compromise structural integrity or safety. Photographs shall be included with the Bridge Maintenance Inspection Form. **All conditions that are causing a Hazard shall be Addressed Immediately.**

Bridge Maintenance Inspection Form

Date_____ **Hwy.**_____ **Location**_____

Inspected by:_____

Structure Identification:

Name	**Site Number**
Type	**Number of Spans**
Length	**Width**

DEFECT	OBSERVED		
Travelled Surface	Yes	No	Maintenance Required/Comments
Cracking			
Spalling, Delamination, Ravelling			
Potholes			
Other			

DEFECT	OBSERVED		
Drainage	Yes	No	Maintenance Required/Comments
Broken, Damaged Components			
Obstructions			
Other			

DEFECT	OBSERVED		
Expansion Joints	Yes	No	Maintenance Required/Comments
Leaking or Damaged Seal			
Joint Armour Broken, Damaged			
End Dams Breaking			
Other			

DEFECT	OBSERVED		
Curbs, Sidewalks, Barrier Walls	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scaled			
Spalled			
Other			

Bridge Maintenance Inspection Form

DEFECT	OBSERVED		
Handrails & Posts	Yes	No	Maintenance Required/Comments
Bent, Broken, Missing			
Corroded			
Loose, Missing Fasteners			
Other			

DEFECT	OBSERVED		
Approaches	Yes	No	Maintenance Required/Comments
Settled			
Potholes			
Cracked			
Other			

DEFECT	OBSERVED		
Lighting/Signs/Guide Rail	Yes	No	Maintenance Required/Comments
Missing Components			
Damaged			
Other			

DEFECT	OBSERVED		
Timber	Yes	No	Maintenance Required/Comments
Cracked			
Broken			
Insects or Rot			
Other			

DEFECT	OBSERVED		
Girders/Beams/Diaphragms	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Corroded			
Spalled			
Other			

Bridge Maintenance Inspection Form

DEFECT	OBSERVED		
Steel Members	Yes	No	Maintenance Required/Comments
Corroded			
Cracked			
Bent, Broken, Twisted			
Other			

DEFECT	OBSERVED		
Bearings	Yes	No	Maintenance Required/Comments
Cracked			
Aligned			
Corroded			
Seized			
Other			

DEFECT	OBSERVED		
Slopes & Embankments	Yes	No	Maintenance Required/Comments
Erosion			
Undermining			
Slope Paving Damage			
Other			

DEFECT	OBSERVED		
Brush/Trees	Yes	No	Maintenance Required/Comments
Growth			
Obstruction to Drainage			
Other			

Sub-Structure

DEFECT	OBSERVED		
Piers	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Spalled			
Other			

Bridge Maintenance Inspection Form

DEFECT	OBSERVED		
Piles	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Settled			
Scoured			
Spalled			
Other			

DEFECT	OBSERVED		
Abutments	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scaling			
Spalled			
Other			

DEFECT	OBSERVED		
Ballast Walls	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scaling			
Spalled			
Other			

DEFECT	OBSERVED		
Wing Walls	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scaling			
Spalled			
Other			

Bridge Maintenance Inspection Form

DEFECT	OBSERVED		
Retaining Walls	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scaled			
Spalled			
Other			

DEFECT	OBSERVED		
Footings	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Scoured			
Spalled			
Other			

DEFECT	OBSERVED		
Soffit/Fascia	Yes	No	Maintenance Required/Comments
Cracked			
Delaminated			
Spalled			
Other			

Bridge Maintenance Inspection Form

Other Findings:

Recommended Repairs:

MQS-552

INTRODUCTION

Structure cleaning is the removal of dirt and debris, including sand, salt residue and other de-icing chemicals from structure and sign support components.

Structure cleaning is performed to ensure components function as designed and to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-552
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

N/A

DEFECTS

All structures shall be washed prior to June 30th.

Components that require a scaffold, a boat or a large bucket truck to gain access to the components, are exempt from this standard.

The following surfaces shall be cleaned of all dirt and debris and washed with water to remove the remaining de-icing chemicals and winter abrasives:

1. Decks, sidewalks, hand rails, curbs, gutters and barrier walls.

2. Abutments and pier columns/caps below expansion joints, abutment and retaining walls, columns and piers within 5m of the edge of a Roadway to a minimum height of 3m above the surface.

3. All associated drainage structures, including scuppers, drain troughs, drain pipes and flumes.

4. The approaches to the structure and all associated bridge elements for a minimum distance of 6m as measured from the abutment joint or the first catch basin thereafter.

5. Expansion joints and deck joints including troughs and seals.

6. The surface of light standards and sign supports attached to the structure to a height of 3m above deck level and facing the Roadway.

7. Concrete slope protection.

8. Bottom truss chords throughout their entire length and the vertical and diagonal members which connect to the bottom chord to a height of 3m above the deck level.

9. All readily accessible steel components and bearing bases of modular bridges.

MQS-553

INTRODUCTION

The surface of the structure is the wearing surface used by vehicles and pedestrians to travel over a structure and includes curbs, gutters, sidewalks and approach slabs.

Adherence to these standards will extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-553
- Maintenance Manual - Maintenance Quality Standards MQS-101,102 and 551
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as per MQS-551.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Asphalt/Concrete Surfaces**

   Asphalt/concrete surfaces shall be repaired as per MQS-101 and MQS-102, unless specified below:

   a) **Potholes**
   Potholes in concrete surface exceeding 20mm in depth shall be repaired within 3 days.

   b) **Cracking**
   Cracks in asphalt wider than 25mm shall be repaired within 14 days.
   Cracks in concrete wider than 6mm shall be Reported to District Office.

   c) **Distortion**
   A sharp vertical displacement of more than 20mm, or settlement of the approach slab by more than 100mm, shall be signed upon Detection and Reported to the District Office.

2. **Timber Deck Surface**

   a) **Loose planks**
   Loose planks shall be secured Immediately.

   b) **Damaged planks**
   Broken, burnt, worn, rotted, crushed, checked, split, or cracked planks shall be Reported to the District Office.

   c) **Missing planks**
   Missing planks shall be replaced Immediately.

MAINTENANCE QUALITY STANDARD
OBSTRUCTION TO WATERFLOW AT BRIDGES

MQS-555

INTRODUCTION

Most rivers and streams carry logs, trees, ice and other debris. Debris carried by a river tends to catch on bridge piers/piles/abutments in or adjacent to the watercourse.

Clearing of obstructions is required to ensure unrestricted waterflow to prevent upstream/downstream flooding and erosion, and to eliminate stress to piers, piles, abutments, and other substructure components. Maintenance operations are performed to extend the life and investment of the infrastructure.

REFERENCES

- Maintenance Manual - Maintenance Best Practices MBP-555 & MBP-557
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. Where flooding and erosion are evident or it is suspected that debris is causing distress to the bridge.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed shall be Reported to the District Office. **All conditions that are causing a Hazard or damage to other properties shall be Addressed Immediately.**

Logs, Trees, Ice and Other Debris

1. Logs, trees, ice and other debris shall be removed after high water event levels have returned to normal depths.

2. Where accumulation of debris or ice causes flooding, erosion or distress to the structure, the obstruction shall be removed Immediately and Reported to the District Office.

3. To ensure unrestricted water flow when entering the winter season, accumulations of logs, trees and other debris shall be removed prior to Oct. 15th.

INTRODUCTION

Structure deck joint systems and bearings are critical components that allow controlled movement of the deck under live loading as well as thermal expansion and contraction.

Properly maintained expansion joints will permit the structure to expand and contract. Most expansion joints are designed to prevent moisture, de-icing salt and debris from damaging the underlying bridge components.

Bearings are maintained in order to ensure that the superstructure can undergo the necessary movements without developing damaging stresses, maintain load carrying capacity and to extend bearing life.

REFERENCES:

- Maintenance Manual - Maintenance Best Practice MBP-556
- Ontario Structure Inspection Manual (OSIM)
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as per MQS-551.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately** and Reported to the District Office.

1. **Expansion Joints**

   a) **Broken, Missing, Loose Clamping Bolts**
   Broken and missing bolts shall be replaced and loose bolts tightened within 5 days of Detection.

   b) **Leaking Joint Seals**
   Defective joint seals shall be repaired or replaced before December 1st.

c) **Damaged Steel Components**
Broken, cracked or missing steel components shall be Reported to the District Office.

d) **Cleaning of Non-Compressible Joints**
Debris shall be removed from joints upon Detection.

e) **Voids Under Joint Armour**
Voids under joint armour shall be monitored and Reported to the District Office.

f) **Damaged End Dams**
Damaged end dams shall be monitored and Reported to the District Office.

g) **Misalignment**
Misalignment shall be monitored and Reported to the District Office.

2. **Bearings**

a) **Seized Bearings**
Seized bearings shall be Reported to the District Office.

b) **Accumulation of Debris**
Accumulations that restrict the movement of the bearing shall be removed as per MQS-552.

c) **Damaged Bearing Seats**
Spalled, cracked or deteriorated bearing seats shall be monitored and Reported to the District Office.

d) **Missing or Damaged Components**
Missing or damaged components shall be Immediately Reported to the District Office.

e) **Misalignment**
Misalignment shall be Immediately Reported to the District Office.

MQS-557

INTRODUCTION

Erosion control at bridges/structures is required to address the incremental disappearance of soil around structures caused by run-off conditions or the sudden removal of soil caused by flood, fast run-off or progressive seepage at or around structures.

REFERENCES:

- Maintenance Manual - Maintenance Best Practice MBP-557
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as per MQS-551.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Washouts of shoulders at ends of wingwalls**

   Washouts shall be filled and water channelled away from the structure area as per MQS-201.

2. **Washouts or erosion at deck drain outlets**

   Washouts shall be filled within 30 days of Detection.

3. **Slope failure**

   Slope failures shall be Reported to the District Office.

4. **Undermining of piers and abutments**

   Undermining of piers and abutments shall be Immediately Reported to the District Office.

MQS-558

INTRODUCTION

Modular bridges are component-type bridges which are made up of a number of standard parts. These bridges can be assembled readily, on location, to provide an economical crossing.

Modular bridge maintenance is necessary to ensure structural integrity and minimize wear and tear of components.

REFERENCES:

- Maintenance Manual - Maintenance Best Practice MBP-558
- Ontario Structure Inspection Manual (OSIM)
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A monthly walk-about inspection to ensure that there are no damaged, missing or loose components.

3. A maintenance inspection on every modular bridge annually by a qualified person. A qualified person is a person with knowledge of modular bridge maintenance practices and the ability to detect structure defects gained through a minimum of 3 years experience relating to inspection of modular bridges. The Modular Bridge Maintenance Inspection Form shall be used to record inspection information and shall be submitted to the District Office.

4. Additional inspection of a modular bridge shall be performed by a qualified person (as defined in item 3 above) under the following conditions:

   a) accident or vehicle collision with structure;
   b) unusual/severe weather conditions or natural disasters;
   c) where a structural integrity or safety issue is suspected; and/or
   d) flooding/ice jams.

MODULAR BRIDGES

DEFECTS

The following defects shall be noted on the Modular Bridge Maintenance Inspection Form and action taken according to the following standards. Photographs shall be taken of defects where it is suspected that the defect may compromise structural integrity or safety. Photographs shall be included with the Bridge Maintenance Inspection Form. Other defects not listed below shall be Reported to the District Office**. All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Loose wear deck planking**
   Loose deck planks shall be nailed tightly to chesses Immediately.

2. **Badly split, rotted or broken wear deck planking**
   Badly split, rotted or broken deck planks shall be Immediately replaced.

3. **Rotted or broken curb timbers**
   Rotted or broken curb timbers shall be replaced within 30 days.

4. **Loose sway bracing**
   Within 30 days of Detection, loose sway bracing shall be tightened snug to the gauging block in each unit and locked tight with a lock nut. Loose sway bracing that cannot be tightened shall be noted and replaced within 30 days.

5. **Loose transom clamps and handles**
   Clamps shall be hand tightened snug to the top surface of each transom and handles shall be tied to the adjacent panel to eliminate movement. Screws holding down transoms shall be tightened snug Immediately.

6. **Broken transom clamp seatings**
   Broken transom clamp seatings shall be Immediately Reported to the District Office.

7. **Loose raker, bracing frame and chord bolts**
   Loose raker, bracing frame and chord bolts shall be tightened within 5 days.

8. **Bent, buckled, damaged or missing components**
   Bent, buckled, damaged or missing components shall be Immediately Reported to the District Office.

9. **Differential settlement of bearings or bearing base plates**
   Differential settlement of bearings or bearing base plates shall be repaired within 15 days.

10. **Settled ramp ends**
    Settled ramp ends shall be corrected within 30 days.

11. **Misaligned steel angle curbs**
    Misaligned steel angle curbs shall be realigned within 15 days.

12. **Loose timber supports under the centre of the end transoms**
    Loose timber supports under the centre of the end transoms shall be re-adjusted, shimmed or replaced Immediately to ensure proper support.

13. **Missing nails or clips from the safety pin in any panel**
    Missing nails or clips from the safety pin in any panel shall be replaced Immediately.
    .

14. **Nails protruding from deck surface**
    Nails protruding from deck surface shall be hammered into the planking Immediately.

15. **Wood Decks**
    Decking with wheel rutting exceeding 25mm in depth shall be Reported to the District Office.

16. **Damaged side panel guide rail**
    Damaged side panel guide rail components shall be replaced within 30 days.

17. **Panel Pins**
    Protruding panel pins shall be reset, and missing panel pins shall be replaced, Immediately.

Modular Bridge Maintenance Inspection Form

Structure Identification				
Name:		**Highway Number:**		**Location:**
Site Number:		**Structure Type:**		
Span(s):	**1.**	**2.**	**3.**	**4.**
Overall Length:		**Width:**	**Sag at centre of span:**	
Weather Conditions:		**Temp:** °C	**Wind:**	

DEFECT	OBSERVED		MAINTENANCE REQUIRED/COMMENTS
	Yes	No	
Approaches			
Pot-holed			
Poor Alignment			
Wrong Elevation			
Other			
Signing			
Incorrect			
Missing			
Damaged			
Panels			
Bent/Damaged			
Corroded			
Transom Seating Broken			
Panel Pins			
Missing			
Corroded			
Protruding			
Missing Security Nail			
End Posts, (Male)			
Bent/Damaged			
Corroded			
End Posts, (Female)			
Bent/Damaged			
Corroded			
Bracing Frames			
Bent/Damaged			
Corroded			
Loose			
Rakers			
Bent/Damaged			
Corroded			
Loose			

Modular Bridge Maintenance Inspection Form

DEFECT	OBSERVED		MAINTENANCE REQUIRED/COMMENTS
	Yes	No	
Chord Reinforcing			
Bent/Damaged			
Corroded			
Loose			
Transoms			
Bent/Damaged			
Corroded			
End Transoms Unsupported			
Transom Clamps			
Bent/Damaged			
Corroded			
Loose			
Missing			
Handle Not Secured			
Stringers, Deck, Plain			
Bent/Damaged			
Corroded			
Stringers, Deck, Button			
Bent/Damaged			
Corroded			
Stringers, Ramp, Plain			
Bent/Damaged			
Corroded			
Stringers, Ramp, Button			
Bent/Damaged			
Corroded			
Steel Beam Guide Rail			
Loose			
Missing			
Corroded			
Bent/Damaged			
Curbs (Ribands)			
Loose			
Missing			
Damaged			

Modular Bridge Maintenance Inspection Form

DEFECT	OBSERVED		MAINTENANCE REQUIRED/COMMENTS
	Yes	No	
Laminated Deck			
Worn			
Damaged			
Tar & Stone Chip Coating Damaged			
Debris			
Chess & Herring Bone Deck			
Worn			
Loose			
Missing Planks			
Damaged			
Broken or Rotted Chesses			
Debris			
Footwalks			
Loose supports			
Loose decking			
Damaged			
Other			
Bearings			
Not in correct position			
Uneven			
Corroded			
Damaged			
Base Plates			
Uneven/Misaligned			
Corroded			
Drain holes plugged			
Damaged			
Dirty			
Cribs			
Uneven			
Rotted/Damaged			
Undermined			
Other			
Piers/Piles			
Damaged			
Other			
Grillage Timbers/Mudsills			
Damaged			
Rotted/Crushed			

Modular Bridge Maintenance Inspection Form

DEFECT	OBSERVED		MAINTENANCE REQUIRED/COMMENTS
	Yes	No	
Sway Bracing			
Loose			
Missing			
Corroded			
Bent/Damaged			
Slopes & Embankments			
Eroded, Unstable			
Overgrown			
Waterway			
Debris			
Blockage			
Miscellaneous Observations			

General Condition of Structure

Recommendations

Inspected by: _____ Title:_____

MQS-601

INTRODUCTION

Roadway markings consist of pavement markings and Roadway markers which warn and guide motorists and enhance the movement of traffic.

Pavement markings are symbols and lane lines applied to the Roadway. Durable pavement markings utilize materials that generally last longer than painted markings. The installation, maintenance and removal of durable markings however, requires greater care and is more costly.

Roadway markers are various types of recessed or surface-mounted reflective markers.

Maintenance of Roadway markings is required to optimize the visibility and reflectivity of all pavement markings and Roadway markers.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-601
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in early spring to determine effectiveness and set work plans and priorities.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Pavement Markings**

a) Reflectivity

If reflectivity is absent within a vehicle's nighttime headlight range, the defect shall be Reported to the District Office.

b) Premature Failure/Excessive Wear

Premature failure is defined as product failure from improper material application procedures, material quality control, winter maintenance abrasion and asphalt deterioration. These defects shall be Reported to the District Office.

c) Physical Damage

Physical damage to pavement markings shall be Reported to the District Office.

The following painting frequency shall be used:

1. Centreline and lane lines of all King's Highways shall be painted a minimum of once per year.

2. The edge line of freeways and high volume highways shall be painted a minimum of once every year. Edge lines on all other highways shall be painted a minimum of once every second year, or as necessary.

3. Roadways marked using durable markings are exceptions to the above. All durable markings shall be inspected annually and defects Reported to the District Office.

2. **Roadway Markers**

a) Conditions where:

i) more than approximately 25% of the castings or lenses are damaged or missing;
ii) on tangent sections 3 or more consecutive castings or lenses are damaged or missing; and/or
iii) on a curve 2 or more consecutive castings or lenses are missing or damaged,

shall be Reported to the District Office.

b) Loose castings shall be removed when Detected.

MQS-604

INTRODUCTION

Signs are devices that inform the motoring public of traffic regulations, Roadway characteristics, Roadway hazards and provide directional information.

Maintenance of Highway signs is required to ensure signs are clearly visible and are properly installed according to the Highway Traffic Act and Ministry policy to warn, guide and regulate traffic.

REFERENCE

- Ontario Traffic Manual (OTM)
- Maintenance Manual - Maintenance Best Practice MBP-604
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. A detailed inspection in late summer or early fall and a list of defects compiled by November 1st for the next year's work plan.

3. Early spring inspections to identify additional defects not included in the November list of defects.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Signs**

TABLE 604

		SIGN TYPE				
		Regulatory signs: ▪ Stop ▪ Yield	**Warning signs:** ▪ Advanced Stop ▪ Advanced Yield ▪ Checkerboard	**All Regulatory signs other than:** ▪ Stop ▪ Yield	**All Warning signs other than:** ▪ Advanced Stop ▪ Advanced Yield ▪ Checkerboard	**Information signs**
DEFECT		**RESPONSE TIMES**				
1	▪ Missing, damaged, illegible, obscured, deflected	Addressed Immediately	Addressed Immediately	Addressed within 3 days	Addressed within 7 days	Addressed within 30 days
2	▪ Delamination, fading, premature material failure ▪ Reduced night reflectivity ▪ Rust stains or pitting ▪ Improper installation or configuration ▪ Graffiti, vandalism or damage from accidents and natural events	repaired within 60 days	repaired within 60 days	repaired within 60 days	repaired within 60 days	repaired within 60 days

2. **Posts**

The following defects shall be corrected within 60 days of Detection:

a) Twisted or bent posts unless legibility is impaired in which case the defect shall be repaired within the timeframe specified in Table 604 (defect 1);

b) Cracked posts;

c) Out of plumb posts; and

d) Unsound posts and posts not solid in the ground.

3. **Proper Placement**

   Improper location and positioning such as distance from edge of the Travelled Portion and improper height and alignment shall be corrected within 60 days of Detection.

4. **Hardware**

   Missing, broken, loose, cracked, bent fasteners and bent brackets shall be repaired within 7 days of Detection.

INTRODUCTION

This standard covers sign supports that are engineer-designed. There are two general categories of engineer-designed sign supports:

1. Overhead sign supports that extend partially or completely above traffic (i.e.: structure-mounted, cantilever, mono-tube and aluminum or steel truss). The purpose of these sign supports is to hold signs that address unique situations such as multi-lane Highways, limited sight distances and limited space for ground-mounted signs; and
2. Ground-mounted Roadside sign supports that have multiple steel, aluminum or timber posts or columns and hold signs equal to or greater than 3.0m^2. The purpose of these sign supports is to hold larger signs in areas where there is adequate space to have the sign located at the side of the road.

This standard does not cover small ground-mounted Roadside signs that have an area less than 3.0m^2.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-604
- Sign Support Inspection Guidelines
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. An annual inspection on all sign supports to inspect the base and perform minor maintenance.

2. An annual maintenance inspection on all sign supports by a qualified person. A qualified person is a person with knowledge of sign support maintenance practices and the ability to identify sign support defects gained through a minimum of 3 years experience relating to inspection of Highway sign supports. Inspections shall be recorded on the Sign Support Maintenance Inspection Form 1 or Form 2, contained herein, and submitted to the District Office. Form 1 is to be used for Overhead Sign Supports and Form 2 is to be used for Ground-mounted Roadside Sign Supports.

3. Additional inspection of a sign support by a qualified person (as defined in item 2 above) under the following conditions:
   a) accident or vehicle collision with structure;
   b) unusual/severe weather conditions or natural disasters; and/or
   c) where a structural integrity or safety issue is suspected.

DEFECTS

Defects where structural integrity, infrastructure preservation and safety issues, such as fatigue cracking, impact damage, cracked welds and deteriorated grout pads, are suspected, shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.** The following defects shall be corrected during the annual inspection:

1. **Debris**

   Debris against the structure shall be removed.

2. **Grade**

   Soil encroaching on the footing base shall be removed and re-graded.

3. **Clamps**

   Clamps of dissimilar metal attached to the structure shall be relocated or removed and replaced with clamps of similar metal.

4. **Plate Covers**

   Missing plate covers shall be replaced to prevent moisture from entering the tubes.

FORM 1: OVERHEAD SIGN SUPPORT MAINTENANCE INSPECTION FORM

Date:_____ **Inspected by:**_____

Sign Support Identification:

Name/Location:			
Hwy/Direction:	**Core/Collector/Ramp:**	**Support Type:**	
Site #:	**# Sign Panels:**	**Footing Type (Left)**	**Footing Type (Right)**

		DEFECT			
		N/A	Yes	No	Maintenance Required/ Comments
Foundation	**Concrete (cracked, spalled?)**				
	Steel Pedestal (bent, rusted?)				
	Grout (broken?)				
	Bearing Surface (poor contact, lifting?)				
Bases	**Anchor Bolts (broken, loose?)**				
	Base Plates (cracked?)				
Legs of Support*	**Leg (bent, dented, cracked?)**				
	Bracing Diagonals (bent, cracked?)				
	Leg Connection (cracked, loose?)				
Horizontal Portion of Support*	**Chords (bent, dented?)**				
	Bracing Diagonals (bent, dented?)				
	In Line Connections (loose?)				
Attachments*	**Sign Panels (bent, loose?)**				
	Sign Panel Clamps (broken, loose?)				
	Walkway Arms (bent?)				
	Walkway (loose, bent?)				
	Walkway Clamps (broken, loose?)				
	Damping Assembly (loose?)				
	Other				
Other					
Follow Up with District Office/Structural Section?					
General Comments:					

*** Inspected from shoulder.**

FORM 2: GROUND-MOUNTED ROADSIDE SIGN SUPPORT MAINTENANCE INSPECTION

Date:_____ **Inspected by:**_____

Sign Support Identification:

Name/Location:		
Hwy/Direction:	**Core/Collector/Ramp:**	**Sign Message:**
Site #:	**# Columns (Posts):**	**# Horizontal cross arms (if steel):**

		DEFECT			
		N/A	Yes	No	Maintenance Required/ Comments
Foundation	**Concrete (cracked, spalled?)**				
Columns (Posts) of Support	**Connection at ground for breakaway sign (cracked, bent, loose?)**				
	Connection below sign, for breakaway sign (cracked, bent, loose?)				
	Leg (bent, dented, cracked?)				
Sign	**Sign Panels (bent, loose?)**				
	Sign Panel Clamps (broken, loose?)				
	Other				
Other					
Follow Up with District Office/Structural Section?					
General Comments:					

INTRODUCTION

Cable Guide Rail is a type of traffic barrier. Traffic barriers are devices installed to improve the safety of vehicular traffic by redirecting errant vehicles or enabling the vehicle to come to rest or slow sufficiently to allow the driver to regain control.

The predominant type of cable guide rail currently used by the Ministry consists of three steel cables mounted on wood posts and anchored at the ends by means of anchor blocks. This system obtains its strength from tension in the cable. Median cable guide rail installations utilize six cables, three on each side of the posts.

Maintenance of cable guide rail systems is required to ensure the system is operational.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. An early spring inspection to identify defects.

3. Additional inspections during the course of other maintenance operations.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Posts**

   Temporary repairs to posts that fail to maintain design height and system integrity shall be completed within 2 days.

Medians:

a) If 3 or more consecutive posts are missing or broken, or if the first 2 posts adjacent to the anchors are missing or broken, they shall be replaced within 7 days.

b) Posts that have heaved, settled or are out of plumb shall be reset to the proper elevation and alignment, or the cable shall be reset to the standard height, by June 15th.

Shoulders:

a) Broken posts shall be permanently repaired within 21 days when the ground is not frozen.

b) When the ground is frozen, permanent repairs shall be made by June 15th.

c) Posts that have heaved, settled or are out of plumb shall be reset to the proper elevation and alignment, or the cable shall be reset to the standard height, by June 15th.

2. **Cables**

a) Cables that are frayed shall be repaired within 7 days.

b) Cables that have sagged in excess of 50mm shall be tightened within 21 days.

3. **Anchors**

Exposed anchors and hardware shall be buried or replaced within 21 days.

4. **Reflectorized Strips**

Damaged or missing reflectorized strips shall be replaced within 21 days.

MQS-662

INTRODUCTION

Steel beam guide rails are a type of traffic barrier. Traffic Barriers are devices installed to improve the safety of vehicular traffic by redirecting errant vehicles or enabling the vehicle to come to rest or slow sufficiently to allow the driver to regain control.

Steel beam guide rail is a semi-rigid barrier system designed to restrain and redirect vehicles coming into contact with it, by a combination of beam bending and the absorbing of energy through the movement and deformation of the beam and posts.

This system consists of 'W' shaped steel rail elements attached to posts by means of bolt connections. The guide rail elements are also offset from the posts by means of blocks. A steel channel placed on the posts or offset blocks below the steel rail elements increases the strength and rigidity of the installation and reduces the snagging of vehicles on the posts.

Median steel beam guide rail installations utilize 'W' shaped steel rail elements mounted on each side of the posts.

Maintenance of steel beam guide rail systems is required to ensure the system is operational.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. An early spring inspection to identify defects.

3. Additional inspections during the course of other maintenance operations.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Posts and Blocks**

   a) Posts that are missing or damaged (including but not limited to broken, excessively split or cracked or generally unsound) and affect the integrity and effectiveness of the system, shall be replaced within 7 days for median installations and 21 days for Shoulder installations.

   b) Blocks that are not bolted firmly between the mounting posts and the steel beam rails shall be re-secured within 7 days.

   c) Posts that have heaved, settled or are out of plumb in such a manner that the system effectiveness has degraded, shall be reset to the proper elevation and alignment by June 15th.

2. **Rails and Channels**

   Rails and channels that are missing or damaged (including but not limited to dented, bent, torn, twisted or rusted) and affect the integrity and effectiveness of the system shall be replaced within 7 days for median installations and 21 days for Shoulder installations.

3. **Anti-Glare Screens**

   Damaged or missing anti-glare screens shall be repaired or replaced within 21 days.

MQS-663

INTRODUCTION

Box beam guide rail is a type of barrier system. Traffic barriers are devices installed to improve the safety of vehicular traffic by redirecting errant vehicles or enabling the vehicle to come to rest or slow sufficiently to allow the driver to regain control.

Box beam guide rail is generally referred to as a strong-beam, weak-post design. This system resists and redirects impacting vehicles by deformation.

This barrier system consists of steel box beam sections bolted together by means of splice plates, resting upon vertical steel posts which have been driven into the ground.

The beam sections are slotted and sit upon a steel plate which is bolted to the upper end of the 'I' post. A steel plate is welded at the lower end of the post. These plates are buried in the ground, parallel to the run of box beam.

Maintenance of box beam guide rail systems is required to ensure the system is operational.

REFERENCE

- Maintenance Manual - Maintenance Best Practice MBP-660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. An early spring inspection to identify defects.

3. Additional inspections during the course of other maintenance operations.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Posts**

   The following defects caused during the winter months shall be repaired or replaced by June 15th and, defects caused during the summer months shall be repaired or replaced by October 15th:

   a) Posts that are bent, twisted or missing;

   b) Posts that have heaved or settled;

   c) Bolts, holding the steel plate to the "I" post, that are missing or excessively rusted; and

   d) Loose bolts.

2. **Rails, Splice Plates and Splice Bolts**

   a) Rails, splice plates and splice bolts that are severely damaged and may affect the integrity and performance of the system shall be replaced within 7 days for median installations and 21 days for Shoulder installations.

   b) Sags or buckles in excess of 75mm, resulting from damaged posts, shall be temporarily realigned within 2 days.

MQS-664

INTRODUCTION

Energy Absorbing Systems (EAS's) are either cylinders filled with energy absorbing materials or mechanical devices with or without energy absorbing cartridges. EAS's are installed at designated locations to improve motorist safety and protect Ministry property. The principle behind EAS's is to prevent vehicles from coming into contact with fixed obstacles or structures being redirected into traffic, and to safely stop vehicles in a relatively short distance. Energy Absorbing Systems are generally attached to concrete barrier, steel beam guide rail, or other fixed objects.

Maintenance of Energy Absorbing Systems is required to ensure the systems are operational.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of these inspections is to identify defects and schedule work.

2. An early spring inspection to identify defects.

3. Additional inspections during the course of other maintenance operations.

DEFECTS

The following defects shall be noted on an inspection from, Reported to the District Office and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. Damaged Energy Absorbing Systems which compromise the integrity and effectiveness of the system shall be secured and delineated Immediately, and replaced or repaired within 7 days.

2. Energy Absorbing Systems which have shifted or moved out of original position shall be returned to the original layout within 7 days.

3. All systems that contain moving parts shall be cleaned by June 1st.

4. All hardware shall be repaired or replaced as required to maintain the integrity and performance of the system.

INTRODUCTION

Concrete barriers are a type of traffic barrier. Traffic barriers are devices installed to improve the safety of vehicular traffic by redirecting errant vehicles or enabling the vehicle to come to rest or slow sufficiently to allow the driver to regain control.

A concrete barrier is a concrete wall or modular retaining system. It is usually placed between lanes of opposing traffic.

Maintenance of concrete barriers is required to ensure the system is operational.

REFERENCES

- Maintenance Manual - Maintenance Best Practice MBP-660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

INSPECTION

Inspections shall be carried out as follows:

1. General drive-by inspections during road patrol as per MQS-395. The purpose of this inspection is to identify defects and schedule work.

2. An early spring inspection to identify defects.

3. Additional inspections during the course of other maintenance operations.

DEFECTS

The following defects shall be noted and action taken according to the following standards. Other defects not listed below shall be Reported to the District Office. **All conditions that are causing a Hazard shall be Addressed Immediately.**

1. **Concrete**

   a) Concrete defects such as cracks and missing concrete, that affect the integrity of the barrier wall shall be Addressed within 24 hours of Detection and Reported to the District Office for scheduling of permanent repairs.

   b) Other concrete defects such as spalling, scaling and cracking shall be Reported to the District Office.

2. **Temporary/Modular Concrete Barriers**

   a) Temporary/modular concrete barriers that are misaligned by more than 75mm over one section shall be realigned within 7 days.

   b) Temporary/modular concrete barriers that are separated greater than 25mm shall be realigned within 7 days.

3. **Anti-glare screens**

   Damaged or missing anti-glare screens shall be repaired or replaced within 21 days.

INTRODUCTION

The purpose of this standard is to establish the level of service for winter snow and ice control for all classes of Provincial Highways.

Winter maintenance operations are provided to maintain a consistent level of service across the province for varying classes of Highways.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-702 & MQS-703
- Maintenance Manual - Maintenance Best Practices MBP-701, 702, 703, & 704
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

LEVEL OF SERVICE

Winter traffic volume is the primary indicator used to determine the winter level of service for each class of Highway. All Highways in Ontario have been divided into five classes: Class 1, 2, 3, 4, and 5 with Class 1 being the highest level of service and Class 5 being the lowest.

CLASS 1

The defined level of service for Class 1 is essentially bare pavement, and is the objective to be reached as soon as reasonably possible after the storm has ended or abated, normally within 8 hours. This level of service applies to hard-surfaced Highways with a Winter Average Daily Traffic volume greater than 10,000 vehicles per day.

CLASS 2

The defined level of service for Class 2 is essentially bare pavement, and is the objective to be reached as soon as possible after the storm has ended or abated, normally within 16 hours. This level of service applies to hard-surfaced Highways with Winter Average Daily Traffic volumes between 2,000 and 10,000 vehicles per day in Southern Ontario and 1,500 and 10,000 vehicles per day in Northern Ontario*. This level of service also applies to the Trans-Canada Highway system throughout Ontario.

CLASS 3

The defined level of service for Class 3 is essentially bare pavement, and is the objective to be reached as soon as reasonably possible after the storm has ended or abated, normally within 24 hours. This level of service applies to hard-surfaced Highways with Winter Average Daily Traffic volumes between 1,000 and 2,000 vehicles per day in Southern Ontario and 800 and 1,500 vehicles per day in Northern Ontario*.

CLASS 4

The defined level of service for Class 4 is essentially bare pavement. A minimum centre bare condition (the centre 2.5m), should be reached within 24 hours after the storm has ended or abated and be maintained until conditions permit baring the pavement to full width. This level of service applies to hard-surfaced Highways with Winter Average Daily Traffic volumes between 500 and 1,000 vehicles per day in Southern Ontario and 400 and 800 vehicles per day in Northern Ontario*.

CLASS 5

The defined level of service for Class 5 is that a snow pack condition on the Travelled Portion be achieved, within 24 hours after the storm. A snow pack condition on the Travelled Portion is defined as a smooth, hard, snow covered driving surface with Shoulders that are void of loose snow. This level of service applies to gravel, surface treated or prime surfaced Highways with a Winter Average Daily Traffic volume less than 500 vehicles per day in Southern Ontario and less than 400 vehicles per day in Northern Ontario*.

*** For the purpose of this Maintenance Quality Standard, Northern Ontario includes all Highways within the MTO districts of Thunder Bay, Sault Ste Marie, Sudbury, New Liskeard as well as Highways in Huntsville and Bancroft Districts north of the MNDM/MTO boundary defined as the southern Muskoka and Nipissing District Boundaries**

INTRODUCTION

The purpose of this standard is to establish the operational requirements for winter maintenance operations for all Classes of Provincial Highways.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-701 & MQS-703
- Maintenance Manual - Maintenance Best Practices MBP-701, 702, 703 & 704
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

GENERAL

Mobilization & Operations

1. Snow and ice control operations shall commence with the call-out of maintenance staff when it becomes evident that the use of winter maintenance equipment and/or de-icing/abrasive materials is warranted to maintain or improve the friction of the Pavement for safety reasons, and/or to attain the specified level of service.

2. Within 30 minutes from the time of the call-out, equipment operators and vehicles shall be ready to begin work. For spreaders, this means in the process of having the spreader(s) filled with material. For plowing, this means on route to the area of concern.

3. Once commenced, snow and ice control operations shall continue, utilizing all resources assigned to the route in the winter equipment complement analysis, until the prescribed level of service is achieved. However, it is acknowledged that conditions may occur which prevent achieving these levels. In such cases, operations shall continue in an effort to keep the Highway open and to achieve and maintain the best possible driving surface under the conditions.

4. When it is determined that the application of de-icers and/or abrasives are required to improve the friction of the Travelled Portion for safety reasons, and/or attain the specified level of service, they shall be applied at the specified application rates.

Communications

1. Radio contact with Central Dispatch shall be established and maintained by the patroller and Central Dispatch is to communicate and receive up-to-date Roadway and weather conditions.

2. Roadway and weather conditions shall be communicated by the patroller to Central Dispatch daily at predetermined times and in accordance with MTO road reporting protocol.

3. Changes in weather or Roadway conditions that occur between scheduled reporting times and which result in operational changes shall be communicated verbally and without delay by the patroller to Central Dispatch.

4. Under severe weather conditions or when it becomes evident that available resources are not sufficient to maintain Highways open and passable, the O.P.P. or local police shall be notified and they will determine if the Highway should be closed. Once the O.P.P. or local police have determined that a closure is warranted, the patroller shall notify Central Dispatch of the closure.

Vehicle Warning Lights

1. Vehicle warning lights shall be operated in compliance with the Highway Traffic Act and Ministry specifications.

PATROLLING

General:

1. Road patrol on all roads shall be performed at least once per day. Inspections of problem areas shall be carried out more frequently if required.

2. During unfavourable weather conditions, patrolling shall be undertaken as frequently as necessary to monitor and communicate Roadway and weather conditions.

3. The patroller shall also monitor weather forecasts and be aware of weather and road conditions in adjoining areas, i.e.: patrols and Districts.

Operations:

1. The patroller shall organize and/or call-out plow and/or spreader operators, and determine when to commence snow and ice control operations, according to Roadway and weather conditions.

2. Once winter operations are in progress, the patroller shall continue to monitor Roadway and weather conditions, direct and adjust snow and ice control operations and ensure that the operations continue to be appropriate for the Roadway and weather conditions.

3. As conditions improve and snow and ice control operations are concluding, the road patroller shall determine the extent and priority of clean-up operations required as well as any Roadway conditions that may require additional snow and ice control operations. The patroller shall direct cleanup operations.

PLOWING

1. Plowing shall commence and continue as required to minimize the accumulation of snow or slush on the Roadway.

2. While it is acknowledged that local weather and Roadway conditions may necessitate deviation from the following order of priority for plowing operations in order to keep the Highway open and to achieve and maintain the best possible driving surface under the conditions, the order of priority for plowing operations shall be as follows:

   a) Through lanes and left turn lanes;

   b) Interchange ramps and acceleration and deceleration lanes including access, egress and through lanes of 7/24 Truck Inspection Stations;

   c) Access, egress and through lanes of freeway service centres;

   d) Auxiliary passing lanes (two-lane Highways):

      Auxiliary lanes shall be cleared when conditions permit. However, clearing the outside lanes or truck climbing lanes, while in the vicinity, will sometimes assist in keeping the through/centre lanes cleared, such as preventing snow from being dragged onto the centre lanes by trucks;

   e) Right turn lanes:

      Right turn lanes on a two lane Highway are generally cleared after the storm. However, it may sometimes be beneficial to clear the right turn lanes during excessive storm conditions to assist in keeping the through lanes clear;

f) Shoulders

Shoulders shall be cleared during the 24 hour period following the end of a storm event to minimize drifting, provide space for emergency pull-offs, provide additional storage for future storms and reduce wet pavement conditions caused by melting windrows. However, if accumulations are excessive, due to the intensity of the storm and high windrows have resulted from plowing through lanes, then the Shoulders shall be cleared during a storm to provide greater storage.

Snow on Shoulders adjacent to median barrier walls shall be plowed during the storm so that snow or other build-up will not have to be cleared across the bare driving lanes;

i) Removal of excessive accumulations of snow at bridge approaches, guide rails, median barriers and energy attenuators which could cause ramping shall be treated as a priority during cleanup operations between storms;

j) Lowering snow banks:

Snowbanks on Shoulders, at or on traffic islands, intersections and recreational trail crossings that are creating visibility, or drifting problems, or are too high to provide adequate future snow storage, shall be lowered during periods between storms. However, snow shall be removed entirely if lowering of snow banks does not adequately address the above concerns;

k) MTO Truck Inspection Stations:

Paved areas in Truck Inspection Stations shall be cleared after the storm; and

l) Commuter parking lots:

Commuter parking lots shall be cleared after the storm.

3. Plowing shall be to the right of the Roadway, except on divided multi-lane Highways where small accumulations may be plowed from the passing lane onto the median, without impacting opposing lane traffic.

4. a) When plowing at railway crossings, the plow blade, wing and other attachments shall be raised sufficiently to clear the highest part of the crossing.

b) If the railway track or any part of the crossing is damaged, warning devices shall be set up, and the District Office, O.P.P. and Railway Authority shall be notified without delay.

SPREADING

General

Priority shall be given to potentially hazardous locations such as hills, curves, intersections, bridge decks, insulated pavement areas, shaded areas and rock cuts.

Sand

1. Sand shall be used:

   a) when slippery conditions are Detected;
   b) when the temperature is too low for salt to be effective;
   c) where traction is required; and/or
   d) on Class 5 Highways.

2. Sand shall be spread at the specified application rates.

3. Sand shall not be applied within 3m of railway crossings, to prevent sand from being carried onto the tracks.

Salt

1. Salt shall be used to:

   a) attempt to prevent snow from bonding to the Travelled Portion; and/or
   b) remove ice or snow pack from the Travelled Portion.

2. The use of salt shall be limited to paved surfaces and spread at specified application rates.

MQS-703

INTRODUCTION

The purpose of this standard is to establish personnel, equipment and material requirements for winter maintenance operations. The availability and type of materials and equipment used for winter maintenance operations is very important in achieving the desired level of service.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-701 & MQS-702
- Maintenance Manual - Maintenance Best Practices MBP-701, 702, 703 & 704
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

PERSONNEL & EQUIPMENT

Training

1. All personnel engaged in winter maintenance operations shall be informed of their specific duties and shall be properly trained in winter maintenance operations.

Equipment/Staff Complement

1. In order to maintain consistency in the level of service across the province for all classes of highways, snow and ice control equipment complement numbers shall be established using a systematic methodology taking into consideration vehicle operational capabilities, typical snowfall rates, loading times, “dead heading” time, anticipated driving conditions, routes, turn around locations and overlap with adjacent patrols.

2. Full snow and ice control equipment complement and road patrol staffing shall be maintained for the winter maintenance operations season. Unless local conditions dictate otherwise, the start and end dates of the winter maintenance operations season shall be based on the median dates for the first and last snowfalls of 2cm or more (see MBP-703). In order to respond to unfavourable Roadway or weather conditions before or after the winter maintenance operations season, snow and ice control equipment and road patrol staff shall be “phased in” starting one month prior to and “phased out” over one month after the established median dates for the first and last snowfalls of 2cm or more.

Communications

All plows, spreaders and combination units and all vehicles used for patrolling shall be equipped with a two-way radio.

Electronic Spreader Control Devices

All spreader units shall be equipped with electronic spreader control devices conforming to Ministry specifications.

Minimum Ballast

Plow trucks and combination units shall be adequately ballasted to maintain sufficient traction to ensure a safe and effective plowing operation.

MATERIALS

Sand

1. Provisions shall be made to ensure an adequate supply of sand will be available for winter operations.

2. Sand shall meet the requirements of OPSS 531.

Salt

1. Provisions shall be made to ensure that an adequate supply of salt will be available for winter operations.

2. Salt used for winter snow and ice control shall conform to OPSS 2502.

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MAINTENANCE BEST PRACTICES

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MBP-101	Concrete Pavement Surfaces	
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MBP-103	Surface Treated Surfaces	
MBP-104	Gravel Surfaces	
MBP-201	Gravel Shoulders	
MBP-202	Hard Surface Shoulders	
MBP-303	Hard Surface Cleaning	
MBP-305	Fences	
MBP-320	Weed Control	
MBP-321	Tree Control	
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MBP-701	Winter Maintenance - Summary	
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MBP-704	Winter Maintenance - Snow Drift Control	
MBP-705	Pre-Wetting - Road Salt	

For maintenance standards on Traffic Signals and Illumination refer to the "Electrical Engineering Manual"

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-101
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Pavement Maintenance Guidelines SP-001
- Pavement Design and Rehabilitation Manual
- Special Asphalt Patching Mixes

BEST PRACTICE

1. Road surface deterioration should be monitored.

2. Concrete deterioration can be caused by aging, improper concrete mix or aggregate, poor placement or compaction, or water trapped in the base or sub-grade. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

3. Special attention should be paid to concrete pavement surfaces during periods of extended high temperature, as this type of highway surface is prone to expansion and blow-ups. Heat blow-ups usually occur in mid or late summer after particularly hot, humid weather. Some possible early warning signs are:

   a) bumps;
   b) concrete slabs squeezed tightly together (with or without joint filler extruding); and
   c) concrete that is fractured at the joint.

4. The use of hot and cold mix materials for repairing the surface of the highway is a temporary, economical practice to hold the surface in a safe condition until major restoration projects or permanent repairs with special concrete mixes are initiated.

5. Concrete surfaces that are severely cracked should be sealed and resurfaced. Joints where sealant is lost should be re-sealed.

6. Ponding caused by high gravel Shoulders should be corrected by grading.

7. Areas of on-going deterioration should be noted in next year's work plan for consideration under the capital or preservation management programs for future rehabilitation.

MBP-102

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-102
- Pavement Maintenance Guidelines SP-001
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Manual for Condition Rating of Flexible Pavements SP-024
- Pavement Design and Rehabilitation Manual
- Special Asphalt Patching Mixes

BEST PRACTICE

1. Road surface deterioration should be monitored.

2. Asphalt deterioration can be caused by aging, improper asphalt mix or aggregate, poor placement or compaction, or water trapped in the base or sub-grade. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

3. In many cases regular SC-800 is the most economical product for warm weather applications. Special cold mixes have value when placed in cold temperatures, for single lift applications, but they have a tendency to push out of deeper holes.

4. Hot mix can be used as an alternative to cold mixes for patching deteriorated surfaces.

5. Ponding caused by high gravel Shoulders should be corrected by grading.

6. Areas of on-going deterioration should be noted in next year's work plan for consideration under the capital or preservation management programs for future rehabilitation.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-103
- Pavement Maintenance Guidelines SP-001
- Manual for Condition Rating of Surface Treated Pavements SP-024
- How to Achieve a Good Surface Treatment MI-57 Pavement Design and Rehabilitation Guidelines
- Special Asphalt Patching Mixes
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICE

1. Road or shoulder deterioration should be monitored.

2. Deterioration can be caused by aging, improper emulsion or aggregate, poor placement or compaction, or water trapped in the base or sub-grade. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

3. Corrugations may be repaired with hot or cold mixes or returned to granular condition, reshaped and surface treated. The severity of the condition will determine the appropriate action.

4. Cold mix products have value as repair materials in a temporary repair situation. Pulverizing or grading and retreatment should be considered for long-term repairs.

5. Sand or aggregate may be applied to remedy flushing.

6. Areas of on-going deterioration should be noted in next year's work plan for consideration under the capital or preservation management programs for rehabilitation.

7. Reduced load restrictions or seasonal load restrictions should be used as a means of preserving the road surface.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-104
- Pavement Maintenance Guidelines SP-001
- Pavement Design and Rehabilitation Manual
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICE

1. Gravel surface deterioration should be monitored.

2. Deterioration can be caused by lack of aggregate, poor aggregate, poor compaction, improper cross-fall or water trapped in the base or sub-grade. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

3. Potholes should be repaired by spot grading, addition of aggregate, or reshaping the surface.

4. Distortions should be repaired by scarifying or reshaping with a grader and by applying additional aggregate, when necessary.

5. Corrugations should be repaired by grading.

6. Crossfall should be maintained by routine grading.

7. Preventive maintenance reduces the occurrence of defects and the need for major repairs. Preventive maintenance consists of:

   i) the application of a dust suppressant; and
   ii) grading operations.

8. A dusty road condition reduces fine particles in the gravel and may reduce visibility. All gravel roads should receive two separate applications of a dust suppressant per season, the first being applied between May 10 and June 30 using approved dust suppressants. The application rate of liquid calcium chloride should be a minimum of 3.5 liquid tonne/km. Application of a dust suppressant helps to:

   a) prevent the loss of fines;
   b) aid compaction;
   c) control dust; and
   d) reduce the need for frequent grading.

9. Grading after the placement of a dust suppressant should only be done to meet requirements of the Maintenance Quality Standards.

10. Grading should be deep enough to remove all potholes without cutting into the sub-grade.

11. The best time to grade is when the surface is damp. Full or “double round” grading should be carried out in the spring to retrieve gravel pushed out by snow clearing operations and to prevent a berm from developing at the edge of the Shoulder or at guide rail installations. A water truck can be used to dampen gravel surfaces.

12. Full width grading should take a minimum of 3 passes.

13. Any late season grading should be done before freeze-up.

14. At locations where the base or sub-base is exposed, a minimum of 100mm of Granular A or M should be spread, graded and compacted to blend into the road profile.

15. During grading operations appropriate action should be taken to ensure that:

    a) no windrows are left at intersections, entrances or on the road surface;
    b) no cuts or gouges occur across intersections; and
    c) no gravel or debris accumulates in the flangeways of railway crossings.

16. Areas of on-going deterioration should be noted in next year’s work plan for consideration under the capital or preservation management programs for rehabilitation.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-201
- Pavement Maintenance Guidelines SP-001
- Pavement Design and Rehabilitation Manual
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Shoulder deterioration should be monitored.

2. Washouts should be marked with traffic warning devices until repaired.

3. Deterioration can be caused by vehicle usage, poor Shoulder compaction, berms that funnel water and drainage appliances that are blocked or not functioning properly. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

4. Shoulder crossfall should be maintained by grading operations. All efforts should be made to maintain cross-fall and width as close as possible to design specifications with the material available. Do not widen the Shoulder.

5. The best time to grade is when the Shoulder is damp. A water truck can be used to dampen gravel surfaces. Full or “double round” grading should be carried out in the spring to retrieve gravel pushed out by snow clearing operations and to prevent a berm from developing at the edge of the gravel Shoulder or at guide rail installations.

6. Edge of pavement drop-off and rutting are the main defects, which require correction by grading. Grading Shoulders, where no apparent need exists, can create problems (i.e. windrows, loss of fines) which may require more costly methods to correct.

7. Areas where edge of pavement drop-off is an on-going problem may be repaired with hot or cold mix, treated with dust suppressants and other stabilization products or additional aggregate may be added.

8. Stabilization of gravel Shoulders may reduce or eliminate other maintenance work. A cost analysis should be carried out prior to Shoulder stabilization.

Some areas that should be considered for Shoulder stabilization:

a) Road gradients greater than 5%;
b) Road gradients between 3%-5% - treatment requirements should be based on local experience and identified need;
c) Where guide rail installations occur in close proximity to the above conditions, the treatment should continue through the guide rail section;
d) Inside (low side) Shoulder sections on super-elevated curves;
e) Isolated areas - where frequent erosion problems have occurred and are anticipated to continue; and
f) Areas where granular materials have proven to be unsatisfactory or costly to maintain.

9. Grading after the placement of a dust suppressant should only be done to meet requirements of the Maintenance Quality Standards.

10. Commercial and private entrances should be maintained to the same width as the gravel Shoulder.

11. Shoulders that can not be maintained at a reasonable cross-fall, due to the lack of gravel, should be noted in next year's work plan and considered under the capital or preservation management programs for rehabilitation.

12. Where Shoulder repairs are made in areas that have stabilization, the repaired areas shall be re-stabilized.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-202
- Pavement Maintenance Guidelines SP-001
- Pavement Design and Rehabilitation Manual
- Manual for Condition Rating of Flexible Pavement SP-024
- Special Asphalt Patching Mixes
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Shoulder surface deterioration should be monitored.

2. Washouts should be marked with traffic warning devices until repaired.

3. Deterioration can be caused by vehicle usage, aging, asphalt thickness, type of surface (asphalt or surface treatment), poor compaction or water trapped in the sub-grade. Maintenance personnel should attempt to determine the cause of the deterioration and Report their findings to the District Office.

4. In many cases regular SC-800 is the most economical product for warm weather applications. Special cold mixes have value when placed in cold temperatures for single lift applications, but they have a tendency to push out of deeper holes.

5. Areas of on-going deterioration should be noted in next year's work plan and considered under the capital or preservation management programs for rehabilitation.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-303
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Roadway surfaces that require repeated cleaning should be monitored.

2. Problem areas can be caused by narrow Shoulders, specific traffic patterns (cutting corners), type of traffic (trucks) and Shoulder material condition (paved or granular). When observing areas that require repeated cleaning, maintenance staff should attempt to ascertain the cause and advise the District Office.

3. A spring cleanup is necessary to remove all sand, gravel and debris from paved areas. This should be scheduled as soon as spring thaw permits and before catchbasins are cleaned, to limit the amount of foreign material entering the drainage system.

4. Water shall be used to minimize dusty conditions during cleaning operations.

5. Windrows resulting from hard surface cleaning operations should be levelled.

6. In many cases, Shoulder stabilization, placement of asphalt or installation of delineators can reduce granular material deposited on the Roadway.

7. Sweeping and flushing are two methods of hard surface cleaning.

8. Areas that require on-going work and monitoring should be noted in next year's work plan and considered under the capital or preservation management programs for permanent repairs.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-305
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Detailed inspections should be done once per year by driving along the Shoulder noting any fencing deficiencies. In particular, fencing deficiencies in urban areas and areas with livestock adjacent to the Highway should be noted.

2. Repeated repairs to fencing during the year can be as a result of aging, repeated accidents, vandalism or snow banks. Vandalized areas should be reported to the O.P.P. When observing areas of concern or areas that require repeated repair maintenance staff should attempt to ascertain the cause and advise the District Office.

3. Prior to undertaking fence repairs it should be determined whether the fence is owned by M.T.O.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-320
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO - Integrated Vegetation Management (IVM) For Highway Rights-of-Way

BEST PRACTICES

Weed control can be achieved using various chemical, mechanical, manual, cultural and biological control methods which are consistent with IVM principles.

Shoulder:

1. Weeds obscuring regulatory signs should be cut, either mechanically or manually.

2. All other weeds should be controlled using herbicide applications or by manual or mechanical cutting.

3. The planned and proper use of residual herbicides can help stop weeds from establishing in the Shoulder.

Roadside:

1. Weeds can be effectively controlled using a combination of biological, chemical, cultural, manual and mechanical control methods.

2. Where prompt results are required, mechanical and manual methods are often the best choices. In some situations, quick acting “burndown” herbicides may also be suitable.

3. Where prompt results are not required, then slower acting, selective, translocated herbicides, cultural control methods and biological control agents should be considered for weed control.

Licensing

Ministry policy requires that any person applying herbicides have an appropriate and valid MOE pesticide license.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-321
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- International Society of Arboriculture Tree-Pruning Guidelines (1995)
- MTO Roadside Safety Manual

BEST PRACTICES

1. Drive-by inspections should note tree conditions which have changed or are declining. Drive-by inspections should note the general condition of trees after severe weather events.

2. Where tree health and vigour is in doubt, a detailed inspection should be performed by someone with an arboricultural background.

3. Trees identified for removal should be marked with a coloured tag or spray painted for field identification.

4. Tree pruning/trimming should be performed in accordance with International Society of Arboriculture guidelines. In particular, pruning should occur outside the bark branch ridge and the branch collar (see guidelines). This will result in the proper healing and good growth of trees requiring trimming. Flush cut pruning is not permitted as it causes improper healing and weak growth resulting in increased maintenance activities.

5. Wound dressings are not recommended on any pruning cut as they encourage infection and poor healing resulting in future maintenance activities.

6. Assistance from the local Hydro Authority shall be requested for tree pruning within 3m of an energized electrical conductor.

7. Trees marked for removal should be close cut (close cutting is the practice of cutting as low as possible to the ground leaving no stump). Remaining stumps should be removed in next year's workplan. Stumps should be removed to a depth of 150mm below the soil line and the exposed area reconditioned with soil and grass seed/sod.

   Note: In Northern Ontario, only stumps within the safety clear zone as defined in the MTO Roadside Safety Manual should be removed in next year's workplan.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-322
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- International Society of Arboriculture Tree-Pruning Guidelines (1995)

BEST PRACTICES

Tree and shrub maintenance consists of various activities required to keep planted trees and shrubs healthy. Tree and shrub maintenance ensures that environmental commitments are sustained and is performed to extend the life and investment of the infrastructure.

1. **Pruning**

   a) Tree pruning should be performed in accordance with International Society of Arboriculture guidelines. In particular, pruning should occur outside the bark branch ridge and the branch collar. This will result in the proper healing and good growth of trees requiring trimming. Flush cut pruning is not permitted as it causes improper healing and weak growth which may require future maintenance activities.

   b) Wound dressings are not recommended on any pruning cut as they encourage infection and poor healing resulting in future maintenance activities.

   c) Assistance from the local Hydro Authority shall be requested for tree pruning within 3m of an energized electrical conductor.

2. **Protection from rodent damage**

   Protection from rodent damage should be provided by mechanical protection (hardware cloth, tree coil guards) or chemical protection (bait stations utilizing rodenticides) or cultural protection (mowing of all grass in vicinity). The most cost-effective and long-term protection is provided by hardware cloth properly installed to a depth of 50-75mm below the soil line. The second best method is to apply rodenticide using bait stations. It is recommended that the type of rodenticide be alternated from year to year to maintain effectiveness.

3. **Pesticides**

   Herbicides, insecticides, fungicides and rodenticides used in weed, insect, disease and rodent control shall be applied in accordance with MTO policy and MOE and Agriculture Canada regulations.

4. **Watering**

   When watering during the establishment period, the root zone should be thoroughly soaked in a uniform manner. Water pressures should be set as to not damage or dislodge soil.

5. **Fertilizer**

   When fertilizer is required during the establishment period, it is recommended that fertilizer be a slow release type and labelled for use with trees and shrubs.

6. **Mulch**

   Mulch cover replacement should be applied in accordance with original design specification.

7. **Coniferous tree wrap**

   During the establishment period, coniferous trees greater that 600mm (diameter) should be completely wrapped with burlap (OPSS 563-8) in the autumn. The wrap should be removed in the spring when conditions permit.

8. **Replacements**

   Tree replacements should conform to original design intent. Tree replacements will only be provided for tree losses occurring during: the initial three-year establishment period; for snow hedge infilling; and for losses occurring due to rodent damage.

9. **Weed and grass control**

   When weed or grass control is required during the establishment period, it is recommended that the mulch be treated with an appropriate herbicide such as glyphosate. Herbicides should not come into contact with any trees and shrubs.

Licensing

Ministry policy requires that any person applying pesticides have an appropriate and valid MOE license.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-320 and MQS-323
- Maintenance Manual - Maintenance Best Practice MBP-320
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Seeding and Cover Specification SP572SO1

BEST PRACTICES

1. General drive-by inspections should be used to identify Roadside in need of ground cover rehabilitation. The inspection should determine whether the loss of desirable ground cover constitutes a negative environmental effect or a Highway infrastructure impact. An example of a negative environmental effect would be the loss of vegetation on a slope adjacent to a watercourse. An example of a Highway infrastructure impact would be the loss of vegetation on a slope adjacent to the Shoulder edge where the absence of vegetation was causing erosion and threatening the stability of the Shoulder. If either of these conditions exists, then work should be scheduled to re-establish vegetation.

2. If the inspection has determined that the loss of desirable ground cover has no critical effect on the environment or infrastructure, then the work should be considered on next year's work plan. An example of this type of condition is the loss of vegetation within the Roadside where the slope gradient is not steep enough to create a critical erosion problem.

3. Surface drainage-induced washouts, including channels, rills and gullies should be repaired by topsoiling and re-seeding with the appropriate seed mix in accordance with Ministry specifications.

4. Repairs to washouts, channels and rills around structures and culvert ends undermining the structure and washing out the base material should consist of replacing the base material, repairing the eroded soil, topsoiling and re-seeding in accordance with Ministry specifications.

5. Areas of recurring erosion problems should be Reported to the District Office.

6. Where the Roadside is bare of vegetation the ground should be scarified and seeding and cover applied in accordance with Ministry specifications.

7. Where the Roadside is covered with undesirable vegetation, for example weeds, the existing vegetation should be removed first, in accordance with MQS-320 and MBP-320. Then appropriate seed and cover should be applied in accordance with Ministry specifications.

Licensing

Ministry policy requires that any person applying herbicides have an appropriate and valid MOE pesticide license.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-324
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO - Integrated Vegetation Management (IVM) For Highway Rights-of-Way

BEST PRACTICES

Brush control can be achieved using various chemical, cultural, manual and mechanical control methods which are consistent with IVM principles.

Shoulder:

1. Brush obscuring regulatory signs should be cut as close to the ground as possible (close cut), either mechanically or manually. The stumps or stubble should be treated with an approved herbicide within 24 hours of cutting (before the formation of callous tissue) to ensure maximum herbicide uptake.

2. All other brush can be controlled using herbicide applications or by cutting, either manually or mechanically, followed by a cut-surface herbicide application within 24 hours of cutting (before the formation of callous tissue) to ensure maximum herbicide uptake.

Roadside:

1. Brush can be effectively controlled using chemical, mechanical, manual and cultural control methods. Where cutting has occurred, the stumps or stubble should be treated with an approved herbicide within 24 hours of cutting (before the formation of callous tissue) to ensure maximum herbicide uptake.

2. The greatest level of activity for brush control is generally between the edge of the Roadway to the back slope of the ditch. Brush growing in this area often requires prompt attention since it affects sight visibility, impedes water flow in ditches, shades the Roadway surface and hides animals that may enter the Roadway. Control can be achieved using chemical, mechanical, manual and cultural methods.

3. Brush growing between the back slope of the ditch and the fence-line seldom requires prompt attention. However, control measures which use chemical, mechanical, manual and cultural methods should be implemented in a timely fashion to maximize cost-effectiveness.

Licensing

Ministry policy requires that any person applying herbicides must have an appropriate and valid, MOE pesticide license.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-102, 103, 104, 305, 320, 321, 322, 323, 324, 325, 326, 331, 601, 604, 661 and 662
- Maintenance Manual - Maintenance Best Practices MBP-102, 103, 104, 305, 320, 321, 322, 323, 324, 326, 331, 601, 604 and 660
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Guidelines for Bacteriological Testing of Non-Municipal Water at MTO Sites
- MOE Manual of Policy, Procedures and Guidelines for Private Sewage Disposal Systems

BEST PRACTICES

1. Rest area/picnic site maintenance repairs and activities should be coordinated and scheduled with the repairs and activities required by other MQS's and MBP's to maintain cost-effectiveness.

2. Activities that should be completed before the rest area/picnic site is opened to the public:

   a) Furniture and site hardware including, but not limited to, signs, tables, benches, pumps, waste receptacles, barbecues, fireplaces, grills and wooden fences should be repaired, re-finished and installed. Furniture and hardware not suitable for repair and re-finishing should be replaced;
   b) Privy holding tanks should be re-charged to an appropriate level with water and an approved privy holding tank chemical mixture. Where surface water has accumulated in the holding tank, the tank should be emptied and re-charged;
   c) Water supplied for drinking and hygienic purposes shall be tested as per MQS-325 and MTO's and provincial water testing guidelines;
   d) Rest area/picnic site identification signs on the Highway should be uncovered or re-installed at the appropriate locations just prior to the site opening to the public;
   e) Rest area/picnic site roads and parking areas should be repaired as per MBP-102, MBP-103 and MBP-104;
   f) Roadway markings should be repaired and re-applied as per MBP-601;
   g) Guide rail systems should be repaired as per MBP-660;
   h) All fences should be repaired to meet the original design intent;
   i) Washroom facilities should be repaired, painted or stained, and cleaned to ensure neat and hygienic conditions;
   j) Toilet paper and paper towel dispensers should be cleaned, in good working order, and replenished with paper;

k) Brush and trees or tree limbs which may infringe upon the safe and useful enjoyment of the rest area/picnic site should be controlled as per MBP-321 and MBP-324;
l) Trees and shrubs should be maintained in a healthy condition as per MBP-322;
m) Turf grass should be fertilized once before June 30th and bare areas reseeded in the spring;
n) Refuse and litter that has accumulated over the winter season should be collected and removed from the site as per MBP-331; and
o) Hard-surfaced areas and pedestrian pathways should be swept clean.

3. During the operating season, the following maintenance activities should be undertaken as part of the daily work schedule:

a) Water supplied for drinking and hygienic purposes shall be tested as per MQS-325 and MTO's provincial water testing guidelines;
b) Privy holding tanks should be treated with an approved chemical to minimize accumulation and odour. Holding tanks should be emptied when 75% full;
c) Furniture, site hardware, structures and fences should be maintained in a good state of repair;
d) Roads, parking areas, markings, guide rail systems and pathways should be maintained in a good state of repair;
e) Debris and litter should be collected and removed from the site as per MBP-331; Litter in waste receptacles should be collected and removed from the site when waste receptacles are 75% full;
f) Fireplace grills should be cleaned with a wire brush and accumulated ashes removed from fire pits of fireplaces and barbecues;
g) Picnic tables should be cleaned and washed with an approved germicide/deodorant preparation;
h) Washroom facilities should be maintained to ensure neat and hygienic conditions. Washroom areas should be cleaned daily with an approved germicide/deodorant preparation during the operating season. Dirt, stains, graffiti, litter, debris, liquid or solid waste should be cleaned and removed from washroom cubicles. Floors, walls, surface areas and screens should be swept to remove litter and debris. All washed areas should be dried prior to re-opening for public use;
i) Toilet paper, paper towel and soap dispensers should be replenished with paper daily during the operating season;
j) Grass areas should be maintained in a healthy condition by mowing as per MQS-325 and with an application of fertilizer in the spring;
k) Trees and shrubs should be maintained as per MBP-322; and
l) Brush, noxious weeds, trees and tree limbs which may infringe upon the safe enjoyment of the rest area/picnic site should be controlled as per MBP-320, MBP-321 and MBP-324.

4. Seasonal closing activities should be completed prior to air temperatures reaching $0^{o}C$ and should consist of the following:

   a) Moveable furniture and hardware including, but not limited to, signs, tables, benches and waste receptacles within the rest area/picnic site should be removed and stored at a safe location;
   b) Rest area/picnic site identification signs on the Highway should be covered or removed and stored at a safe location;
   c) Privy holding tanks should be emptied and recharged half-full with water to prevent frost damage;
   d) Washroom facilities should be cleaned, closed and locked;
   e) Toilet paper towel and soap dispensers should be emptied;
   f) Wherever water is provided, the water source should be closed, drained and winterized; and
   g) Gates to the site, where provided, should be closed and locked.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-326 & MQS-331
- Maintenance Manual - Maintenance Best Practices MBP-320, MBP-324 & MBP-331
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO - Integrated Vegetation Management (IVM) For Highway Rights-of-Way

BEST PRACTICES

Grass control can be achieved using various mechanical and manual control methods which are consistent with IVM principles.

Mowing is not an effective control option where the eradication of grass is essential. The use of appropriate total vegetation control herbicides may be required in these situations.

To ensure that Roadside grass control is effective, economical and environmentally responsible, the following best practices should be followed:

1. Mowing and trimming should be scheduled in conjunction with litter pick-up as per MQS-331 and MBP-331;

2. At provincial gateways and in Ministry-designated areas, trimming should be performed around stationary objects (e.g.: sign/guide rail posts, fences, delineators, etc.) to a minimum height of 200mm promptly following the mowing operation; and

3. Adequate safety precautions shall be taken such as the use of shrouds or shields to ensure safety to the travelling public. Mowing equipment should not be operated on steep slopes.

Licensing

Ministry policy requires that any person applying herbicides have an appropriate and valid MOE pesticide license.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-331
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO: Adopt-A-Highway Guidelines & Agreements

BEST PRACTICES

1. Where litter and debris pick-up is deemed necessary (e.g.: urban areas, commuter lots, interchanges) pick-up should be done after spring thaw. Adopt-a-Highway partnerships should be considered as an alternative means for accomplishing Roadside (excluding medians) litter and debris pick-up.

2. Debris removal should occur before any mowing operations to reduce the potential for re-distribution of litter, equipment damage and worker and public safety hazard.

3. All debris collected, including dead animals, shall be disposed of as per EP-9.

4. **Notification**

   a) **Game Animals**
   Vehicle collisions with large game animals including moose and deer will likely have inflicted some damage on the striking vehicle. The District Office should contact the local police or O.P.P. and the appropriate office of the Ministry of Natural Resources to advise them of the incident.

   b) **Large Domestic Animals**
   Vehicle collisions with large domestic animals such as cows or horses will likely have inflicted some damage on the striking vehicle. The District Office should advise the local police or the O.P.P. of the incident.

   c) **Small Domestic Animals**
   In the case of small, dead domestic animals, such as cats and dogs, all identification should be removed before disposal. The District Office should contact the owner and local Animal Control, if feasible. Central Dispatch should also be notified in the event that the owner calls to inquire of a missing animal.

5. There is a potential hazard when handling dead animals, syringes and other sharp objects. Proper gloves, footwear and clothing should always be worn when engaged in these types of activities.

6. Expert assistance should be obtained to identify unlabelled containers or unidentifiable materials.

7. Suspected explosives, such as pipe bombs, blasting caps or discarded dynamite, shall not be handled and the O.P.P. or local police authority shall be called without delay.

REFERENCES

- Maintenance Manual - All Maintenance Quality Standards
- Maintenance Manual - All Maintenance Best Practices
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Road patrolling consists of driving at a safe speed to look for deficiencies identified in the Maintenance Quality Standards. Road patrolling can be completed as a separate activity or combined with other operations.

2. Actions to Address Hazardous conditions may include, but are not limited to, one or more of the following:

   a) installing signs;
   b) dispatching a work crew;
   c) contacting the police;
   d) undertaking the repair, if it can be completed safely;
   e) contacting the appropriate authorities (i.e.: Central Dispatch, O.P.P., M.O.E., in case of a spill); and
   f) placing appropriate temporary warning signs or markers to warn the public of a Hazard.

3. All deficiencies identified in the Maintenance Quality Standards are important. However, first priority should be given to public safety and road surface items.

4. Damage to MTO property should be reported to the O.P.P. or local police.

5. The vehicle used for road patrolling should contain:

   a) necessary equipment, materials and tools to undertake minor emergency repairs;
   b) signs that can be easily installed to warn motorists of potential safety Hazards; and
   c) a two-way radio programmed to the same frequency as Central Dispatch or a cellular/satellite telephone.

6. Before patrolling an isolated road, the road patroller shall make contact with another employee before and after the trip.

7. When the patroller observes a defect, such as debris on the Roadway that can be Addressed safely, the patroller should do the work in accordance with the OTM.

8. When the patroller observes defects that could be Hazardous, such as washouts or guide rail damage, the patroller should mark the location with a TC 54, safety cone, or hazard marker, to alert motorists.

9. If the patroller suspects that a road closure may be necessary, the O.P.P. or local police shall be contacted. Only the O.P.P. or local police have the authority to close a road.

10. Patrollers who find stranded motorists in isolated areas should inquire if assistance for towing or other services is required. If an incapacitated vehicle is posing a Hazard to other vehicular traffic, (e.g.: on a hill or curve) it should be removed as soon as conditions permit. The O.P.P. or local police force should be called for assistance.

11. All signs, without an approved Ministry permit, within the Right-of-Way should be noted and removed by the patroller where possible.

12. The patroller should discuss, with the holder of the Ministry permit, any nonconformities with the permit.

13. Visual inspection of traffic signal heads and supports should be undertaken following storms accompanied by high winds.

WINTER OPERATION

1. The patroller should have knowledge of Highway areas that typically warrant additional attention during winter operations.

2. Where conditions permit, maintenance personnel should continue with snow and ice control operations on Highways closed by the O.P.P.

3. Patrollers who find stranded motorists in isolated areas should inquire if assistance for towing or other services is required. If an incapacitated vehicle is posing a Hazard to other vehicular traffic, (e.g.: on a hill or curve) or plowing operations, it should be removed as soon as conditions permit. The O.P.P. or local police force should be called for assistance.

4. In addition to the condition of the Roadway surfaces, particular attention should be given to the following items:

   a) the condition and visibility of all Regulatory Signs, Warning Signs and Traffic Control Devices;
   b) railway crossings;
   c) stranded motorists;
   d) drainage problems; and
   e) illumination and traffic signals.

REFERENCES:

- Maintenance Manual - Maintenance Quality Standard MQS-396
- MTO - Sand Domes Inspection Manual (SDIM)
- MTO - Oil/Water Separator Interim Field Guide for Patrol Yards Working Draft
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

INSPECTION:

The condition of the following facility components should be noted on the Facility Inspection Form, contained herein, and retained on file.

Storage Structures

Wooden Rectangular Salt Sheds:

1. **Foundation**

   a) Concrete – cracks, spalling, dislodging
   b) Wood – breaks, alignment, dislodgement or decay

2. **Framing Walls**

   a) Damaged sheeting
   b) Cracked, broken or decayed studs
   c) Loose cables
   d) Door hardware

3. **Roof**

   a) Rafters/Trusses (Any truss damage noted should have an engineering evaluation conducted)
   b) Damage to roofing material

Domes:

1. **Critical Components**

The critical components of the dome structure are the panels, entrance trusses, lintel and compression plugs. During inspection, particular attention shall focus on the condition of these components.

a. **Lintel** -The lintel is the built-up laminated wood beam, which spans between the entrance trusses. This lintel is installed under the panel above the entrance, and is designed to transmit the loads to the entrance trusses.

b. **Compression Plug** - The compression plug is the round built-up disk-like element at the peak of the dome. This plug connects the dome panels together at the peak and locks the building together to maintain its shape.

c. **Panels** - Each panel supports the load from adjacent panels. The design of the panel is a stressed skin component. This means that the plywood, framing members and glue laminate are all very important.

d. **Entrance Trusses** - The entrance trusses are the large triangular shaped components which sit on the foundation entrance wing wall and support the entrance lintel and panels above. They are critical as they provide the structural support at the entrance. Similar to the panels, the plywood covering is laminated to the framing members and is very important to its strength.

2. **Roofing**

a) The condition of dome roofs should be inspected to ensure there are no missing and/or cracked shingles which could cause water leakage.

3. **Bolt Tightness**

a) Bolt tightness should be periodically inspected, since it is possible that the bolts could work themselves loose.

4. **Building Shape**

a) The dome profile should be a consistent, segmented curve with no large sags or bulges at the panel joints. This is best checked by visually observing the profile against the skyline. Any abnormal bulges or irregularities in shape should be Reported to the District Office and usually require an engineering evaluation to determine the cause.

Fabric Structures:

1. **Base Tensioning**

   a) The base tensioning system should be inspected to ensure that the fabric membrane is properly tensioned over the structural frame.

MAINTENANCE

Grounds:

1. **Septic Tanks & Tile Beds**

   a) Vehicles and equipment should not be parked or driven on top of septic tanks and tile beds.

2. **Fencing/Gates & Perimeter Lighting**

   a) Fencing, gates and perimeter lighting should be maintained in good condition.

3. **Asphalt Pads & Catch Basins**

   a) Asphalt pads and catch basins should be maintained in good condition to prevent salt brine from entering the ground water system.

4. **Fuel/Waste Oil Storage**

   a) All new or temporary fuel installations shall be in above ground containers that comply with Federal and Provincial legislation.

   b) Waste oil shall be stored in an approved above ground waste oil storage tank.

5. **Drainage**

   a) Perimeter ditches should be kept clear of obstructions.

   b) All drain inlets and outlets should be kept free and clear of any obstruction.

6. **Material Storage**

   a) All materials shall be stored in accordance with Federal and Provincial legislation and recommended procedures.

7. **Snow & Ice**

   a) Snow and ice should be removed from areas in front of overhead garage doors and storage structures during and after a storm.

   b) De-icing materials should be cleaned from both the garage floors and the patrol yard aprons before the material enters the drainage system. The material collected shall be re-deposited into the covered material pile.

   c) All travelled portions and parking areas should be kept free of snow and ice accumulations by using a minimum of de-icing agents.

8. **Housekeeping**

   a) Housekeeping and yard maintenance should be performed to achieve and maintain a tidy and orderly appearance.

Storage Structures

Wooden Rectangular Salt Shed:

1. **Doors**

   a) Doors should be installed and maintained on all salt sheds and should remain closed, except when materials are required. Salt sheds with a minimum extended overhang of 2m above the entrance eliminates the need for a door. For such sheds, salt should be stored far enough into these sheds to ensure that it does not become wet as a result of inclement weather.

   b) Where repairs are required on the front of the salt shed, consideration should be given to widening the opening to a minimum of 5m, if the structure will allow for a door or canopy to be installed.

2. **Walls**

   c) The wooden back wall of the salt sheds is susceptible to being pushed out or displaced due to the loader applying pressure while handling material. One method of treatment is to install a flat steel stock, such as a used grader blade, attached to the concrete foundation and extended approximately two feet above to act as reinforcement for the wooden wall.

3. **Roof**

    d) Where re-roofing is required, it is recommended that a minimum of 30-gauge steel be overlaid directly on top of the existing asphalt shingles. In addition:

        i) All cables should be kept snug;
        ii) All hardware should be galvanized; and
        iii) All salt sheds should be painted every 4 years.

Domes:

1. **Roofing**

    a. Missing shingles should be replaced. If left unrepaired, water leakage could lead to decay of the plywood.

    b. Before shingling the domes, skirts should be built to deflect the water away from the foundation.

    c. All canopies should have steel roofing applied. In areas where snow load is a concern, consideration should be given to retrofitting to a gable system.

    d. Vents should be replaced or installed when buildings are re-shingled. Missing vents should be replaced.

    e. All repairs to panels should be done with approved structural glue.

    f. Lightning rods may be utilized in areas susceptible to thunder storms.

2. **Bolt Tightness**

    a. Prefabricated modular panels are bolted together with structural bolts. When installed, the bolts are tightened to a snug-tight condition so they cannot be loosened by hand. Bolts should be re-tightened if necessary, since it is possible that they could work themselves loose. Special care should be used to ensure the bolts are not over-tightened as this may cause crushing of the wood fibres.

3. **Building Shape**

    a. It is very important that the stored material be piled no higher, against the foundation/retaining wall, than 0.3m below the top of the concrete foundation or retaining wall and not allowed to rest against the dome.

b. Snow should be removed from the external perimeter of the salt/sand storage building to at least 300mm below the top of the concrete support wall.

4. **Concrete Foundation Wall**

a. In the unlikely event of damage or sub-soil settlement, any cracks or chips in the concrete should be cleaned and grouted to protect the reinforcing steel.

b. Anchor bolts, which connect the dome superstructure to the concrete foundation should be greased or oiled annually to protect the bolts and prevent the nuts from seizing.

Fabric Structures:

1. **Fabric**

a) Fabric should be prevented from rubbing against any surface that may result in a rip or tear of the fabric.

b) Repairs to fabric should be completed by applying a compatible patching material.

c) Extreme caution should be exercised when working or operating equipment around the structure to ensure fabric is not damaged.

d) Fabric structures should be maintained according to manufacturer's recommendations.

2. **Cables**

a) Cables should be properly tensioned.

b) All loose cable ends should be taped.

Facilities Inspection Form

Component		Defects		Maintenance Requirements/ Comments
		YES	NO	
Grounds	Fences/Gates			
	Waste Piles/Debris			
	Asphalt			
	Catch Basins			
	Ground Water Priming Systems			
Garage/Office Buildings	Windows			
	Floor Drains			
	Entrance Doors			
	Garage Doors			
	Fire Extinguishers			
	Siding			
	Roof			
	Floors			
	Walls			
	Paint			
	Housekeeping			
	Septic Tanks & Tile Beds			
	Oil/Water Separator Systems			
	Well & Water Pump			
	Heating Systems			
	Air Conditioning Systems			
	Plumbing			
	Electrical/Lighting			
Storage Structures	Entrance Trusses			
	Entrance Lintel			
	Canopy Walls			
	Canopy Joist			
	Canopy Roof			
	Anchor Bolts			
	Foundation Wing Walls			
	Floor Surface			
	Anchor Bolts			
	Sill Plates			
	Panels/Frame Walls			
	Vents			
	Dormer			
	Plug/Compression Ring			
	Foundation			
	Shingles/ Fabric			
	Dome Profile			
	Fall Arrest Systems			

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-501
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Drainage Manual
- Pavement Design and Rehabilitation Manual

BEST PRACTICES

1. The detailed spring and fall inspections should be carried out by driving along the Shoulder noting any deficiencies, including but not limited to, illegal outlets to ministry property, ponding and erosion.

2. Specific inspections of a drainage area that requires more frequent monitoring due to repeated flooding or washouts should be Reported to the District Office.

3. During inspections, maintenance staff should attempt to determine the cause of the defect and report their findings to the District Office. Defects may include sloughing of back or front-slopes, ditch obstructions (vegetation, rock slides), outlet and inlet scouring or damaged pipes (rusted, buckled, separated).

4. During ditching operations, environmental protection practices shall be in accordance with EP-3 to protect downstream watercourses.

5. Excess materials from ditching shall be disposed of in accordance with EP-9.

6. Ditching should be conducted in dry weather.

7. The Municipal Drainage Superintendent and the District Office shall be notified before any work is conducted at/on Municipal drains.

8. Ditch cleaning equipment/machinery shall not be operated within 3m of energized overhead electrical conductors. Prior to any digging or ditching operations, all utilities must be clearly located and marked in the work area.

9. Beaver dams may present a problem to the Highway and should be monitored during routine road patrol drive-by inspection. MNR should be consulted prior to removal of beaver dams.

10. Some basic principles of drainage should be kept in mind when monitoring areas of concern. They are:

    a) There is no “right of drainage” for surface water, therefore the Ministry as a landowner is not obligated to accept water from adjacent landowners, without giving permission, other than from a natural watercourse;
    b) A landowner may not collect surface water (eg ditch, curb and gutter, tile drains, eavestroughs etc.) and discharge it on to the lands of others;
    c) Once surface or subsurface water is collected it must be taken to a sufficient outlet where it can be discharged and do no harm;
    d) A landowner may increase the elevation of his/her property and stop surface flow without being required to take the water to an outlet;
    e) Landowners are not required to clean obstructions from natural watercourses. However, if they do clean the channel they are liable for any damages their work may cause;
    f) The Drainage Act is legislation which permits landowners to get their collected water to a sufficient outlet; and
    g) Municipal Drains are under the jurisdiction of the Municipal Drainage Superintendent, and all work within a municipal drain, or the outletting of additional drainage water into a municipal drain, requires his/her permission.

11. Seeding or sodding may be required to prevent erosion after ditching operations have been carried out.

12. Rip-rap can be used as ditch lining in areas where erosion is a recurring problem.

13. Areas that require on-going work and monitoring should be noted in the work plan for consideration under the capital or preservation management programs for future rehabilitation.

14. Water flow in ditches should be monitored during road patrol. Any abnormalities in the normal flow of water in ditches should be investigated to determine the cause.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-502 & MQS-505
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Drainage Manual

BEST PRACTICES

1. Culvert or sub-drain installations that require repeated cleaning and repair, due to silt, debris and/or other material build-up, rusting or deterioration, etc., to restore the proper function of the appliance, should be monitored.

2. The Municipal Drainage Superintendent and the District Office shall be notified before any work is conducted at/on municipal drains.

3. During inspection, maintenance staff should attempt to determine the cause of the defect and Report their findings to the District Office. Defects may include culvert fatigue (due to aging, rusting, frost heaving, undermining, scouring and crushing), bent or damaged inlets/outlets, restricted water flow and headwall movement, etc.

4. For culverts with a diameter greater than 700mm, inspections should be recorded on the Culvert Inspection Form contained herein.

5. Subdrains should be marked for ease in locating.

6. When working on culverts, sub-drains and outlets, environmental protection practices shall be in accordance with EP-3 to protect downstream watercourses.

7. Safety precautions in accordance with OHSH-2 shall be taken for any work that requires workers to enter a “confined space”.

8. Installations or repair work should be conducted in dry weather if possible.

9. Screens may be required at some locations to prevent people or animals from entering drainage facilities.

10. Culverts or other drainage facilities that are causing problems and require on-going work and monitoring should be noted in the work plan for consideration under the capital or preservation management programs.

CULVERT INSPECTION FORM

INSPECTION DATE: _____

LOCATION: _____ HIGHWAY NO. _____

INSPECTED BY: _____
(PLEASE PRINT)

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. Up/Down Stream, North, East, West, South, Wall, Top, Bottom, Distance From	REMARKS/EXTENT OF DAMAGE
WATER DAMAGE (ALL CULVERTS)			
Scouring around the footings or any undermining of concrete aprons or cut-offs			
Washout of culvert backfills			
Scouring at inlets or outlets			
Erosion under or around culvert			
Loss or displacement of hand-laid and grouted rip rap			

CULVERT INSPECTION FORM

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. Up/Down Stream, North, East, West, South, Wall, Top, Bottom, Distance From	REMARKS/EXTENT OF DAMAGE
CONCRETE CULVERTS			
Cracks, spalling or deterioration			
Broken, damaged or missing security bars or grids			
Reinforcing steel exposed			
Stream-bed lower than culvert footing			
METAL CULVERTS (CSP)			
End(s) are deformed			
Broken, damaged or missing security bars or grids			
Headwall moved away from backfill			

CULVERT INSPECTION FORM

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. Up/Down Stream, North, East, West, South, Wall, Top, Bottom, Distance From	REMARKS/EXTENT OF DAMAGE
METAL CULVERT (CSP) (cont.)			
Culvert changed shape			
Coupling ring(s) failing			
Longitudinal seams failing			
Pipe walls rupturing or buckling			
Gaps developed between overlapping corrugations			
Cracks or corrosion			
Bolt holes are larger than the bolt and do not secure plates			

CULVERT INSPECTION FORM

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. Up/Down Stream, North, East, West, South, Wall, Top, Bottom, Distance From	REMARKS/EXTENT OF DAMAGE
METAL CULVERTS (CSP) (cont.)			
Bolts or rivets shearing, loosening, missing or deteriorating			
Pipe material corroding/ deteriorating			
Pipe uplift at inlet/outlets			
TIMBER CULVERTS			
Bowed centre supports causing deck sagging			
Displaced timbers			
Granular material not level with sills			
Unsound wood			

CULVERT INSPECTION FORM

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. Up/Down Stream, North, East, West, South, Wall, Top, Bottom, Distance From	REMARKS/EXTENT OF DAMAGE
PLASTIC CULVERTS			
End(s) are deformed			
Pipe uplift at inlet/outlets			

MAINTENANCE BEST PRACTICE
CURB and GUTTER, CATCHBASINS, MAINTENANCE ACCESS POINTS, DITCH INLETS, and OUTFALLS

MBP-503

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-503 & MQS-504
- Maintenance Manual - Environmental Best Practices
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Detailed catchbasin, maintenance access points, ditch inlet and outfall inspections should be done during cleaning operations. For catchbasins, maintenance access points, and ditch inlets and outfalls, defects should be recorded on the “Catchbasin, Maintenance Access Points, Ditch Inlet and Outfall Inspection Form” contained herein.

2. Curbs and gutters or catchbasins, maintenance access points and ditch inlet and outfall installations that require on-going cleaning and repair due to waterponding, settlement, erosion, excessive weed growth or other defects, to restore the proper function of the appliance should be monitored.

3. During inspections, maintenance staff should attempt to determine the cause of the defect and report their findings to the District Office.

4. Locations where the edge of the concrete gutter has separated from the edge of the asphalt surface and a crack has opened, the crack should be filled.

5. Safety precautions in accordance with OHSH-2 shall be taken for any work that requires workers to enter a “confined space”.

6. All materials removed from a drainage appliance shall be disposed of in accordance with EP-9.

7. Installations or repair work should be conducted in dry weather, if possible.

8. Drainage facilities causing problems that require on-going work and monitoring should be noted in the work plan for consideration under the capital or preservation management programs.

CATCHBASIN, MAINTENANCE ACCESS POINTS, DITCH INLET & OUTFALL INSPECTION FORM

INSPECTION DATE: _____

LOCATION: _____ HIGHWAY NO. _____

INSPECTED BY: _____
(PLEASE PRINT)

INSPECTION ITEM	Y/N	LOCATION OF DAMAGE eg. North, East, West, South, Wall, Bottom, Distance From	REMARKS/ EXTENT OF DAMAGE*
Cracks			
Spalling			
Holes			
Missing, broken or damaged frames, grates and anchoring devices			
Ladder rungs that are broken, missing or badly rusted			
Crumbling or broken bricks or concrete rings			
Depressions around catch basins or manholes			

*Attach additional information if necessary.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-551
- Ontario Structure Inspection Manual (OSIM)
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Safety Practices for Structure Inspection

BEST PRACTICES

DEFECTS

The following conditions should be inspected and noted on the Bridge Maintenance Inspection Form included in MQS-551:

1. **Surface**

   a) Condition of asphalt/concrete surface for potholes, rutting, scaling, cracks and slipperiness.

   b) Other defects including, but not limited to, debris and sand accumulation and water ponding.

2. **Drainage**

   Condition of deck surface drains, frames, grates, down pipes and end-dam drains.

3. **Expansion Joints**

   a) Condition of joint seal, armour, end dams, slider plates, clamping bars, welds and modular joint components.

   b) Elevation and alignment of joints.

   c) Other defects including, but not limited to, loose nuts, bolts and accumulation of dirt and debris in joint seals.

4. **Curbs, Sidewalks and Barrier Walls**

   Condition of curbs, sidewalks and barrier walls for scaling, spalling, delamination, exposed rebar and cracking.

5. **Handrails and Posts**

   Condition of handrails, posts, fasteners, paint, welds for cracks, corrosion, bending, twisting and other defects.

6. **Approaches**

   a) Condition of asphalt/concrete approach surface for potholes, rutting, scaling, cracks, slippery surface and other defects.

   b) Settlement and tilting.

7. **Lighting, Signs and Guide Rail**

   Condition of lighting, signs, guide rail, fasteners, coatings and other attachments for broken, cracked or missing components. Other attachments can include anti-glare screens, sound/snow barriers, anti-splash panels and navigation lights.

8. **Timber**

   Condition of timber members, deck planks, fasteners and deck surface for damage, breaks, crushing, cracks, warping, bulging, vibration, deterioration and other defects due to rotting or boring insects, loosening, excessive wearing or other causes.

9. **Girders, Beams and Diaphragms**

   a) Condition of concrete/steel girders, beams, diaphragms, welds and paint for cracks, twisting, misalignment, spalling, delamination, corrosion and other defects.

   b) Missing, loose and broken fasteners.

10. **Steel Members**

    a) Condition of steel members (trusses, bracing, portal), welds and coating for corrosion, cracks, bending, twisting and other defects.

    b) Dirt and debris on bottom flanges and fasteners.

11. **Bearings**

    a) Condition of bearings, welds, fasteners and pads for cracks, corrosion, misalignment, deterioration and other defects.

    b) Condition of other components such as cover plates, rollers, bearing seats and bearing lubricants.

12. **Slopes and Embankments**

    Condition of slopes and embankments for erosion, undermining, animal burrows and other defects.

13. **Brush and Trees**

    Growth of brush and trees preventing a clear view of a bridge, contacting a bridge, preventing free movement of water and/or obstructing drainage.

14. **Sub-Structure**

    Condition of sub-structure components such as abutments, piers, piles, pier caps, ballast/retaining/wing walls and footings for scaling, cracking, delamination, tilting, misalignment, scouring, spalling and settlement.

15. **Soffit and Fascia**

    Condition of soffit and fascia for scaling, cracking, delamination and spalling.

16. **General**

    a) Unusual noise and/or movement can indicate potential problems.

    b) Generally, the detailed inspection should be performed in conjunction with the bridge washing schedule since it is easier to identify defects when components are clean.

    c) Equipment commonly used in bridge inspection includes a measuring tape, binoculars, ladder, marking paint, camera and prospector's hammer.

    d) Whenever possible, inspections should be carried out in conjunction with the biannual Regional Structural Section schedule.

    e) Working in and around water shall be in accordance with the Occupational Health and Safety Act and the Ministry’s Occupational Health and Safety policies and guidelines (refer to OHSH-15).

MBP-552

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-552
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. **Equipment**

   a) The minimum requirement for pressure washing equipment is 520 kPa with a volume of 225 litres per minute, continuously running.

   b) A water tank with a minimum capacity of 9000 litres is recommended.

2. **Procedures**

   a) The accumulation of winter sand, salt and debris shall be removed prior to washing. This can be done manually or by mechanical sweeping.

   b) Particular attention should be given to the cleaning and flushing of any pockets formed where vertical and diagonal members connect to the bottom chord. Bottom truss chords should be cleaned and flushed along their entire length.

   c) No washing should take place when there is a potential for temperatures below 0ºC.

   d) When washing structures, debris shall not be dropped on vehicles and/or pedestrians passing below.

   e) Washing should occur from higher to lower elevation to allow the water to carry debris downwards.

   f) Local authorities should be consulted for permits and regulations before obtaining water from hydrants.

   g) Caution should be exercised when cleaning expansion joints so as not to damage the seal.

h) Working in and around water shall be in accordance with the Occupational Health and Safety Act and the Ministry's Occupational Health and Safety policies and guidelines (refer to OHSH-15).

i) Refer to the Environmental Protection, EP-4, for dealing with birds' nests found on structures.

j) When performing cleaning operations, workers may be exposed to bird droppings and feathers from birds or bats. These materials may carry spores of infectious diseases. To control dust exposure, these materials should be wetted before removal and workers should wear appropriate personal protective equipment including disposable masks, gloves and coveralls. If materials cannot be dampened before removal, the worker should also wear a high efficiency particulate air (HEPA) filter. Before leaving the work site, protective clothing should be removed and dust should be washed from footwear.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-553
- Maintenance Manual - Maintenance Best Practices MBP-101 & MBP-102
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Bridge surface deterioration should be monitored.

2. The use of hot and cold mixed materials for repairing bridge surfaces is a temporary and economical practice to hold the surface in a safe condition until such time as major restoration projects or permanent repairs with special concrete mixes are initiated.

3. When observing surface deterioration, maintenance personnel should attempt to determine the cause. Deterioration can be caused by age, excessive movement, water entering cracks and joint sealant failure. Continuous, or rapidly deteriorating conditions, should be reported to the District Office.

4. Areas that have become polished and potentially slippery should be signed and noted in next year's work plan for consideration under the capital or preservation management programs.

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-555
- Maintenance Manual - Maintenance Best Practice MBP-552
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Directive PHY-C-180 - Trapping Nuisance Beavers
- MTO Safety Directive B-12 - Explosives Use by MTO Employees

BEST PRACTICES

1. Debris removed from a waterway in or around a structure opening should be placed in such a manner that it will not re-enter the waterway.

2. Debris, sediment or vegetation build-up at an inlet or outlet may be removed using a backhoe or excavator.

3. All vegetation and structural features not specified for removal shall be preserved in order to minimize erosion and sedimentation.

4. It may be necessary to remove obstructions inside a structure by using a dragline or high pressure water jet.

5. Working in and around water shall be in accordance with the Occupational Health and Safety Act and the Ministry's Occupational Health and Safety policies and guidelines (refer to OHSH-15).

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-556
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

Expansion Joints

1. Some types of leaking joint seals can be temporarily repaired using vulcanized rubber when permanent repairs cannot be immediately completed. This method works best when the ambient temperature is above 10°C.

2. Voids under joint armour can be detected by sounding with a hammer. Voids can be filled using epoxy injection methods.

3. To correct misaligned joint armour that is being damaged by the snowplow, weld wearing beads on leading edge. Finger plate style joints can be ground flush.

4. To allow a plow blade to travel over a joint that is skewed at the same angle as the plow blade, the joint should be filled with hot poured rubberized asphalt or small metal slider plates (joint fingers) should be welded to the joint facing traffic. Do not place slider plates in wheel tracks or near the centreline.

5. To avoid damage to a joint seal, water should be used to keep the seal cool whenever applying excessive heat (grinding, welding, and oxy-acetylene torches).

Bearings

1. Sealed roller bearings should be greased in the spring after washing and in the fall using an approved lubricant.

2. Rocker bearings should not be lubricated. Experience has shown that grease tends to attract additional debris which leads to premature wear of the bearings.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-557 & MQS-555
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

1. Before modifying existing drainage systems to redirect water away from the erosion area, the Regional Structural Section shall be consulted.

2. Rip-rap or patio stones should be placed on the ground beneath deck drains.

3. Curb & gutter and/or catchbasins should be installed to redirect water flow.

4. Spillways should be installed using concrete, asphalt or an old C.S.P. split in half.

5. Eavestroughing should be installed on abutment walls to direct water away from the slope backfill.

6. Eroded areas can be repaired using materials such as Granular A, O, M, rock fill, cold mix or RAP.

7. Use of geotextile filter cloths, rip-rap, plantings, retaining walls and gabions are common erosion control methods.

8. Working in and around water shall be in accordance with the Occupational Health and Safety Act and the Ministry's Occupational Health and Safety policies and guidelines (refer to OHSH-15).

REFERENCES

- Maintenance Manual - Maintenance Quality Standard MQS-558
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Bailey Bridge Manual
- Acrow Manual
- MTO Directive: PLNG-B-007

BEST PRACTICES

1. Parts requiring adjustment or tightening may be rust-frozen and require the application of penetrating oil to loosen. Heat shall not be applied without approval from the Regional Structural Section.

2. A road closure may be required to perform certain maintenance. Proper authorization shall be obtained from the O.P.P. or local police where a road closure is necessary. Schools, hospitals and municipalities should be notified where there is a closure.

3. The Regional Structural Section shall be contacted for jacking locations.

4. All fasteners should be lubricated in the spring, after cleaning, and again in the fall before winter freeze-up.

5. All replacement parts shall meet manufacturers' specifications. Components shall not be interchanged without approval from the Regional Structural Section.

6. If a missing panel pin is detected during inspection, adjacent panels should be inspected for broken or cracked welds.

7. Guide rail should be installed on the second story of multiple story structures.

8. Ensure that grillage/mudsill timbers are in good condition when correcting the alignment of bearing bases.

9. Working in and around water shall be in accordance with the Occupational Health and Safety Act and the Ministry's Occupational Health and Safety policies and guidelines (refer to OHSH-15).

10. The Environmental Protection section (EP-4) should be referred to when birds' nests are encountered on structures.

11. Differential settlement of bearings or bearing base plates should be corrected by jacking the bridge and installing wood or steel shims to ensure that the bridge is level transversely and the top chords are in line longitudinally.

12. Settled ramp ends should be jacked, shimmed and re-seated to maintain correct approach alignment.

REFERENCES:

- Maintenance Manual - Maintenance Quality Standard MQS-601
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Ontario Traffic Manual (OTM)

BEST PRACTICES

A variety of pavement marking materials and technologies are available for the marking of Highways. To ensure successful performance of pavement markings, special attention should be given to material selection, application methods and quality control procedures.

PAVEMENT MARKING MATERIAL SELECTION

1. In order to determine the type of pavement marking material to be applied, consideration should be given primarily to the A.A.D.T. and surface type. Recommended pavement marking materials for a wide range of surface types are described in the MTO Pavement Marking Manual.

   a) The use of durable type markings in rural communities will be influenced by traffic volumes and turning movements. However, should a site present potential safety hazards to the application crew during installation, durables are recommended for use regardless of A.A.D.T.

   b) The use of durable type markings should be considered at high accident rate locations where painted pavement markings do not last through the winter months.

PAVEMENT MARKING APPLICATION

1. The site should be inspected to determine if surface preparation is necessary.

2. To ensure good bonding of the material to the Roadway, surface preparation is mandatory prior to application of durable markings on any existing pavement type condition, and shall be in accordance with specifications and manufacturers' recommendations. Generally the area where pavement markings are to be applied shall be dry and free of contaminants such as: sand, salt, aggregates, oil, dust and dust suppressant. To accomplish this, a thorough sweeping or cleaning with compressed air should be carried out just before application.

3. The concrete curing agent should be removed and the manufacturer's suggested primer/sealer placed on new and existing concrete surfaces where Field Reacted Polymeric Marking Materials will be applied.

4. The OTM should be referred to for pavement marking color, locations, line widths and spacings. Durable markings on freeways should be offset at least 5cm from longitudinal joints.

5. Pavement markings shall not be applied within 30cm of the reflective lens of permanent Roadway markers.

6. Markings should follow premarks closely and shall conform to the plans.

7. Leading edges of durable markings should be tapered when applied.

8. An overlay of glass beads shall be applied, without delay after painting either by hand or mechanical means, to achieve complete and uniform coverage across the full width of the line.

9. Inlaid durable markings are recommended in areas where other materials have not performed satisfactorily.

TEMPORARY PAVEMENT MARKING

The following factors should be considered before selecting the appropriate temporary pavement marking material. Is the pavement:

a) existing or new, and if existing will it be left in place?
b) to be overlaid or removed during or after the completion of a project?

Traffic paint, spray durables and durables are products that are not removable without the use of some type of mechanical means, such as grinding. When these materials are removed a scar remains on the pavement that can be confusing to motorists.

Existing/New Pavement to be Left in Place

1. Only “Temporary Removable Pavement Marking Tapes” and “Temporary Removable Black Mask Marking Tapes” should be used in order to avoid scarring of the pavement.

2. Traffic paint may be used when specification conditions for “Temporary Removable Pavement Marking Tapes” cannot be met. To avoid scarring, abrasive blasting should be used when removing traffic paints.

Overlaid/Removed Pavement Surfaces

"Temporary Pavement Marking Tapes" can be used where the material will be paved over or where the pavement will be removed.

Note: "Temporary Pavement Marking Tape" is not intended for use where removal will be necessary for construction stages.

MARKING REMOVAL

Approved removal methods should be used to ensure as little scarring as possible.

ROADWAY MARKERS

Roadway Markers can be an effective means of enhancing Roadway delineation and may be used in conjunction with other pavement markings as specified in the OTM.

These markers may only be used on the recommendation of the Regional Traffic Office.

Permanent Roadway Markers

1. When relensing, old reflectors should be removed from castings.
2. To ensure that the new reflector mounts flush, the casting should be cleaned down to the surface metal where the new reflector is to be installed. All of the old adhesive pad shall be removed.
3. A casting should be replaced if the casting:
   a) Has any part missing;
   b) Is loose;
   c) Is cracked and has a potential to dislodge; or
   d) Is worn so that the lens sits higher than the snow plow rails of the casting.

Manufacturer's instructions and the MTO Pavement Marking Manual should be followed when replacing castings.

Temporary Raised Pavement Markers

Where the use of Temporary Raised Pavement Markers is recommended:

1. The Roadway surface should be cleaned and primed to ensure maximum adhesion of each marker.

2. The use of an adhesive butyl pad is acceptable where vehicle volumes and speeds are low.

3. An approved durable type adhesive should be used to hold the marker in place in locations where vehicle volumes and speeds are high.

4. The rumble strip effect and daytime visibility of markers can be enhanced by decreasing their spacing.

REFERENCES:

- Maintenance Manual - Maintenance Quality Standards MQS-604 & MQS-605
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Population Sign Directive
- MTO King's Highway Guide Signing Policy Manual
- MTO Sign Support Manual
- Ontario Traffic Manual (OTM)
- MTO Sign Support Inspection Guidelines
- Highway Traffic Act
- MTO Tourism-Oriented Directional Signing Policy (TODS) Manual
- MTO Logo Sign System Policy Manual

BEST PRACTICE:

1. Utility locates shall be carried out where appropriate.

2. Sign inspections should be carried out when the surface of the sign is dry.

3. Breakaway steel sign supports should be inspected and pressure washed at the base to clear away sand/salt and debris as required.

4. Finish grading around the sign support base should be maintained in accordance with the installation manual.

MOUNTING POSTS

Steel:

1. Steel posts shall be assembled with two sections of "U" flange bolting them together using hex head bolts. All steel posts should be driven a minimum of 90cm into the ground.

2. Provincial highway route markers and small metal signs up to and including 75cm x 45cm size, shall be attached to "U" flange steel posts using hex head bolts and post filler.

3. Small metal signs, delineators and plow markers shall be attached to tubular steel posts with appropriate fasteners.

Wood:

1. Larger metal signs and plywood signs shall be attached to wooden posts 10cm x 10cm, or 15cm x 15cm, depending on the sign size. The sign placement detail drawings indicate the post size that should be used with various sign sizes.

2. Galvanized lag screws and washers should be used when fastening all signs to either wood or steel posts.

3. Wood posts should be dug a minimum of 1m and preferably 1.2m into the ground. Posts shall not extend above the sign.

4. In areas where signs cannot be dug in due to rock, signs may be reinforced using: Crows Feet, Buried Stand, Cribbing or Corrugated Steel Pipe.

5. One method of installing signs with 2 posts is to dig both holes, attach pre-determined lengths of posts to the sign(s), set the assembled sign and posts into the holes, check the horizontal level of the sign, level accordingly by either removing or adding fill to the holes, add fill and tamp posts into place, and continue vertical plumb checks on front and side view of the posts.

6. There are other accepted methods of installing signs. The above should be considered as a guide to assist in the placement of traffic signs. Local conditions may warrant an increase in the size or type of post used to support signs.

SIGN MAINTENANCE

Cleaning:

1. The face of the signs should be cleaned by a method that does not scratch or damage the reflective sheeting.

2. Graffiti should be removed using an approved method. The use of an approved clear coat overlay is recommended in areas with recurring graffiti problems.

Temporary Repairs:

When conditions do not allow for the replacement of sign supports, signs should be mounted on a portable stand or other acceptable method that will maintain the integrity of the sign.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-661, 662, 663, 664 & 665
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- Ontario Provincial Standard Drawings (OPSD's)

BEST PRACTICES

The Ministry maintains many types of traffic barrier systems, each having their own maintenance requirements.

General

1. Any traffic barrier system installation where greater than 50% is damaged or deteriorated should undergo an assessment for system upgrade to current standards. These recommendations should be forwarded to the District for implementation.

2. As part of the inspection of a damaged traffic barrier system, an inspection of the surrounding area for additional damage to Ministry property (e.g.: bridge piers, sign posts, anchor blocks, Shoulders and light standards) should be conducted.

3. In order to meet response times in the Maintenance Quality Standards, traffic barrier materials should be readily available.

4. Special attention should be given to traffic barrier systems that are frequently damaged. Hazard markers should be strategically located to warn motorists and be easily accessible by maintenance workers.

5. All winter maintenance operators (MTO and Contractors) should be familiar with the location of traffic barrier systems to reduce the risk of damage to the systems by winter maintenance equipment. All traffic barrier systems should be easily identifiable (i.e.: hazard markers at Energy Absorbing Systems (EAS's), green/white delineators at guiderail ends, reflectorized strips).

6. All damage resulting from winter maintenance operations should be documented and scheduled for repairs.

7. Reusable materials that are structurally sound should be incorporated into the work.

8. Damage to the surrounding infrastructure resulting from traffic barrier system repairs should be corrected to restore the infrastructure to its original condition.

9. The Shoulder area under and around guide rail installations should be maintained to ensure positive drainage for Roadway runoff.

10. A melting agent (e.g.: calcium chloride) can be placed around posts to assist with post removal in the winter months.

11. The soundness of posts can be checked by tapping with small sledge hammer.

Cable Guide Rail

The major components affecting the performance of this system are post stability, and cable height and continuity.

1. The cable height shall be measured from the ground below the cable to the cable. The height shall be as per the applicable OPSD's.

2. When replacing cable guide rail posts, the height of the post from ground level to the top, and to the cut off, shall be as per the applicable OPSD's.

3. All fittings and splicers should be sound and in good working order. Cable strands shall be properly installed and bent over the wedge in splice fittings. Multiple splices on the same cable shall be spaced at least 15 metres apart. There shall be no more than one splice per panel.

4. Cables shall be securely fastened to each wooden post with approved fasteners. There should be sufficient clearance in the staples to enable the cables to move during tensioning. Tensioning should be such as to allow for temperature variances. Do not over-tension.

Steel Beam Guide Rail

1. The beam height shall be measured from the ground below the beam to the beam. The height shall be as per the applicable OPSD's.

2. When replacing posts, the height of the post from ground level shall conform to the applicable OPSDs.

3. Rails and channels shall overlap in the direction of traffic flow.

4. Rails and channels shall be bolted securely to the mounting posts. Missing bolts and nuts shall be replaced. The ends of the bolts should be cut off flush with the face of the nut.

5. Rails and channels shall be secured to structures as per OPSD's.

Box Beam Guide Rail

The major components affecting the performance of this system are height, continuity and joint strength.

1. Box beam guide rail shall be secured to support structures as per OPSD's.

Concrete Barriers

The major component affecting the performance of this system is system continuity.

1. The larger the broken area, the higher the repair priority. In addition, the repair and repair surface profile, once completed, should be as close to the original system as possible.

Energy Absorbing Systems (EAS's)

1. The alignment of the system should be checked in the event of the following: excessive snow accumulations, severe washouts or severe frost.

2. If the system is out of alignment, or has been damaged as the result of an impact, repairs shall be made as per the approved manufacturer's specifications.

3. For damaged EAS's, inspections should be recorded on the "Energy Absorbing Systems Inspection Form" contained herein.

4. Missing hardware/parts shall be replaced as per approved manufacturer's specifications.

5. All surfaces on which EAS's rest shall be maintained as per approved manufacturer's specification.

TEMPORARY REPAIRS

Traffic control devices should be used to warn motorists of all extensively damaged traffic barrier systems.

Cable Guide Rail

1. Temporary measures should be taken to maintain cable height (e.g.: TC-52 stands, T-bars, U-flange post or round iron bars).

2. T-bars should be driven about 325mm into the ground or into the top of a broken timber post and cables attached appropriately.

Box Beam

1. One of the major advantages of box beam is that it can be made operational and effective after a collision by the use of appropriate temporary support repairs. The temporary support used should not protrude more than 2cm from the vertical face of the beam element. It is critical that the impact face of the beam be as smooth as possible and snag free. In addition, no more supports than absolutely necessary should be used. It is suggested that if more than 5 successive temporary supports are required, the beam should be permanently repaired as soon as possible to avoid the system tipping or breaking due to larger-than-usual deflections.

2. Where a splice hole is damaged, a new threaded hole should be created close by and a bolt installed. It is important to have the required number of bolts. When possible, an 8 bolt pattern should be used as per the design requirements to provide sufficient strength.

Concrete Barriers

1. Steel beam rails should be attached to sound concrete on either side of the “break-out”, major cracks or large pieces of missing concrete on the side adjacent to traffic. Steel beam rails should be attached as per OPSD 921.060 using a double end steel beam end section. A pre-manufactured double-end or a bolted-together single-end section should be used.

Energy Absorbing Systems
Inspection Form

Date: _____

Highway: _____

Location: _____

System Type: _____Investigated by Police: Yes_____ No_____

Accident Report #_____

Damage:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Date to be repaired: _____ Inspector: _____

Repairs completed:

_____
_____
_____
_____
_____
_____
_____
_____
_____
_____

Date completed: _____ Inspector: _____

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-701 & MQS-702
- Maintenance Manual - Maintenance Best Practices MBP-702 & MBP-703

The following winter maintenance summary is a compilation of Maintenance Quality Standards, and Maintenance Best Practices. Conditions will dictate the appropriate work required:

	CLASS 1	CLASS 2	CLASS 3	CLASS 4	CLASS 5
WINTER MAINTENANCE - LEVEL OF SERVICE (MQS-701)					
Primary Objective	Essentially Bare Pavement	Essentially Bare Pavement	Essentially Bare Pavement	Essentially Bare Pavement	Snow Pack
Time to Meet Primary Objective A.S.A.P. after the storm, not exceeding:	8 Hrs.	16 Hrs.	24 Hrs.	Centre-bare within 24 Hrs. And essentially bare pavement when conditions permit	24 Hrs.
WINTER MAINTENANCE - OPERATIONS (MQS-702 & MBP-702)					
SALTING					
Begin salting:					
- When snow accumulation:	<0.5 cm	<0.5 cm	<0.5 cm	<0.5 cm	N/A
- During icy conditions	when required	when required	when required	when required	N/A
- Follow-up salting: **	when required	when required	when required	when required	N/A
PLOWING					
- Begin plowing when accumulation: ***	≤ 2.0 cm	≤ 2.0 cm	≤ 2.0 cm	≤ 2.0 cm	≤ 2.0 cm
SANDING					
- Sand when: ****	Slippery conditions	Slippery conditions	Slippery conditions	Slippery conditions	Slippery conditions
EQUIPMENT COMPLEMENT CALCULATION (MBP-703)					
SALTING					
- Theoretical circuit time: *	1.3 Hrs.	1.8 Hrs.	2.9 Hrs.	4.9 Hrs.	N/A
PLOWING					
- Maximum single lane km/plow:	55 km	75 km	120 km	206 km	336 km
SANDING					
- Theoretical circuit time: *	NA	NA	NA	NA	8 Hrs.

WINTER MAINTENANCE - SUMMARY

* Circuit time is the **theoretical time** required to complete the entire route but does not include the dead-head time to return to the point of departure upon completion of the entire route.

** The need for follow-up salting will be determined by the precipitation, road conditions and weather.

*** Generally, salt on the road takes time to become fully effective and therefore plowing should not normally occur until at least 30 minutes after the salt has been placed, but may occur earlier if warranted due to snow accumulation, ambient temperature, and traffic volume.

**** Sanding should begin as soon as slippery conditions are detected.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-701, 702 & 703
- Maintenance Manual - Maintenance Best Practices MBP-701, MBP-703 & MBP-704
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

GENERAL

1. In the event that the O.P.P. or local police decide to close a highway, maintenance staff may be requested to assist in installing all road closure devices as directed by the O.P.P. This assistance shall not interfere with operations required on roads not to be closed.

2. Snowdrifts should not be permitted to accumulate on the Travelled Portion and should be removed from the Shoulder before the snowdrift extends onto the Travelled Portion.

PATROLLING

While unfavourable weather conditions would normally include precipitation, there may be situations that do not involve precipitation (e.g.: whiteouts and drifting snow due to high winds, dew points, rapidly dropping temperatures, etc.).

1. When unfavourable weather conditions become apparent, determine and document the following where appropriate:

   a) Storm severity and duration;
   b) Type of precipitation (e.g.: wet snow, dry snow, sleet, etc.);
   c) Visibility (good, fair, poor, nil);
   d) Condition of pavement (e.g.: wet, dry, icy, ice patches, etc.);
   e) Wind direction and velocity;
   f) Existing temperature;
   g) Temperature changes (falling or rising); and
   h) Road temperature.

2. The patroller should monitor weather and road conditions during a storm event through radio communications with plow and spreader operators.

3. The patroller should monitor snow and ice control operations to ensure that:

   a) sand or salt is being applied at the correct rate and time;
   b) appropriate speeds are being maintained; and,
   c) material is effective for the conditions.

4. The following activities should be carried out during the periods between storm events after the level of service has been achieved for the Class of Highway:

   a) Monitor drainage facilities (ditches, culverts, catchbasins, deck drains, and storm sewer systems) and complete appropriate work to have them functioning properly;

   b) Check the effectiveness of snow fence and snow hedge locations. Note areas where snow drifts are nearing, or have reached, the top of snow fence. Record observations in the Patrol Diary to assist in next year's planning;

   c) Check all signs and Highway markers to ensure their message is visible to motorists;

   d) Have snow build-up removed from all areas where storage space is restricted/limited:

      i) Where snow or ice is loaded and hauled away, it shall be disposed of at properly selected land sites, based on criteria in the MOE guideline entitled "Snow Disposal and De-icing Operations in Ontario Guideline". Snow disposal shall not be into or near water, or onto ice covered water;

      ii) Where snow or ice is moved or removed from a bridge or causeway over water using a loader or other mechanical means, snow disposal shall not be into or near water, or onto ice covering water.

5. Snowplow sidewalks where agreements are in place.

6. Note any damages which resulted from the storm and:

   a) replace or repair snowplow markers as necessary;

   b) replace or repair all damaged mail boxes. Record location, owner's name and date in the Patrol Diary for future reference.

EQUIPMENT

Vehicles:

This section covers those activities and procedures required to maintain and operate winter maintenance equipment throughout the winter:

1. All equipment should be washed within 24 hours after the end of the storm event.

2. Operation of trucks and loaders inside storage domes shall be guided by the following:

   a) loading operations may proceed in a dome if all equipment is diesel powered;

   b) loading operations shall be performed outside the dome if either the loader or the truck is gasoline powered. A sign to this effect shall be posted at the entrance to each dome;

   c) equipment should not be left idling.

Snowplow Markers:

1. Snowplow markers should be installed for the purpose of identifying the location of obstacles as well as acting as guides to plow operators.

2. Snowplow markers should be installed before the ground freezes, at culvert ends, the beginning and end of structures, the beginning and end of guide rail locations, and wherever else there may be a hazard to the plowing operation.

3. Median snowplow markers should be used where opposing traffic lanes are separated by a median. These markers should be positioned laterally 2m to 2.5m from the edge of the Travelled Portion of the passing lane with the bottom of the marker approximately 1.2m above the Travelled Portion.

   Median snowplow markers should be installed at intervals of 150m along straight Roadway sections and 75m on curves.

OPERATIONS

PLOWING:

1. Plowing should commence upon or before the accumulation of 2cm of snow or slush on the Travelled Portion or sooner if unsafe conditions warrant.

2. Maximum plowing speeds recommended for plowing through lanes and Shoulders, when conditions permit, are:

   Freeways:

   a) on Travelled Portion with plow and wing - 70 km/h
   b) on paved Shoulders- 60 km/h
   c) on gravel Shoulders- 40 km/h

   Non-Freeways:

   a) on Travelled Portion with plow and wing - 70 km/h
   b) on Shoulders - 40 km/h

   Shoulder plowing speed should be reduced to take into account the condition of the Shoulders and the proximity of mail boxes, residential/commercial properties, signs, guide rails, or other appurtenances.

3. Snow banks on Shoulders, at or on traffic islands and intersections should be lowered to provide adequate future snow storage capacity, reduce drifting problems and provide adequate visibility. Snow banks on Shoulders should be lowered to 1.0m for a distance of 150m in either direction of recreational trail crossings to provide for adequate visibility.

4. A reversible plow should be used when plowing from the passing lane onto the median.

5. On multi-lane Highway, where echelon plowing is performed, the following should be noted:

   a) Motorists should be discouraged from passing plowing vehicles by operating the plows tight together when in the plow operator's judgement:

      i) the passing manoeuvre would be hazardous due to the lead plow leaving a heavy windrow of snow;

      (ii) the road ahead could be in a Hazardous condition due to heavy drifts, slipperiness, accidents, or other causes;

      (iii) visibility is limited, rendering passing too hazardous; or

      (iv) traffic volume is so heavy that, even if passing were permitted, only a small percentage of the overtaking vehicles could actually make their way through the one passing route available.

6. Plowing activities should be co-ordinated to minimize windrows of snow being left along the through lane where it connects with a ramp or transfer lane.

7. When plowing at railway crossings, the following procedures should be followed:

   a) When it is not necessary to stop at a crossing during plow operations due to the weather, visibility, or any other condition:

      i) reduce speed on approaching the crossing; raise the plow blade and wing or other attachments to clear the highest part of the crossing and then drive over the crossing without changing gears.

   b) When the view is obstructed due to weather, snow embankments or other conditions during snow plow operations:

      (i) stop the plow before reaching the crossing;

      (ii) ensure that it is safe to cross the tracks; and

      (iii) raise the plow blade and wing or other attachments, drive over the crossing, lower the blade and wing or other attachments and resume plowing.

   c) When it is necessary to examine a railway crossing to check for damage to the tracks, remove any obstruction or Hazard, or to perform any other necessary task, the plow operator should:

      (i) drive over the crossing, making a visual inspection of the crossing while doing so; and

      (ii) stop the truck with the rear of the truck at least 15m clear of the crossing and on the Shoulder. When the weather and visibility are poor, place "flares" on the Highway, at least 30m in both directions from the area occupied by the plow and railway crossing.

8. Early in the season when gravel Shoulders are not frozen and are still soft, snow should be removed from the Shoulders using the wing only. Only when the Shoulders become frozen should the plow and wing be used. Plows and wings should be properly adjusted prior to plowing gravel Shoulders.

9. Plowing speed shall be reduced over structures to prevent snow and ice being thrown over parapets or through railings onto the roadway or railway beneath.

10. For Class 5 Highways, all snow pack surfaces that are wash-boarded, rutted, and potholed or exhibit signs of developing ice, or where ice has developed, shall be ice bladed. During warming trends, usually in the spring and fall, it may be more efficient and economical to bare the surface than to try to maintain a snow pack condition.

SPREADING:

1. Maximum spreading speeds are variable, but are in a range of 32 to 48 km/h, depending on a number of factors. Materials should be spread to ensure maximum efficiency in consideration of the type of spreading equipment, the weather and road conditions and whether spreading is on a two-lane or multi-lane Highway.

Sand

1. Sand is used as an abrasive to provide traction on slippery surfaces. It is most often used under conditions when the temperature is too low for salt to be effective and on Class 5 Highways. As a general rule, sand should be used when the temperature is falling below, or not expected to rise above, -12^{o}C. However, sand should be used at higher temperatures where improved traction is required.

2. Sanding, when required, should normally follow the plowing operations. This minimizes the amount of sand being pushed off to the side of the road.

3. The application rate of sand shall be 570 kg/2 lane km. The spinner on the spreader shall be turning at such a rate that sand is applied only on the Travelled Portion. Spread width should be between 2 and 2.5m along the centre of the Travelled Portion.

4. Priority areas such as hills, curves, intersections, bridge decks, insulated pavement areas, shaded areas and rock cuts may require heavier application rates of sand.

5. Additional salt shall not be added to the sand except to treat a unique situation where either salt or sand alone would be ineffective. Mixtures shall only be used after approval from the District Office. Any addition of salt should be thoroughly mixed into the sand before the application is required and before loading into the spreader unit. Calibration rates shall be adjusted so that the application rate does not exceed the recommended application rate of salt. When used, a specific note is required in the Patrol Diary and Winter Operation Record explaining the reason for use.

Salt

1. Salt applied to snow forms a brine mixture. This reduces the possibility of the snow sticking or packing on the pavement. It also prevents ice build-up and allows the plow to remove the snow easier. Salt, assisted by sun, traffic and warmer daytime temperatures, is also used as a melting agent to eliminate icy conditions.

2. As the temperature decreases, the effectiveness of the salt decreases until it becomes ineffective. Normally, salt should not be applied when the temperature is below -12^{o}C. However, in the presence of sun and/or heavy traffic volume, which creates a higher road surface temperature, salt can be effective down to a temperature of -18^{o}C.

3. Salting is not recommended if the pavement is dry and the snow is not packing or sticking.

4. Salting should commence before 0.5cm of snow accumulates on the Pavement.

5. In general, salt should be applied a minimum of 30 minutes in advance of plowing to prevent the salt from being pushed off before it has had a chance to work. This is consistent with salt being used to assist in the plowing operations. The lower the temperature, the longer it will take for the salt to work.

6. Salt shall be applied at the rate of 130 - 170 kg/2 lane km. Salt should be applied in a narrow strip by chute(s) or slow moving spinner, along the centre-line (crown) of two-lane Highways and between lanes on multi-lane Highways. On super-elevated sections (curves) the salt should be kept as high up on the curve as possible to allow the brine to flow across the two lanes.

7. The spinner, operating at normal speed, should be used to spread salt uniformly where the brine cannot flow across the Travelled Portion and on Travelled Portions with:

   a) open graded asphalt mixes;
   b) distorted crossfall;
   c) cracked pavements; or
   d) no crossfall.

REFERENCE

- Maintenance Manual - Maintenance Quality Standards MQS-701, 702 & 703
- Maintenance Manual - Maintenance Best Practices MBP-701, MBP-702 & MBP-704
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO Provincial Highways Directive B-18

BEST PRACTICES

PERSONNEL

All personnel engaged in winter maintenance operations shall be familiar with:

1. shift schedules, reporting procedures, equipment routes, material application rates and safety precautions;

2. the requirements of Winter Maintenance Contracts, Maintenance Best Practices, Maintenance Quality Standards and Policies, Environmental Protection and Occupational Health and Safety requirements;

3. the importance of maintaining accurate detailed records of work accomplishment, as well as pertinent reporting documents and their preparation;

4. the care and caution to be exercised during plowing operations involving the following:

   a) structures;
   b) delineators, median markers, sign posts, mail boxes and other appurtenances;
   c) railway crossings;
   d) auxiliary lanes;
   e) weigh scale platforms;
   f) commuter parking lots; and
   g) emergency crossovers;

5. the procedures for emergency road closures according to MTO Provincial Highways Directive B-18 (Placement of Signs and Traffic Control Devices for an Emergency Road Closing);

6. the procedures for aiding stranded motorists. Employees shall not accept payment for rendering aid or assistance; and,

7. voice communication and other communication equipment operation procedures and protocols.

EQUIPMENT

Vehicle Complement Calculations

It is intended that this best practice be applied uniformly and consistently across the entire province. However, it is recognized that a strict application of this best practice may not address and account for all circumstances in all areas of the province.

In this regard, local discretion may be permitted to adjust the base equipment complement to reflect local and special circumstances. For example, accessibility to hospitals and schools, commercial traffic volumes, distances between urban centres, areas of provincial economic importance, road geometrics, numbers of truck climbing and passing lanes and winter tourism are all justifiable reasons to adjust the winter equipment complement to account for particular Highways or geographical areas. However, the use of local discretion shall be the exception and not the rule.

In most cases, rounding up the basic equipment complement calculation to the next whole piece of equipment should be sufficient to address the local and special considerations. Rounding down is also permissible to account for anticipated efficiencies in the type of equipment used, in the route analysis and general operations for that route.

All applications for local discretion shall be recommended by the District Office and approved by the Regional Office prior to implementation.

1. Plow routes shall be established based on the following single-lane-km per plow criteria:

Highway Class	Kilometres
1	55
2	75
3	120
4	206
5	336

2. Spreader routes shall be established based on the key snow and ice control operation for that Class of Highway and shall not exceed the following circuit times, which are based on a spreading speed of 32 km/h, a dead-heading speed of 60 km/h, sand/salt spreading rates as specified, and a 5 minute loading time:

Highway Class	Theoretical Circuit Times***	Key Operation	Spreading Rates per 2 lane km
1	1.3 hours	Salting	130 kg*
2	1.8 hours	Salting	130 kg*
3	2.9 hours	Salting	130 kg*
4	4.9 hours	Salting	130 kg*
5	8 hours	Sanding	300 kg**

* Actual spreading rate can range from 130 to 170 kg/2 lane km.
** Actual spreading rate is 570 kg/2 lane km.
*** Circuit time is the **theoretical time** required to complete the entire route but does not include the dead-head time to return to the point of departure upon completion of the entire route.

3. A complete route and financial analysis, based on equipment costs and anticipated hours of operation, should be completed prior to determining the most beneficial type and size of equipment that should be used.

4. The calculation of the operational distance of a combination unit that is spreading and plowing simultaneously should factor in an adequate ballast requirement.

5. Truck climbing and passing lanes should not be considered as plowable or spreadable kilometres when completing vehicle complement calculations.

6. Paved shoulders shall not be considered as plowable kilometres for the purposes of equipment complement calculations.

7. For the calculation of equipment complement, the class standard for single lane interchange ramps and freeway service centre access and egress including acceleration and deceleration lanes on Class 1 and Class 2 Highways shall be Class 3. Two lane ramps are to be maintained at the same Class standard as the through Highway.

8. Spare equipment is an essential component of the equipment fleet in maintaining the prescribed level of service. The spare equipment complement may be calculated at 10% of the rationalized complement.

Winter Maintenance Operations Season

Table 703 shows the median dates for the first and last snowfall of 2 cm or more. These dates shall be used as a minimum to establish a full equipment complement. Local conditions may warrant starting earlier and/or ending later than these dates.

TABLE 703

MEDIAN DATES FOR FIRST AND LAST SNOWFALL OF 2 CM OR MORE		
AREA	**FIRST SNOWFALL**	**LAST SNOWFALL**
London	December 1	March 31
Chatham	December 1	March 31
Owen Sound	November 15	April 7
Central Region	November 15	March 31
Bancroft	December 1	March 31
Ottawa	December 1	March 31
Huntsville	November 7	April 15
Sudbury	November 1	April 15
North Bay	November 1	April 15
New Liskeard	October 22	April 15
Cochrane	October 22	April 22
Thunder Bay	October 22	April 22
Sault Ste. Marie	October 22	April 22

Electronic Spreader Controls

1. Electronic spreader controls shall be properly calibrated and operational.

Equipment Maintenance

1. Equipment should be inspected to ensure proper working order. Special attention should be given to the gate opening and electronic sand/salt controllers on spreaders. Any breakdown shall be repaired immediately. If repairs could affect equipment calibration the unit shall be re-calibrated. Replacement equipment, if available, should be brought on site where repairs cannot be made immediately.

Communications Equipment

1. Radio equipment in all vehicles required for winter snow and ice control operations should be checked daily. Prior to leaving the yard, the operator shall ensure that it is functioning properly. If repairs or adjustments are required, they should be performed but they should not delay the operation.

Signs and Traffic Control Devices

1. A sufficient supply of miscellaneous winter maintenance signs and traffic control devices should be obtained prior to the winter season. For example:

   a) flashing lights;
   b) barricades and other emergency road closure devices;
   c) “bump”/“bump ahead” signs; and,
   d) “water over road” signs.

2. Sufficient numbers of signs and traffic control devices for Emergency Road Closing shall be readily available to ensure ability to comply with MTO Provincial Highways Directive B-18.

MATERIALS

Salt and Sand Storage and Management

1. All returned materials, not placed on the Roadway, should be emptied from the spreader box at, or near, the covered storage pile and returned to storage.

2. All material that is spilled at a maintenance yard should be cleaned up and returned to storage as soon as possible, and no later than 24 hours after spillage or, in the case of a winter storm event, no later than 24 hours after the end of the event. Appropriate precautions shall be taken to prevent salt and treated sand from entering any watercourse.

Salt:

1. All areas outside of the salt storage buildings shall be maintained free of salt. Doors on salt storage buildings shall be kept closed except when material is required.

Sand:

1. Salt shall be uniformly mixed throughout the sand at a minimum rate of 3% by volume for stockpiles stored in domes and a maximum rate of 5% by volume for covered stockpiles located outdoors.

2. In areas where a structure is not available, the treated sand should be placed on a concrete or asphalt pad and covered with a protective tarp.

3. Small amounts of treated sand may be placed in “sand boxes” on steep hills for use by motorist(s) in emergencies. Sand boxes should be visibly marked and located in safe locations.

INTRODUCTION

This Maintenance Best Practice describes temporary methods of controlling wind blown snow which may accumulate on a Roadway. Effective snow drift control measures can reduce winter snow removal expenditures and assist in eliminating inconsistent and hazardous driving conditions. Although snow drift controls may assist in reducing whiteout conditions, the primary function is reducing the amount of snow that collects on the Roadway.

The most common snow control devices currently used by the Ministry are snow fences and hedges.

REFERENCES

- Maintenance Manual - Maintenance Quality Standards MQS-701, 702 & 703
- Maintenance Manual - Maintenance Best Practices MBP-701, 702 & 703
- Public Transportation and Highway Improvement Act, Subsection 30(8)
- Snow Fence Guide SHRP - W/FR-91-106
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards
- MTO R&D Report (MAT-98-01) – Design and Maintenance Procedures to Minimize Impacts from Drifting Snow on Highways – Provisional Guidelines

BEST PRACTICES

General:

Common characteristics of snow drifting problem sites are that they lie downwind of level, open fields with low ground cover over which wind speeds are frequently high enough to initiate drifting. The severity of drifting is affected by site factors such as exposed hilltop location, steep upwind embankment, upwind obstruction or windbreak, downwind obstruction and plowed snow bank.

It is likely that the wind accompanying, or following, a snowfall will cause more snow accumulation in certain areas than the snowfall itself. During the winter months, winds normally come from the prevailing wind direction about 60-80% of the time. Snow begins to move when the wind speed reaches about 10 km/h and increasing amounts of snow are picked up and moved as the wind speed increases. The snow is carried just above the surface (within 1m) until it reaches an obstruction, such as a tree or rising ground.

The resulting turbulence and slower wind speeds on the lee side of the obstruction allows the snow to settle out and form drifts. "Whiteouts" may occur when turbulence is created as the wind and snow move over the top of, and around, an obstruction (e.g.: trees) adjacent to the Roadway.

Snow fences and hedges can be used to induce turbulence, causing snow to settle at selected locations away from the Roadway thus preventing both the formation of snowdrifts on the Roadway, and whiteouts (loss of visibility) caused by blowing snow.

Snow fence can be installed on private property adjacent to the Highway without the consent of the owner under authority of subsection, 30 (8) of the Public Transportation and Highway Improvement Act.

During the winter season, personnel engaged in winter road patrolling should note any areas of problem snow drifting and Report them to the District Office.

Problem snow drifting areas should be identified and existing snow fence/hedge placements monitored to assist in planning future snow fence/hedge needs and placements. Such information should include:

a) location where snow drifting and "whiteout" conditions are occurring;
b) prevailing wind direction as determined by actual field checks;
c) cause of wind turbulence (such as buildings, hedges or slopes);
d) areas where snow fence is not collecting snow because drifting does not appear to be a problem (based on a 2 - 3 year period), consideration may be given to discontinuing or reducing the length of snow fence at these locations. Such proposals should be reviewed with the District Office; and
e) areas where snow fence has filled to capacity thus limiting its effectiveness as a snow control device (consideration should be given to increasing the height of snow fence at these locations or installing a second row of snow fence).

Snow Hedge:

Snow hedge management should be in accordance with MQS-322 and MBP-322.

Snow Fence:

Installation

1. Snow fence should be installed prior to the season when local conditions permit. The condition of the location, e.g.: plowed field or crops in the field, will dictate when access to the property should be made.

2. When installing snow fence on private property, it is necessary to contact the property owner each year before entering the property. If difficulties are encountered with the property owner, the District Office should be contacted.

3. The location of a snow fence is dependent upon the minimum distance from the edge of the Shoulder of the Roadway;

   The following distances should be used when placing snow fence:

Minimum Height of Fence	Minimum Distance from Edge of Shoulder*
1.2m	40m
1.8m	50m
2.4m	60m

   * Note: These distances may be reduced if location and size of ditch provides adequate storage capacity. The District office should be consulted for specifics.

4. Snow fence should be installed with a 200mm gap between the ground and the bottom of the fence.

5. Snow fence is most effective when placed at right angles to the prevailing wind; however, since the wind direction varies, it is normally placed parallel to the road, on the same side as the prevailing wind.

6. Where extensive drifting occurs, and single snow fences have been filled with snow in previous years, additional storage of snow may be accommodated by:

   a) placing additional parallel rows of snow fence behind the first fence; and/or,

   b) utilizing a greater height of snow fence, i.e.: 1.8m or 2.4m (stacked 1.2m fence above 1.2m fence).

7. Snow fence should be attached to the windward side of the posts to provide maximum stability of the installation.

8. Snow fence posts should be installed at a minimum of 5m apart, in a straight line.

9. Posts should be driven 0.6m into the ground. Posts should be braced with guy wires and steel posts at the ends of the snow fence and at 35m intervals. On sharp curves and steep hills, line braces should be placed every 20m.

10. Snow fence should be stretched tight enough to prevent excessive sag.

11. Snow fence should be fastened to each post with a minimum of 3 equally spaced ties.

Removal

1. Snow fence should not be removed earlier than:

TABLE 704

AREA	EARLIEST REMOVAL DATE
London	March 31
Chatham	March 31
Owen Sound	April 7
Central Region	March 31
Bancroft	March 31
Ottawa	March 31
Huntsville	April 15
Sudbury	April 15
North Bay	April 15
New Liskeard	April 15
Cochrane	April 22
Thunder Bay	April 22
Sault Ste. Marie	April 22

Snow fence may be removed earlier when approval has been given by the District Office to a request from the owner for earlier removal.

2. When removing snow fence, all material should be removed from the property including the fence, post and ties.

MAINTENANCE BEST PRACTICE
PRE-WETTING - ROAD SALT

MBP-705

REFERENCE

- Maintenance Manual - Maintenance Quality Standard MQS's-701, 702 & 703
- Maintenance Manual - Maintenance Best Practices MBP's-701, 702 & 703
- Maintenance Manual - Environmental Protection
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

GENERAL

This Maintenance Best Practice describes the pre-wetting of road salt, which involves the use of liquid chemicals to enhance the performance of the road salt being applied to the road surface during winter operations.

When salt is pre-wet, more material is retained on the road surface, and as such, a reduction in salt application rates can achieve the same effectiveness as dry salt application at traditional rates. Pre-wetted salt begins to form a brine solution quicker than dry salt. It is the brine solution that prevents or breaks the bond between the road surface and the snow/ice.

The enhanced performance of the salt as well as the retention of salt on the road surface facilitates achieving a bare road more quickly and maintains bare pavement longer. A bare road surface provides better traction thereby increasing the safety of the highway for the motoring public.

The retention of the salt on the road surface not only enables a reduction in application rate it also reduces the amount of salt that is introduced into the environment from the road maintenance operation.

SPREADING

1. The methods for applying pre-wetted salt should follow MBP 702, with the exception of application rates.

2. Pre-wetted salt should be applied at rates in accordance with Table 705, Variable Application Rates for Onboard Pre-wet Road Salt.

3. When freezing rain is occurring or anticipated, pre-wetted salt may be applied. In such cases, it is recommended that the material be applied by spinner.

PRE-WETTING SALT APPLICATION RATES

The variable application rates for onboard pre-wet road salt should be used as suggested in Table 705. If the desired results are not achieved, then material can be re-applied.

The rates are based on a liquid chemical rate of 5% by weight added to the road salt as it is applied to the road. As with dry salt, results may vary depending on a variety of related conditions, such as road surface temperature, sun, cold wind, traffic volumes, high precipitation accumulation, high humidity or a combination of any number of these conditions.

TABLE 705

Variable Application Rates for Onboard Pre-wet Road Salt			
Precipitation	**Pavement Temperature Range**		
	0 to -5	**-5 to -10**	**-10 to -18**
Frost	50	70	70
Light Snow	70	100	130
Heavy Snow	130	130	170
Freezing Rain	130	170	170
Application rates are in kg/2 lane km of pre-wetted salt			
Temperatures are in Celsius			

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ENVIRONMENTAL PROTECTION

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EP-5	Salt, Sand & Snow Management	
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EP-9	Waste & Excess Materials Management	
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PREFACE
ENVIRONMENTAL PROTECTION

This section of the Maintenance Manual currently contains interim direction on environmental requirements and practices that apply to the Maintenance Quality Standards and Maintenance Best Practices. A permanent, more comprehensive version is under development and will replace this interim section at a later date.

The individual components of this section have been given temporary numbers and are organized alphabetically by environmental issue and not in order of importance. The permanent section may be arranged in a different manner and is likely to use a different numbering system.

A matrix, which demonstrates the link between the MBP's and Environmental Protection provisions, resides at the front of this section. Users should consult the matrix to determine if any Environmental Protection provisions pertain to the maintenance operations being undertaken in accordance with the MQS's and MBP's.

Please note that the direction on environmental protection within this section has been included to provide greater clarity with respect to the requirements of environmental legislation. This does not relieve MTO staff or contractors from being familiar with and in compliance with the specific requirements of environmental legislation and will not prevent charges under the respective Acts and Regulations where an environmental impact results from an operation. The directions provided will need to be tailored to meet the needs of each specific location and operation.

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & ENVIRONMENTAL PROTECTION

		MAINTENANCE BEST PRACTICES											
		MBP-101	MBP-102	MBP-103	MBP-104	MBP-201	MBP-202	MBP-303	MBP-305	MBP-320	MBP-321	MBP-322	MBP-323
		Concrete Pavement Surfaces	Asphalt Pavement Surfaces	Surface Treated Surfaces	Gravel Surfaces	Gravel Shoulders	Hard Surface Shoulders	Hard Surface Cleaning	Fences	Weed Control	Tree Control	Tree & Shrub Maintenance	Ground Cover Rehabilitation
ENVIRONMENTAL PROTECTION													
EP-1	**Beaver/Beaver Dam Removal**												
EP-2	**Dust Control**	X	X	X	X	X		X					
EP-3	**Erosion & Sedimentation Control**								X		X		X
EP-4	**Migratory Birds**												
EP-5	**Salt, Sand & Snow Management**												
EP-6	**Spills**	X	X	X		X	X	X		X		X	
EP-7	**Transportation of Dangerous Goods**	X	X	X		X	X	X		X		X	
EP-8	**Vegetation Management**								X	X		X	
EP-9	**Waste & Excess Materials Management**	X	X	X		X	X	X	X		X	X	
EP-10	**Water Testing**												
EP-11	**Watercourse & Fisheries Protection**	*	*	*		*		X		X			

* Applies when working around water.

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & ENVIRONMENTAL PROTECTION

		MAINTENANCE BEST PRACTICES										
		MBP-324	MBP-325	MBP-326	MBP-331	MBP-395	MBP-396	MBP-501	MBP-502	MBP-503	MBP-551	MBP-552
		Brush Control	Rest Area/Picnic Site Maintenance	Grass Control	Debris Control	Road Patrol	Facilities	Ditches	Culverts, Outlets & Subdrains	Curb & Gutter, Catchbasins, Maintenance Access Points, Ditch Inlets & Outfalls	Bridge Maintenance Inspection	Structure Cleaning
ENVIRONMENTAL PROTECTION												
EP-1	**Beaver/Beaver Dam Removal**							X	X			
EP-2	**Dust Control**											
EP-3	**Erosion & Sedimentation Control**							X	X	X		X
EP-4	**Migratory Birds**								X		X	X
EP-5	**Salt, Sand & Snow Management**						X					
EP-6	**Spills**	X	X	X		X	X					
EP-7	**Transportation of Dangerous Goods**	X	X	X			X					
EP-8	**Vegetation Management**	X	X	X				X				
EP-9	**Waste & Excess Materials Management**	X	X		X	X	X	X	X	X		X
EP-10	**Water Testing**		X				X					
EP-11	**Watercourse & Fisheries Protection**	X						X	X	X		X

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & ENVIRONMENTAL PROTECTION

		MAINTENANCE BEST PRACTICES											
		MBP-553	MBP-555	MBP-556	MBP-557	MBP-558	MBP-601	MBP-604	MBP-660	MBP-701	MBP-702	MBP-703	MBP-704
		Bridge Surfaces	Obstruction to Waterflow at Bridges	Expansion Joints/Bearings	Erosion Control at Bridges	Modular Bridges	Highway Markings	Signs & Sign Supports	Traffic Barrier Systems	Winter Maintenance - Summary	Winter Maintenance - Operations	Winter Maintenance - Resources	Winter Maintenance - Snow Drift Control
ENVIRONMENTAL PROTECTION													
EP-1	**Beaver/Beaver Dam Removal**		X										
EP-2	**Dust Control**												
EP-3	**Erosion & Sedimentation Control**		X		X	X		X	X				X
EP-4	**Migratory Birds**					X							
EP-5	**Salt, Sand & Snow Management**									X	X	X	
EP-6	**Spills**	X		X	X		X	X					
EP-7	**Transportation of Dangerous Goods**	X		X	X		X	X					
EP-8	**Vegetation Management**		X		X								X
EP-9	**Waste & Excess Materials Management**	X	X			X	X	X	X				X
EP-10	**Water Testing**												
EP-11	**Watercourse & Fisheries Protection**	X	X	X	X	X		X					

REFERENCES

- Fisheries Act (Canada)
- MTO/MNR/DFO "Fisheries Protocol"
- MTO Construction "Special Provision 199F47 - Watercourse and Fisheries Protection, Use of Confined Explosives"
- DFO "Guideline for the Use of Explosives In or Near Canadian Fisheries Waters"
- DFO "Guideline for Road Maintenance and the Fisheries Act: A Guide to Avoiding Conflict"
- Maintenance Manual - Occupational Health and Safety Hazards
- Maintenance Manual - Environmental Protection EP-11

BEST PRACTICES

Beaver Removal:

The MNR should be contacted to obtain the services of a licensed trapper for the removal of beaver.

Beaver Dam Removal:

1. Except as noted below, established beaver dams which have become stabilized with their surrounding environment such that they may have fish habitat dependent on them, shall not be removed without prior consultation with MNR and possible subsequent referral to DFO. Mitigation and possibly DFO authorization may be required if there are potential adverse effects on fisheries resources.

   Beaver dams may be removed without consultation with MNR or subsequent referral to DFO, where it is determined that there is an imminent threat to the Highway infrastructure or to the safety of the travelling public.

   Removal shall be done in a controlled manner which minimizes potential adverse effects to fish, fish habitat and downstream properties. As soon as practical following removal, MNR should be contacted to determine any damage to downstream fish habitat and any consequent need for restoration.

   Newly built beaver dams may be removed, when necessary for the routine maintenance of Highway drainage, without consultation with MNR or subsequent referral to DFO. Although damage to fish habitat is unlikely to occur from such activity, removal shall be done in a manner which minimizes adverse effects.

   The MTO/MNR/DFO "Fisheries Protocol" should be consulted for further details on consultation with MNR and DFO.

2. If explosives are used in the removal of beaver dams, the operation shall adhere to DFO "Guideline for the Use of Explosives In or Near Canadian Fisheries Waters" per MTO specifications.

REFERENCES

- Environmental Protection Act (Ontario)
- "OPSS 506 - Dust Suppressants"
- MTO Construction "Special Provision 105S14 - Environmental Requirements for Waste and Product Dust Suppressants"
- MOE "Dust Suppressant List"
- Maintenance Manual - Occupational Health and Safety Hazards
- Maintenance Manual - Environmental Protection EP-6, EP-7 & EP-11

BEST PRACTICES

1. If product or waste dust suppressants are used instead of water to control dust during maintenance operations, only MOE and MTO approved materials shall be used as specified in MOE's "Dust Suppressant List" and MTO specifications. Application of approved dust suppressants shall conform to the requirements of "OPSS 506 - Dust Suppressants" and MTO specifications.

2. The best time to grade the Roadway is when the surface is damp.

REFERENCES

- "OPSS 577 - Temporary Erosion and Sediment Control Measures"
- MTO Construction "Special Provision 571S01 - Sodding"
- MTO Construction "Special Provision 572S01 - Seeding and Cover"
- Maintenance Manual - Occupational Health and Safety Hazards
- Maintenance Manual - Environmental Protection EP-11

BEST PRACTICES

1. Erosion shall be controlled during maintenance operations to prevent sedimentation of watercourses.

2. Temporary erosion and sedimentation control measures used during maintenance operations may include, but are not limited to, sediment barriers, turbidity curtains and flow checks. In addition, alternative materials or methods are acceptable provided they meet industry standards and protect the environment from the impacts of erosion and sedimentation. Installation, maintenance and removal of measures shall be in compliance with "OPSS 577 - Temporary Erosion and Sediment Control Measures"

3. Preservation of vegetation on ditch slopes and on watercourse banks is recommended where possible, to control erosion and sedimentation.

4. Side-casting of materials from ditch clean-out operations shall not be done near watercourses. Materials should be removed from the site to prevent their entry or re-entry to watercourses, and managed in accordance with EP-9.

5. Deck drains on bridges should be blocked prior to removal of excess dirt, debris and deleterious materials such as sand and salt, to prevent their entry into watercourses.

6. Sodding or seeding in accordance with MTO specifications may be required to prevent erosion after ditching operations have been carried out.

7. Rip-rap can be used as ditch lining in areas where erosion is a recurring problem.

8. Ground cover rehabilitation and washout repair involving topsoiling and seeding and cover shall be done in accordance with Ministry specifications.

REFERENCES

- Migratory Birds Convention Act, 1994 (Canada)
- Canadian Wildlife Service
- Fish and Wildlife Conservation Act, 1997 (Ontario)
- Endangered Species Act (Ontario)
- MTO "Interpretative Bulletin for Migratory Birds Convention Act Compliance Requirements for Bridge and Culvert Maintenance and Reconstruction"
- MTO "Migratory Bird (Damage) Permit"
- Maintenance Manual - Occupational Health and Safety Hazards

BEST PRACTICES

General:

MTO's "Interpretative Bulletin for Migratory Birds Convention Act Compliance Requirements for Bridge and Culvert Maintenance and Reconstruction" should be consulted for more detailed information than is provided below:

Prior to commencement of maintenance operations, bridges and culverts shall be inspected for the presence of nests and/or birds.

All nests, eggs, and young birds shall be considered protected under the Migratory Birds Convention Act, 1994 (MBCA), or other legislation such as the Fish and Wildlife Conservation Act, 1997 (Ontario), or the Endangered Species Act (Ontario), as applicable, until accurate species identification is undertaken by a qualified individual.

1. Bird Species under MTO's Migratory Bird Permit

   a) If identification determines the nest to be that of a species protected under the MBCA, a site specific permit application form must be obtained, completed and submitted to Canadian Wildlife Service.

   b) The nests of all species of swallows, American Robin, Eastern Phoebe and Mourning Dove protected under the MBCA may be removed and destroyed in accordance with the conditions of the MTO "Migratory Bird (Damage) Permit", a copy of which must be available on the job-site. All removed nests, eggs and birds must be disposed of either by burial or by laboratory waste disposal methods.

   c) **The permit does not allow the removal of young birds, which is prohibited under any circumstances.** Should they be present, all activities around the nest must cease until the young birds are able to leave the site.

d) In addition, efforts must be made to ensure that no new nests are built prior to, or during, the maintenance operations.

2. Bird Species not covered by MTO's Migratory Bird Permit

   If the nest is determined to be that of a species protected under other legislation, the local Ministry of Natural Resources office must be contacted for advice on how to proceed.

3. Bird Species not covered by Legislation

   Although removal and destruction of European Starling, House Sparrow and Pigeon nests, eggs and young is not prohibited, it must be done in a humane manner.

REFERENCES

- Canadian Environmental Protection Act, 1999 (Canada)
- Environmental Protection Act (Ontario)
- Ontario Water Resources Act
- MOE "Snow Disposal and De-icing Operations in Ontario Guideline"
- Maintenance Manual - Environmental Protection EP-6 & EP-11
- Maintenance Manual - Maintenance Best Practices MBP-702 & 703
- Maintenance Manual - Maintenance Quality Standards MQS-396 & 702
- Maintenance Manual - Occupational Health & Safety Hazards

BEST PRACTICES

Salt and Sand General:

1. Appropriate precautions shall be taken to prevent salt and treated sand from entering any watercourses.

   a) Salt should be stored under cover and not exposed to the elements. Salt and any other de-icing agents should immediately be placed under covered storage upon delivery. All areas outside of salt storage buildings shall be maintained free of salt. Doors on salt storage buildings must be kept closed except when material is required.

   b) Salt-treated or chemically-treated sand should be stored under cover and not exposed to the elements. Sand should be placed under covered storage upon being treated with salt or chemicals.

   c) In areas where a structure is not available, treated sand should be placed on a concrete or asphalt pad and covered with a protective tarp.

   d) All returned materials, not placed on Roadway surfaces, should be emptied from the spreader box into the covered storage pile.

   e) All materials that are spilled at the maintenance yard should be cleaned up and returned to storage as soon as possible and no later than 24 hours after the spillage or, in the case of a winter storm event, no later than 24 hours after the end of the event.

SALT, SAND & SNOW MANAGEMENT

Patrol Yard Maintenance:

1. Asphalt pads and catch basins should be maintained in good condition to prevent salt brine from entering ground water.

2. De-icing materials should be cleaned from both the garage floors and the patrol yard aprons before the material enters the drainage system. The material collected shall be re-deposited into the covered material pile.

3. All travelled portions and parking areas should be kept free of snow and ice accumulations using a minimum of de-icing agents.

Snow Removal and Disposal:

1. Snow removal and disposal shall be done in accordance with the Ministry of the Environment (MOE) "Snow Disposal and De-icing Operations in Ontario Guideline".

2. Where snow or ice is loaded and hauled away, it shall be disposed of at properly selected land sites, based on criteria in the MOE guideline referred to in 1 above.

3. Snow disposal shall not be into, or near, water, or onto ice-covering water.

4. Where snow or ice is removed from a bridge or causeway over water, using a loader or other mechanical means, disposal shall not be into, or near, water or onto ice-covering water.

REFERENCES

- Fisheries Act (Canada)
- Transportation of Dangerous Goods Act, 1999 (Canada) and regulations
- Environmental Protection Act (Ontario), Part 10
- Pesticides Act (Ontario) and regulation 914
- Ontario Water Resources Act
- MTO Interpretive Bulletin “Patrol Response to Non-MTO Spills"
- MTO Construction "Special Provision 100S35 - Incident Management Under Legislation Protecting the Natural Environment"
- MTO/MNR/DFO "Fisheries Protocol"
- Maintenance Manual - Environmental Protection EP-7, EP-9 & EP-11
- Maintenance Manual – Occupational Health & Safety Hazards

BEST PRACTICES

General:

1. All materials must be handled and stored in accordance with recommended procedures to prevent contamination of the environment including land, water or air.
2. In the event of a spill, indoor drain inlets as well as outdoor catchbasins and culvert inlets, etc. should be blocked to prevent the entry of contaminants.
3. All spills shall be managed in accordance with the legislation listed below and MTO specifications. In addition, non-MTO spills shall be managed in accordance with the MTO Interpretive Bulletin “Patrol Response to Non-MTO Spills”.

Environmental Protection Act:

In the event of a spill or abnormal release into the environment of a material used during maintenance operations (e.g.: pavement marking materials, pavement marking primers and sealers, solvents, operating fuels and fluids, asphalt primers and surface treatments, joint sealants, Shoulder stabilization materials, pesticides, cleaning products, dust suppressants, fertilizers and waste oil), the person in control of the material at the time of the spill shall ensure that:

- the spill is contained and cleaned up;
- the environment is restored to pre-spill conditions;
- the spill clean-up materials are properly disposed of; and
- all required notifications are made including to: the owner of the spilled material, the municipality in which the spill occurred and the Ministry of the Environment (MOE) Spills Action Centre at 1-800-263-6060.

SPILLS

Other Legislation:

In addition to requirements under the Environmental Protection Act, requirements for spills response exist under other legislation as follows:

Pesticides Act

Every person who discharges a pesticide or substance or thing containing a pesticide into the natural environment, must notify the Ministry of the Environment forthwith and must take reasonable measures to clean up the environment. The required notification can be made to the MOE Spills Action Centre at 1-800-263-6060.

Ontario Water Resources Act

Every person who causes or permits a discharge of any material to water which may impair water quality, must notify the Ministry of the Environment forthwith. This notification can be made to the MOE Spills Action Centre at 1-800-263-6060.

Fisheries Act

A spill under this Act is considered to be a significant deposit of a deleterious substance (e.g.: a significant amount of sediment) into a water body, that occurs out of the normal course of events and that could cause adverse effects to fish or fish habitat.

The notification of such a spill will be made to the local Ministry of Natural Resources (MNR) District Office as soon as possible following the spill event.

In accordance with the MTO/MNR/DFO "Fisheries Protocol", MTO shall take reasonable corrective action to address the adverse effects of the deposit and shall advise the MNR District Office of these actions.

Transportation of Dangerous Goods Regulations

The person in control of dangerous goods which are released during transport, must comply with Dangerous Occurrence Reporting requirements under the Transportation of Dangerous Goods Regulations. Dangerous Occurrences as set out in the Regulations shall be reported to the local police.

REFERENCES

- Transportation of Dangerous Goods Act, 1992 (Canada) and regulations
- Dangerous Goods Transportation Act (Ontario) and regulation
- Maintenance Manual - Environmental Protection EP-6, EP-9 & EP-11
- Maintenance Manual – Occupational Health & Safety Hazards

BEST PRACTICES

1. All materials used during maintenance operations **that are regulated dangerous goods,** which **may** include, but are not limited to:

   explosives, operating fuels and fluids, pavement marking materials, pavement marking primers and sealers, solvents, oxygen/acetylene tanks, asphalt primers and surface treatments, joint sealants, Shoulder stabilization materials, pesticides, cleaning products, dust suppressants, fertilizers and waste oil

   shall be transported in compliance with the requirements of the Transportation of Dangerous Goods Act, 1992 (Canada) and regulations for packaging, labelling, documentation, safety requirements for handling and transport, training and Dangerous Occurrence Reporting.

REFERENCES

- Pest Control Products Act (Canada)
- Pesticides Act (Ontario) and regulation 914
- Weed Control Act (Ontario) and regulation 1096
- Environmental Protection Act (Ontario)
- Endangered Species Act (Ontario)
- MTO - Integrated Vegetation Management (IVM) For Highway Rights-of-Way
- Maintenance Manual - Environmental Protection EP-3, EP-4, EP-6, EP-7, EP-9 & EP-11
- Maintenance Manual – Occupational Health & Safety Hazards

BEST PRACTICES

1. Review of the vegetation to be controlled, the Highway and adjacent land use should be carried out to determine the most appropriate control options and environmental protection measures.

2. Desirable vegetation should be identified and preserved where it is beneficial to erosion and sedimentation control.

3. Vegetation control should be achieved using chemical, mechanical, manual, cultural and biological methods which are consistent with MTO Integrated Vegetation Management principles and policies.

4. No herbicides should be applied to brush taller than 1m.

5. Pesticides used in weed, insect, disease and rodent control shall be stored, handled and applied in accordance with all applicable provincial and federal Acts and regulations, and MTO policies.

REFERENCES

- Environmental Protection Act (Ontario) and regulation 347 - General Waste Management
- MOE "Manual of Policy Procedures and Guidelines for Private Sewage Disposal Systems"
- MTO - "Oil/Water Separator Interim Field Guide for Patrol Yards Working Draft"
- Maintenance Manual - Environmental Protection EP-6, EP-7 & EP-11
- Maintenance Manual - Occupational Health & Safety Hazards
- MTO “Provisional Certificate of Approval for a Waste Management System”
- “MOE/MTO “Protocol for Management of Excess Materials in Road Construction and Maintenance”

DEFINITIONS

For the purposes of this Environmental Protection provision (EP-9):

Asphalt: means any combination of asphaltic material and natural aggregate.

Catchbasin Clean-out Material: means composite sludge and liquid material removed from Highway storm sewer catchbasins.

Concrete: means concrete mixtures produced with Portland cement, and may include blended hydraulic cement, supplementary cement materials, spent debris and silica sand abrasives, blasting media from abrasive cleaning of concrete and reinforcing steel, concrete brick and associated mortar, and can include embedded steel, and excludes asbestos-modified Portland cement concrete mixtures.

Ditch/Drainage System Clean-out Material: means earth, sediment, soils, rocks and vegetation resulting from the clean-out of drainage system components such as ditches.

Excess Material: means non-hazardous solid material collected or removed as a result of maintenance operations including surplus, abandoned or unsuitable material.

Fabricated Metal: means metal such as culverts, fence materials, and guide rails, but does not include used paint containers, other packaging materials containing residues, storage tanks, septic tanks, and ancillary equipment associated with sanitary sewage systems, septic systems, and fuel/lubricant dispensing and storage systems.

Litter: means any garbage, rubbish, trash, refuse, can, bottle, container, wrapper, paper, paper product, tire, appliance, mechanical equipment or part, building or construction material, tool, machinery, wood, motor vehicle or motor vehicle part, dead animal or identifiable abandoned material found on Ministry property.

Manufactured Wood: means wood that is not entirely natural wood and includes wood that is painted, treated, coated or glued.

Masonry: means clay brick and associated mortar.

MOE: means the Ministry of the Environment, Ontario.

Natural Wood: means stumps, trunks, branches and associated debris from tree and shrub removal, and wood products that are not painted, treated, coated or glued.

Non-Hazardous Solid Industrial Waste: means Waste described as Non-Hazardous Solid Industrial Waste, excluding asbestos Waste, in Regulation 347 under the Environmental Protection Act, Ontario.

Plastic Products: means plastic products such as culverts, components of fencing, discarded containers such as pop bottles, and any other common household packages.

Re-use: means utilization and management of Excess Material as, or by processing, re-processing or recycling into, a construction material or other useful product.

Roadsweeping Material: means a sand/gravel/vehicle dirt mixture resulting from winter maintenance operations and general Highway use, but does not include Litter.

Waste: means Excess Material that is not managed by re-use or recycling.

BEST PRACTICES

General:

1. All collected Litter should be separated, if practical, in accordance with local municipal recycling requirements.

2. Where possible Excess Materials should be diverted from disposal as Waste to landfill, through the application of the 3R's (reduction, re-use and recycling) of waste management. For example, some components of Litter, such as motor vehicle parts, may have value to metal, rubber or battery recyclers.

3. Reusable materials, if they are structurally sound, should be incorporated into maintenance operations.

4. All notification, approval, release and agreement requirements shall be obtained and complied with as necessary for the management of Waste and Excess Material.

5. All Excess Materials shall be managed so as to prevent their entry to water bodies and sensitive areas as may be identified.

6. Where Waste or Excess Material is a mixture of materials, it shall be managed in compliance with the most stringent conditions associated with any of the constituent Wastes or Excess Materials.

7. Any Excess Material which is to be used in maintenance shall not have any obvious evidence of contamination beyond that which would normally be expected.

Non-Hazardous Waste:

1. Waste and Excess Materials resulting from routine maintenance operations and limited to Non-Hazardous Solid Industrial Waste shall be managed and disposed of in accordance with this EP and should adhere to recommendations from the MOE and the local municipality.

2. Where Excess Material is managed by disposal as Non-Hazardous Solid Industrial Waste, it must be transported using a Waste management system covered by an MOE Certificate of Approval that is valid for Non-Hazardous Solid Industrial Waste, the entire period of work, the entire haul route and the equipment to be utilized.

Hazardous Waste:

1. Waste and Excess Materials that are hazardous or liquid industrial wastes and/or that are generated through the provision of maintenance services (e.g.: waste oil, sewage from patrol yard septic tanks, oil/water separator sludge) shall be managed in accordance with applicable Ministry of the Environment (MOE) Waste Generator Registrations and the requirements of EPA Regulation 347 - General Waste Management, and in compliance with any applicable MOE Certificates of Approval.

2. Sewage from rest area privy holding tanks and patrol yard septic tanks shall be removed and disposed of by a licensed contractor in accordance with the MOE "Manual of Policy Procedures and Guidelines for Private Sewage Disposal Systems".

3. Oil/water separators shall be cleaned out as per the MTO "Oil/Water Separator Interim Field Guide for Patrol Yards, Working Draft".

Management Options:

Management of Waste and Excess Material shall be as described in Table EP-9 unless approval in writing has been received from the Ministry of the Environment, Ontario, prior to implementing any new management procedures.

Legend for Table EP-9:

Option 1: Recycling/Reuse outside the ROW

Management as per the local municipality's waste management plan, or other management, reuse or recycling options as endorsed by MOE. The District Office must be informed of any other MOE-endorsed re-use or recycling options.

Option 2: Management within the ROW

Due consideration must be given to the environmental setting and minimization of environmental impacts.

Option 3: Disposal to a Certified Landfill Site

Non-Hazardous Solid Industrial Waste shall be transported from the area of the maintenance operation directly to a landfill site that has an MOE Certificate of Approval for a Waste Disposal Site that is valid for Non-Hazardous Solid Industrial Waste.

Option 4: Management of Unidentified or Contaminated Materials

Unidentified materials (including unlabelled containers) which have been abandoned within the ROW, or Ditch/Drainage System Clean-out Material being managed during maintenance operations which is suspected of being contaminated with a pollutant, may be hazardous to worker safety and the environment. Such materials shall be Reported to the District Office. Expertise should be enlisted to assist in the identification (through possible sampling and testing), and removal of these materials.

Where the material is identified to be Non-Hazardous Solid Industrial Waste, it shall be managed in accordance with Option 3.

Where the material is confirmed to be hazardous or liquid industrial Waste, it shall be transported using a Waste management system covered by an MOE Certificate of Approval that is valid for hazardous and liquid industrial Waste and the applicable Waste Class, the entire period of the work, the entire area within the limits of the work, the entire haul route and the equipment to be utilized. The Waste shall be transported directly to a site with an MOE Certificate of Approval for a Waste Disposal Site valid for hazardous and liquid industrial waste and the applicable Waste Class. The Waste shipment must be properly manifested in accordance with Regulation 347 of the Environmental Protection Act, Ontario, and must comply with packaging, documentation and safety mark requirements of the Transportation of Dangerous Goods Regulations, where the material is also dangerous goods.

WASTE & EXCESS MATERIALS MANAGEMENT

Note:
The additional information provided in the right column of Table EP-9 is given only where applicable to demonstrate past standard practice and specific restrictions.

TABLE EP-9

WASTE OR EXCESS MATERIAL	OPTION	ADDITIONAL INFORMATION
Asphalt	1	
	2	Where engineering requirements can be met in Roadways. Contact the District Office for other management options within the Highway.
	3	
Batteries	1	Battery re-cycler or scrap yard.
	3	
Bottles (see Glass or Plastic)		
Bricks	1	
	2	Where engineering requirements can be met in Roadways. Contact the District Office for other management options within the Highway.
	3	
Cans (see Metal or Litter)		
Cardboard boxes (see Paper or Litter)		
Catchbasin Clean-out Materials	3	

TABLE EP-9 (Continued)

WASTE OR EXCESS MATERIAL	OPTION	ADDITIONAL INFORMATION
Concrete	1	
	2	Where engineering requirements can be met Roadways. Contact the District Office for other management options within the Highway. Excess Portland cement concrete may be used for rip rap, rock protection and gabion stone provided it is of sound structural quality, without exposed reinforcing steel, and it is graded in sizes from 75mm to 525mm.
	3	
Culvert (See Metal, Wood or Plastic)		
Dead Animals (Road Kills)	1	Transfer to a rendering facility for processing. Contact the District Office for additional direction.
	2	Weather/location permitting, burial of small animals within the Roadside is **only permitted** under a Certificate of Approval for a Waste Management System that includes this option as a condition. Remove to brush area in remote areas.
	3	Check if local landfill has specific requirements for easy identification such as placing the carcass in a blue bag before disposal.
Debris (see Litter)		
Ditch/Drainage System Clean-out Material	2	
	3	
	4	Clean-out Material suspected of being contaminated by a pollutant such as gasoline, shall be Reported the District Office.
Garbage Bags (See Litter or Unidentified or Contaminated Materials)		Garbage bags suspected of containing anything other than garbage shall be Reported to the District Office.

WASTE & EXCESS MATERIALS MANAGEMENT

TABLE EP-9 (Continued)

WASTE OR EXCESS MATERIAL	OPTION	ADDITIONAL INFORMATION
Glass	1	
	3	
Lights/Luminaires	1	
	3	
Litter	3	
Metal (fabricated)	1	
	3	
Motor Vehicle Parts (except Batteries & Tires)	1	
	3	
Paper	1	
	3	
Plastics	1	
	3	
Posts (see Wood or Metal)		
Roadsweeping Material (including bridge sweepings)	2	Litter shall be separated out and disposed of in accordance with requirements of the local municipality. Where granular Shoulders are adjacent to the area being swept, the resulting sweepings excluding Litter can be blended into the adjacent granular Shoulder.
	3	
Rubber	1	No stockpiling of tires shall occur on Ministry property.
	3	
Signs (see metal)		
Tire Rims & Hubs (see Metal)		
Tires (see rubber)		
Vegetation	2	

WASTE & EXCESS MATERIALS MANAGEMENT

TABLE EP-9 (Continued)

WASTE OR EXCESS MATERIAL	OPTION	ADDITIONAL INFORMATION
Wood (Natural)	1	
	2	Stumps may be managed as push outs. Contact the District Office for other management options within the Highway. Open burning, which is subject to multiple restrictions, is not recommended, and should be considered only in exceptional circumstances, upon approval of the District Office.
Wood (Manufactured)	1	
	3	
Unidentified or Contaminated Materials	4	Contact the District Office.

REFERENCES

- MTO - "Guidelines for Bacteriological Testing of Non-Municipal Water at MTO Sites"
- Maintenance Manual – Occupational Health & Safety Hazards

BEST PRACTICES

1. To ensure compliance with provincially acceptable limits for bacteriological contamination, water testing and public notification requirements for natural springs and where MTO provides water (non-municipal) to the public, employees and contractors for drinking and purposes other than drinking shall be carried out as per the MTO "Guidelines for Bacteriological Testing of Non-Municipal Water at MTO Sites".

2. Sampling procedures should be carried out as per the "Standard Procedure - Taking a Water Sample" section of the above-noted guideline.

REFERENCES

- Fisheries Act (Canada)
- Ontario Water Resources Act (Ontario)
- DFO "Guideline for the Use of Explosives In or Near Canadian Fisheries Waters"
- MTO/MNR/DFO "Fisheries Protocol"
- DFO "Guideline for Road Maintenance and the Fisheries Act: A Guide to Avoiding Conflict"
- Maintenance Manual - Environmental Protection EP-1 & EP-3
- Maintenance Manual – Occupational Health & Safety Hazards
- MTO Construction "Special Provision 199F47, Watercourse and Fisheries Protection - Use of Confined Explosives"

BEST PRACTICES

1. Maintenance operations shall be screened for potential environmental impacts, and environmentally sensitive areas within the work area such as watercourses shall be identified and protected prior to commencement of the maintenance operation.

2. Maintenance operations and equipment shall be controlled to minimize harm to fish and harmful alteration, disruption or destruction of fish habitat. Consultation with regulatory agencies such as the Ministry of Natural Resources (MNR) and the Department of Fisheries and Oceans (DFO), and possible authorization from DFO, may be required in accordance with the MTO/MNR/DFO "Fisheries Protocol", where the potential for adverse effects exists.

3. The timing of maintenance operations shall take into account fish migration and spawning periods.

4. Maintenance operations in, or around, watercourses shall be conducted in dry weather.

5. Maintenance operations shall be controlled at all times to prevent the entry of deleterious substances such as petroleum products, waste, debris, silt or sediment to watercourses.

6. Watercourses shall not be diverted or blocked, and temporary watercourse crossings shall not be constructed or utilized.

7. All equipment maintenance and refuelling shall be controlled so as to prevent any discharge of petroleum products. Any discharge shall be contained and cleaned up without delay. Vehicular maintenance and refuelling shall be conducted away from watercourses and watercourse banks.

WATERCOURSE & FISHERIES PROTECTION

8. The taking of surface or ground water in quantities in excess of 50,000 litres per day per source requires a "Permit to Take Water" from the Ministry of the Environment under the Ontario Water Resources Act.

9. Water shall not be transported from one source to another. This is to prevent the potential spread of zebra mussels and other exotic organisms.

10. If explosives are used in, or near, Canadian fisheries waters, the operation shall adhere to Department of Fisheries and Oceans "Guideline for the Use of Explosives In or Near Canadian Fisheries Waters" per MTO specifications.

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OCCUPATIONAL HEALTH & SAFTEY HAZARDS

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PREFACE
OCCUPATIONAL HEALTH & SAFETY HAZARDS

The Ministry has developed Occupational Health and Safety policies and guidelines to fulfill the Ministry's obligations as an employer under the Occupational Health and Safety Act (OHSA). These policies and guidelines ensure all reasonable precautions are taken for the protection of worker safety. To provide general guidance to the user the Occupational Health and Safety Hazard (OHSH) Section of this manual references Ministry policies/guidelines, relevant legislation and other applicable resources.

For maintenance operations performed by contractors, the user should refer to the Ministry's “Occupational Health and Safety Contractor Liability Guideline for Non-Construction Work/Services”. Maintenance work is generally classified as non-construction work for the purpose of compliance with the Occupational Health and Safety Act and the Ministry continues to retain the status of an employer when contracting for these services. The guideline provides information on managing the Ministry's liability as an employer under the OHS Act when contracting for non-construction work.

All MBP's refer to the OHSH Section. A matrix, which demonstrates the link between the MBP's and the applicable Occupational Health and Safety Hazard reference, resides at the front of this section. Users should consult the matrix to determine whether there is any direction contained in the Occupational Health and Safety Hazard Section that pertains to the maintenance operations being undertaken in accordance with the MQS's and MBP's.

Please note that the direction provided on OHSH’s within this manual has been included to provide greater clarity with respect to the requirements of OHS legislation. This does not relieve MTO staff or contractors from being familiar with, and working in compliance with, the specific requirements of the OHS legislation and will not prevent charges under the OHS Act where a contravention results during the operation. The directions provided will need to be tailored to meet the needs of each specific work operation.

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & OCCUPATIONAL HEALTH & SAFETY HAZARDS

		MAINTENANCE BEST PRACTICES										
		MBP-101	MBP-102	MBP-103	MBP-104	MBP-201	MBP-202	MBP-303	MBP-305	MBP-320	MBP-321	MBP-322
		Concrete Pavement Surfaces	Asphalt Pavement Surfaces	Surface Treated Surfaces	Gravel Surfaces	Gravel Shoulders	Hard Surface Shoulders	Hard Surface Cleaning	Fences	Weed Control	Tree Control	Tree and Shrub Maintenance
POTENTIAL HAZARDS												
OHSH-1	Chainsaw								X		X	X
OHSH-2	Confined Space											
OHSH-3	Electrical										X	X
OHSH-4	Excavation		X	X	X	X	X		X			X
OHSH-5	Explosives											
OHSH-6	Eye & Face	X	X	X	X	X	X	X	X	X	X	X
OHSH-7	Fall from Height								X		X	X
OHSH-8	Fire & Explosion	X	X	X	X		X					
OHSH-9	Foot	X	X	X	X	X	X	X	X	X	X	X
OHSH-10	Head	X	X	X	X	X	X	X	X	X	X	X
OHSH-11	Lockout/Tagout											
OHSH-12	Skin	X	X	X	X		X	X	X	X	X	X
OHSH-13	Traffic & Visibility	X	X	X	X	X	X	X	X	X	X	X
OHSH-14	Vehicle/Equipment Operation	X	X	X	X	X	X	X	X	X	X	X
OHSH-15	Working Around Water			X	X							
OHSH-16	Biological	X	X	X	X	X	X	X	X	X	X	X
OHSH-17	Chemical	X	X	X	X		X	X		X		X
OHSH-18	Vibration	X	X	X	X	X	X	X	X	X	X	X
OHSH-19	Hot Work, Welding & Cutting											
OHSH-20	Noise	X	X	X	X	X	X	X	X	X	X	X
OHSH-21	Respiratory	X	X	X	X	X	X	X		X		
OHSH-22	Thermal (Hot & Cold) & Solar UV	X	X	X	X	X	X	X	X	X	X	X
OHSH-23	Muscle Strain/Injury	X	X	X	X	X	X	X	X	X	X	X

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & OCCUPATIONAL HEALTH & SAFETY HAZARDS

		MAINTENANCE BEST PRACTICES									
		MBP-323	MBP-324	MBP-325	MBP-326	MBP-331	MBP-395	MBP-396	MBP-501	MBP-502	MBP-503
		Ground Cover Rehabilitation	Brush Control	Rest Area/Picnic Site Maintenance	Grass Control	Debris Control	Road Patrol	Facilities	Ditches	Culverts, Outlets & Subdrains	Curb & Gutter, Catchbasins, Maintenance Access Points, Ditch Inlets and Outfalls
POTENTIAL HAZARDS											
OHSH-1	**Chainsaw**		X	X			X				
OHSH-2	**Confined Space**			X			X	X	X	X	X
OHSH-3	**Electrical**		X	X		X	X		X	X	X
OHSH-4	**Excavation**			X			X		X	X	X
OHSH-5	**Explosives**										
OHSH-6	**Eye & Face**	X	X	X	X	X	X		X	X	X
OHSH-7	**Fall from Height**			X		X	X		X	X	X
OHSH-8	**Fire & Explosion**			X			X		X	X	X
OHSH-9	**Foot**	X	X	X	X	X	X	X	X	X	X
OHSH-10	**Head**	X	X	X	X	X	X		X	X	X
OHSH-11	**Lockout/Tagout**			X							
OHSH-12	**Skin**	X	X	X	X	X	X		X	X	X
OHSH-13	**Traffic & Visibility**	X	X	X	X	X	X	X	X	X	X
OHSH-14	**Vehicle/Equipment Operation**	X	X	X	X	X	X		X	X	X
OHSH-15	**Working Around Water**			X			X		X	X	X
OHSH-16	**Biological**	X	X	X	X	X	X	X	X	X	X
OHSH-17	**Chemical**	X	X	X	X	X	X	X	X	X	X
OHSH-18	**Vibration**	X	X	X	X		X		X	X	X
OHSH-19	**Hot Work, Welding & Cutting**			X			X			X	
OHSH-20	**Noise**	X	X	X	X		X		X	X	X
OHSH-21	**Respiratory**	X	X	X	X		X		X	X	X
OHSH-22	**Thermal (Hot & Cold) & Solar UV**	X	X	X	X	X	X	X	X	X	X
OHSH-23	**Muscle Strain/Injury**	X	X	X	X	X	X		X	X	X

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & OCCUPATIONAL HEALTH & SAFETY HAZARDS

		MAINTENANCE BEST PRACTICES								
		MBP-551	MBP-552	MBP-553	MBP-555	MBP-556	MBP-557	MBP-558	MBP-601	MBP-604
		Bridge Maintenance Inspection	Structure Cleaning	Bridge Surfaces	Obstruction to Waterflow at Bridges	Expansion Joints/Bearings	Erosion Control at Bridges	Modular Bridges	Highway Markings	Signs & Sign Supports
POTENTIAL HAZARDS										
OHSH-1	**Chainsaw**			X	X	X	X	X		X
OHSH-2	**Confined Space**	X	X	X	X	X	X	X	X	
OHSH-3	**Electrical**	X		X	X	X	X	X		X
OHSH-4	**Excavation**	X		X	X		X	X		X
OHSH-5	**Explosives**				X					
OHSH-6	**Eye & Face**	X	X	X	X	X	X	X	X	X
OHSH-7	**Fall from Height**	X	X	X	X	X	X	X		X
OHSH-8	**Fire & Explosion**								X	
OHSH-9	**Foot**	X	X	X	X	X	X	X	X	X
OHSH-10	**Head**	X	X	X	X	X	X	X	X	X
OHSH-11	**Lockout/Tagout**								X	
OHSH-12	**Skin**	X	X	X	X	X	X	X	X	X
OHSH-13	**Traffic & Visibility**	X	X	X	X	X	X	X	X	X
OHSH-14	**Vehicle/Equipment Operation**	X	X	X	X	X	X	X	X	X
OHSH-15	**Working Around Water**	X	X	X	X	X	X	X		
OHSH-16	**Biological**	X	X	X	X	X	X	X		
OHSH-17	**Chemical**	X		X	X	X	X	X	X	X
OHSH-18	**Vibration**	X		X	X	X	X	X	X	X
OHSH-19	**Hot Work, Welding & Cutting**	X		X	X	X	X	X		X
OHSH-20	**Noise**	X	X	X	X	X	X	X	X	X
OHSH-21	**Respiratory**	X	X	X	X	X	X	X	X	X
OHSH-22	**Thermal (Hot & Cold) & Solar UV**	X	X	X	X	X	X	X	X	X
OHSH-23	**Muscle Strain/Injury**	X	X	X	X	X	X	X	X	X

CROSS-REFERENCE MATRIX FOR:

MAINTENANCE BEST PRACTICES & OCCUPATIONAL HEALTH & SAFETY HAZARDS

		MAINTENANCE BEST PRACTICES								
		MBP-660	MBP-660	MBP-660	MBP-660	MBP-660	MBP-701	MBP-702	MBP-703	MBP-704
		Cable Guide Rail	Steel Beam Guide Rail	Box Beam Guide Rail	Energy Absorbing Systems	Concrete Barriers	Winter Maintenance - Summary	Winter Maintenance - Operations	Winter Maintenance - Resources	Winter Maintenance - Snow Drift Control
POTENTIAL HAZARDS										
OHSH-1	**Chainsaw**	X		X	X			X		X
OHSH-2	**Confined Space**									
OHSH-3	**Electrical**						X	X	X	X
OHSH-4	**Excavation**	X	X	X	X		X	X	X	X
OHSH-5	**Explosives**									
OHSH-6	**Eye & Face**	X	X	X	X	X				X
OHSH-7	**Fall from Height**	X	X		X		X	X	X	X
OHSH-8	**Fire & Explosion**						X	X	X	X
OHSH-9	**Foot**	X	X	X	X	X	X	X	X	X
OHSH-10	**Head**	X	X	X	X	X	X	X	X	X
OHSH-11	**Lockout/Tagout**						X	X	X	X
OHSH-12	**Skin**	X	X	X	X	X	X	X	X	X
OHSH-13	**Traffic & Visibility**	X	X	X	X	X	X	X	X	X
OHSH-14	**Vehicle/Equipment Operation**	X	X	X	X	X	X	X	X	X
OHSH-15	**Working Around Water**							X		X
OHSH-16	**Biological**	X	X		X			X		
OHSH-17	**Chemical**							X		
OHSH-18	**Vibration**	X	X	X	X		X	X	X	X
OHSH-19	**Hot Work, Welding & Cutting**		X	X			X	X	X	X
OHSH-20	**Noise**	X	X	X	X	X	X	X	X	X
OHSH-21	**Respiratory**	X	X	X	X		X	X	X	X
OHSH-22	**Thermal (Hot & Cold) & Solar UV**	X	X	X	X	X	X	X	X	X
OHSH-23	**Muscle Strain/Injury**	X	X	X	X	X	X	X	X	X

GENERAL DESCRIPTION OF HAZARD

Chainsaws are a high-speed cutting tool that demands the operator's full attention. Operator hazards include contact with the revolving chain, being struck by the object being cut; vibration, noise, falling trees and debris.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO Administrative Safety Directive C-18 - Chainsaw Operation Protection
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual

GENERAL SAFETY INFORMATION

1. Workers required to operate a chainsaw shall have attended a training course in the operation, use and maintenance of a chainsaw.

2. Before using a chainsaw the operator should prepare a felling plan that includes an emergency escape route and location of chicos (dead trees and branches).

3. Chainsaws should only be used to cut wood. They are not designed to cut other materials.

4. Contact with nails, pipes or other metallic objects should be avoided.

5. In addition to hard hat and safety boots, the following CSA-approved personal protective equipment should be worn when operating a chainsaw:

   a) Eye protection in the form of goggles;
   b) Leather gloves with ballistic nylon reinforcement to protect the hands and absorb vibration;
   c) Hearing protection; and
   d) Trousers or chaps with sewn-in ballistic nylon pads.

6. Kickback is the term that describes the violent motion of the saw that can result when a rotating saw is unexpectedly interrupted. The cutting chain's forward movement is halted and energy is transferred to the saw, throwing it back from the cut towards the operator.

7. Regulations require that chainsaws be equipped with "anti-kickback" chains. These chains incorporate design features intended to minimize kickback while maintaining cutting performance.

8. Chains should be filed correctly and maintained sharp at all times. A dull or improperly filed chain will increase the risk of kickback.

9. Chainsaws should be inspected and maintained according to manufacturer's instructions regarding chain tension, wear, replacement, etc.

10. Working with chainsaws should be avoided when tired, ill or taking attention-altering medications.

GENERAL DESCRIPTION OF HAZARD

A confined space means a space in which, because of its construction, location, contents or work activity therein, the accumulation of a hazardous gas, vapour, dust or fume or the creation of an oxygen-deficient atmosphere may occur.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO Administrative Safety Directive C-10 - Safety Practises for Entry into Confined Spaces
- MTO Policy Memorandum - Safety of Employees working in Box Girders, April 1994
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- Electrical & Utilities Safety Association of Ontario - Electric Utility Operations Rule Book
- MTO Guideline – First Aid

GENERAL SAFETY INFORMATION

1. Confined space entry training shall be undertaken by all workers who enter confined spaces and provide emergency response.

2. Workers entering confined spaces shall have access to instrumentation capable of measuring the oxygen content of the air, explosive conditions and toxic gases.

3. The instrumentation shall only be used by a competent worker, who shall determine and certify in writing whether the confined space may endanger a worker.

4. The instrumentation should be equipped with an alarm system.

5. Results of testing shall be kept as a permanent record.

6. When a worker is present in a confined space another worker trained in CPR shall be stationed outside.

7. A means of communication between a worker in the confined space and a worker stationed outside shall be provided.

8. All mechanical equipment shall be disconnected from its power source and lockout/tagout procedures used.

9. An emergency rescue plan shall be prepared before entering the confined space.

GENERAL DESCRIPTION OF HAZARD

Sources of electrical hazards include, but are not limited to, working around overhead wires, on electrical systems and with flammable liquids. The effect of electricity on the body is dependent on the amount of current, the path it takes through the body and the length of time the body is exposed to it. The higher the current, the less time a human can survive the exposure. Electricity can cause 3 types of burns: electrical burns; arc or flash burns; or thermal contact burns. Electricity always seeks the easiest path to the ground. Electricity passing through the body can cause irregular beating or quivering of the heart (fibrillation) leading to respiratory failure or cardiac arrest. Muscular spasms from electric shock can cause a worker to fall or be thrown resulting in fractures and other injuries. Other dangers include energy arcs from short circuits that can shatter equipment and send metal fragments flying.

REFERENCES

- MTO - First Aid Guideline
- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO - Personal Protective Equipment Guideline
- Electrical Utilities Safety Association of Ontario - Electric Utility Operations Rule Book and Low Voltage Applications Safe Practice Guide
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- CSA Standard "Rubber Insulating Gloves and Mitts"

GENERAL SAFETY INFORMATION

1. Work on electrical fields shall be avoided when tired, ill or taking attention-altering medications.

2. All workers exposed to electrical hazards should receive appropriate training including lockout/tagout procedures.

3. Electrical Certification may be required when working on electrical installations.

4. Safe work procedures should be developed and implemented when working with, or near, electricity.

5. All safety rules and regulations shall be followed. Shortcuts should never be taken.

6. All circuits and equipment shall be treated as live until they are isolated, tested for potential, grounded, tagged and locked out of service.

7. All electric tools should be double insulated and not used in wet or damp locations unless a ground fault circuit interrupter is used to protect the operator.

8. Double insulated tools should not be used if the case is cracked or broken.

9. Workers who work with electric power tools and/or energized electrical equipment should wear foot protection suitable for construction work and with soles resistant to electric shocks, as set out in the CSA Standard.

10. Clothing which is resistant to ignition and propagation of flame should be worn when working around energized electrical equipment.

11. Class 0 rubber gloves should be worn any time testing is performed on energized electrical equipment up to 750 volts.

12. Before beginning work, power lines above and below ground shall be located. Hydro One or the local electrical utility shall be contacted for the location of underground wiring and the voltage of overhead power lines. Specific safety requirements when working around power lines are prescribed in the OHSA regulations.

GENERAL DESCRIPTION OF HAZARD

Excavation hazards result from a hole being left in the ground after the contents have been removed. Trenches are excavations where the depth of the excavation exceeds the excavation width. Potential hazards associated with working around excavations include:

a) Cave-ins;
b) Material falling into the excavation;
c) Falls as workers climb into or out of the excavation;
d) Falling into the excavation; and
e) Worker exposure to toxic substances.

REFERENCES

- OHSA - Construction Projects regulation 213/91
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual

GENERAL SAFETY INFORMATION

1. The three basic methods of protecting workers against cave-ins are sloping, trench boxes and shoring:

   a) Sloping is a method of ensuring that a trench will not collapse by changing the angle of the slope. This angle is dependent on soil conditions. Soil is classified as Type 1, 2, 3 or 4 in accordance with the descriptions set out in the OHSA-Construction Projects regulations.
   b) Trench boxes are support structures designed by a Professional Engineer to resist the pressure from the walls in an excavation.
   c) Shoring is a built-in-place system that supports trench walls. The two types of most commonly used shoring are timber and hydraulic. Both consist of posts, whales, struts and sheathing.

2. The Ministry of Labour requires a Notice of Project registration when the trench into which a worker may enter is greater than 300m long, more than 1.2m deep and over 30m long or the work design requires the approval of a Professional Engineer.

3. Workers who enter trenches shall be trained in the hazards associated with trenches and the work procedures that shall be used to provide protection.

4. Work shall not be performed in a trench unless another worker is working above ground in close proximity to the trench or the means of access to it.

5. Trenches deeper than 6m or wider than 3m shall have an engineered support system.

6. Before an excavation is begun, gas, electrical and other services must be accurately located and marked. The service shall be shut off if it poses a potential hazard.

7. The walls of the excavation shall be stripped of loose rock or material that may slide, roll or fall upon a worker.

8. A level area extending at least 1m from the upper edge of each wall of an excavation shall be kept clear of equipment, excavated soil, rock and construction material.

9. Ladders may be used to access trenches provided they are securely tied off and extend 1m above the shoring or trench box.

10. Inspections of trenches shall be done regularly regardless of the protective system that is used to stabilize the trench.

11. Consideration should be given to atmosphere testing and worker training if excavation situation meets criteria of a confined space.

GENERAL DESCRIPTION OF HAZARD

The use of explosives is periodically required for Highway maintenance operations. Explosives are used for operations such as the removal of beaver dams, ice jams in streams, ditching and includes the removal of rocks or boulders impeding Highway maintenance operations. If safe distances are not maintained, potential hazards could include flying rock/debris, unexploded explosives, post-blast toxic fumes, and concussion.

REFERENCES

- OHSA - Construction Projects regulation 213/91
- MTO Administrative Safety Directive B-1 - Explosives, Use by Ministry Employees
- MTO/OHS Bulletin - Roadway Maintenance Explosives Recognition
- MTO Guideline - Personal Protective Equipment
- The Explosives Act (Canada)

GENERAL SAFETY INFORMATION

1. Workers using explosives require training through a Level I and Level II certification process provided through the Ontario Good Roads Association. This training is designed specifically for Highway maintenance and construction activities. Successful participants of this training are certified to blast rock and ice and can use up to 2 electric caps.

2. Explosive devices may be encountered during other Highway maintenance operations. Although the likelihood of encountering one of these devices is low, any object bearing suspicious characteristics should be treated with caution, as it may be live. The following steps should be taken when a suspicious-looking object is found:

    a) Treat all situations involving explosives and suspected explosives seriously but do not panic;
    b) Do not attempt to touch, move, or disarm a suspected explosive device;
    c) Move away from the object to a safe location;
    d) Without alarming fellow workers, promptly notify them of the potential hazard and ensure that they move away to a safe distance;
    e) Promptly notify your supervisor and provide your name, crew, location and description of the suspicious object;
    f) The supervisor shall contact Central Dispatch; and
    g) Central Dispatch shall contact the local O.P.P. detachment.

h) Wait in a safe location for the O.P.P. to respond to the call. The O.P.P. will investigate the suspicious device and initiate closing of the Highway, if necessary.

i) The O.P.P. Officer will contact the Explosive Disposal Unit (E.D.U.) of the O.P.P. to deal with all situations involving explosives.

3. Working with explosives should be avoided when tired, ill or taking attention-altering medications.

GENERAL DESCRIPTION OF HAZARD

Eye and face hazards include exposures to physical and chemical elements. Examples of physical eye and face hazards include flying objects or particles, abrasive blasting material or intense light/radiation (ultraviolet, infrared and/or visible). Examples of chemical eye and face hazards include contact with chemicals (e.g.: acids, cleaners, solvents and pesticides) or harmful gases, dusts, mists or fumes.

REFERENCES

- OHSA - Industrial Establishments regulations, 851/90
- OHSA - Construction Projects regulations, 213/91
- CSA Standard “Industrial Eye and Face Protectors”
- CSA Standard “Non-Prescription Sunglasses”
- CSA Standard “Safety in Welding, Cutting and Allied Processes”
- ANSI Standard for Emergency Eyewash and Shower Equipment
- ANSI Standard for Occupational and Educational Eye and Face Protection
- MTO Guideline on Solar, Ultra-violet Radiation
- MTO Personal Protective Equipment Guideline

GENERAL SAFETY INFORMATION

1. Workers shall use appropriate CSA-approved eye and face protection equipment where they may be exposed to potential eye or facial injury from flying particles, hot, corrosive or poisonous substances, harmful light, radiation or other substances.

2. Eye and face protection equipment shall be provided to all workers who, due to the nature of their jobs, require such protection.

3. Workers shall be trained in the proper use and maintenance of the eye and face protective equipment.

4. Eye and face protection equipment shall be kept clean and in good repair, and maintained according to the manufacturer’s instructions.

5. An eye wash station/fountain shall be provided in areas where workers are exposed to the potential of injury to the eyes from contact with biological or chemical substances.

6. A quick acting deluge shower shall be provided in areas where workers are exposed to the hazard of full-body chemical exposure.

GENERAL DESCRIPTION OF HAZARD

A fall hazard exists where a worker could fall: a distance of more than 3m; into/onto machinery or other hazardous objects; onto a roadway or railway; or into water or another liquid.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- CSA Standard "Fall-Arrest Systems - Practical Essentials"
- CSA Standard "Fall Arresting Devices, Vertical Lifelines and Rails"
- CSA Standard "Self-Retracting Devices for Personal Fall Arrest Systems"
- CSA Standard "Descent Control Devices"
- CSA Standard "Full Body Harnesses"
- CSA Standard "Shock Absorbers for Personnel Fall Arrest Systems"

GENERAL SAFETY INFORMATION

1. OHSA regulations require that, unless a safety net or travel restraint system is used, a fall-arrest system shall be worn where a worker can fall more than 3m into liquids, or into or onto operating machinery, hazardous substances or objects.

2. The selection of the particular fall protection system for the worker shall be appropriate for the circumstances and the job task.

3. Depending on the type of fall hazard, the following control measures should be implemented,:
   a) Surface protection (non-slip flooring);
   b) Fixed barriers (handrails, guardrails);
   c) Surface opening protection (removable covers, guardrails);
   d) Travel restraint systems (safety line and belt);
   e) Fall arrest systems (safety line and harness); or
   f) Fall containment systems.

4. The preferred choice of a fall protection system will be one that removes the risk of falling entirely (e.g.: a fixed barrier versus the use of personal protective equipment (PPE), such as a safety harness and lifeline).

5. When using PPE, all components of the fall-arrest system, including safety belts, full body harnesses, lanyards and shock absorbers, shall be CSA-certified.

6. All components of the fall-arrest system shall be inspected by a competent worker before each use. If a component of the fall-arrest system is found to be defective, the component shall be taken out of service. Safety lines, belts or lanyards that have been involved in an actual fall shall be discarded even though no damage is apparent.

7. A worker shall wear a full body harness and lanyard secured to a fixed support or a life line when working:
   a) Within 2m of the edge of a rock cut over 3m high;
   b) On steep slopes that do not provide stable footing;
   c) On structures more than 3m high where there is not adequate guardrail protection;
   d) Where there is the potential to fall into or onto hazardous materials; or
   e) In any other situation where an employee is exposed to the dangers of falling more than 3m.

8. Harnesses and belts shall be used only for the purpose for which they were designed.

9. All workers who use fall-arrest systems shall be adequately trained in their use and maintenance.

10. Other practices that should be observed when working at heights include:
    a) Fastening all ladders securely;
    b) Wearing footwear that provides sure footing;
    c) Keeping materials well secured and within easy reach;
    d) Avoiding work on exposed high places in adverse weather conditions; and
    e) Avoiding work on heights when tired, ill, or taking attention-altering medication.

GENERAL DESCRIPTION OF HAZARD

Vapours, dusts and gases can pose fire and/or explosion hazards. The elements necessary to create a fire or an explosion are fuel, an oxidizing material and an ignition source. Both the fuel and the oxidizer must be in suitable proportions to enter into a reaction. Some materials are normally flammable in air at standard atmospheric conditions while others are non-flammable or of low flammability in air but will burn in the presence of a strong oxidizer, high oxygen concentration, very high temperature, or strong ignition source.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- OHSA - WHMIS Regulation 860/90
- Dangerous Goods Transportation Act, regulation 261/90
- Fire Protection and Prevention Act, 1997 - Ontario Fire Code 388/97
- MTO Guideline - WHMIS
- MTO Guideline - Personal Protective Equipment

GENERAL SAFETY INFORMATION

1. All workers involved in the handling and use of flammable materials shall be trained in the hazards and safe use for each product.

2. The least flammable and least hazardous material possible should be used for the prescribed maintenance operation.

3. All ignition sources shall be eliminated when working with flammable materials (i.e.: smoking, static charge, sparks and hot work).

4. Intrinsically safe, grounded equipment shall be used when working in a potentially flammable or explosive atmosphere.

5. The Material Safety Data Sheets should be consulted to obtain detailed information on the safe use and handling of all materials.

6. Workers shall wear appropriate personal protective equipment.

7. Suitable containers (with covers to minimize contact with air) shall be used for storage of fuel, oil, gasoline, cleaning compounds and other flammables.

8. Containers should be suitably labelled with information indicating the safe handling, use and storage of the material.

9. Fuel and oxidizer tanks shall not be located where they might be ruptured or damaged by the impact of vehicles, handling equipment or projectiles.

10. Suitable fire isolation and suppression equipment shall be provided where flammable atmospheres may occur.

11. Clean up and decontamination procedures and equipment to provide the capacity for prompt containment and clean up of leaks or spills of fuels and oxidizers shall be provided.

12. Atmospheres in enclosed spaces shall be checked for the presence of flammable gases before entering and again before conducting any work activities.

GENERAL DESCRIPTION OF HAZARD

Foot injuries can be sustained due to a fall from a height, toe impacts, strains or sprains, crushes from falling objects, sole puncture wounds and electrical shocks.

REFERENCES

- OHSA - Industrial Establishments regulations 851/90
- OHSA - Construction Projects regulations 213/91
- CSA Standard “Protective Footwear”
- MTO Personal Protective Equipment Guideline

GENERAL SAFETY INFORMATION

1. Footwear shall be of a design so as not to impede the safe performance of any work being carried out.

2. Workers shall wear CSA-approved foot protection as required.

3. A shoe/boot with an “aggressive” tread pattern and ankle support should be chosen to provide sure footing on steep and slippery slopes.

4. Anti-slip resistant overshoes, shoe chains, cleats and slings should be considered for workers working on slippery surfaces.

5. CSA-approved metatarsal protection is required, where there is a risk of crushing foot injuries from falling objects.

6. Safety footwear shall be laced up correctly and, when required, provide protection above the ankle.

OHSH-10

GENERAL DESCRIPTION OF HAZARD

Injury to the head can occur when working around falling or flying objects.

REFERENCES

- OHSA - Industrial Establishments regulations 851/90
- OHSA - Construction Projects regulations 213/91
- MTO Personal Protective Equipment Guideline
- CSA Standard “Industrial Protective Headwear"
- CSA Standard “Industrial Eye and Face Protectors”
- ANSI Standard on Occupational and Educational Eye and Face Protection

GENERAL SAFETY INFORMATION

1. CSA-approved protective headwear shall be worn as required by legislation and/or as directed by the employer.

2. Safety hat shells and suspensions shall be checked regularly and maintained in accordance with the manufacturer's recommendations.

3. Defective or damaged shells or suspensions shall be destroyed to prevent their re-use.

4. Safety hats should be discarded and replaced after sustaining a severe blow, even if there appears to be no visible damage to the hat.

5. Exposure to certain chemicals and light can affect the service life of a safety hat. The manufacturer should be consulted for further information.

OHSH-11

GENERAL DESCRIPTION OF HAZARD

Lockout means to physically neutralize all energies in a piece of equipment before beginning any maintenance or repair work.
Tagout means securely attaching identification tags to equipment and/or energy controls so that the equipment or process will not be activated.
If lockout/tagout procedures are not performed, uncontrolled energies could cause:

a) Electrocution (contact with live surfaces);
b) Cuts, bruises, crushing, amputations and/or death, resulting from:
   - Entanglement with belts, chains, conveyors, rollers, shafts, impellers;
   - Entrapment by bulk materials from bins, silos or hoppers; and/or
   - Drowning in liquids in vats or tanks;
c) Burns (contact with hot parts, materials, or equipment such as furnaces);
d) Fires and explosions; and/or
e) Chemical exposures (gases or liquids released from pipelines).

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO Policy Memorandum - Workplace Procedure for Electrical Lockout, December 1997
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- Electrical & Utilities Safety Association of Ontario - Electric Utility Operations Rule Book

GENERAL SAFETY INFORMATION

1. For lockouts/tagouts to be effective, clear, well-defined lockout/tagout work procedures shall be in writing and communicated to all workers.

2. Lockouts generally involve:
   a) Stopping all energy flows (for example, by turning off switches, or valves on supply lines);
   b) Locking switches and valves; and
   c) Securing the machine, device, or power transmission line in a de-energized state (for example, by applying electrical blocks or blanks, or bleeding hydraulic or pneumatic pressure from lines).

3. Lockout may not completely achieve physical neutralization of all energies (back feed) especially if working near a transformer.

4. All workers shall be trained in the lockout/tagout procedure. Training should address the:
   a) Importance of lockouts/tagouts (energy forms and hazards);
   b) Legal requirements and Ministry policy for lockouts/tagouts;
   c) Proper use of all tools; and
   d) Use and care of personal protective equipment.

GENERAL DESCRIPTION OF HAZARD

A skin hazard can exist in circumstances when there is a risk of injury from contact between the worker's skin and:

a) a noxious gas, liquid, fume or dust;
b) an object that may puncture, cut or cause abrasion to the skin;
c) a hot object, hot liquid or molten metal;
d) radiant heat;
e) an allergen such as poison ivy or poison oak (refer to OHSH-16);
f) insect bites (refer to OHSH-16); and
g) radiation (refer to OHSH-22).

REFERENCES

- OHSA - Industrial Establishments regulations 851/90
- OHSA - Construction Projects regulations 213/91
- MTO Personal Protective Equipment Guideline
- Local Public Health Departments
- ANSI Standard for Emergency Eyewash and Shower Equipment
- Maintenance Manual – OHSH-16 & OHSH-22

GENERAL SAFETY INFORMATION

1. Workers shall wear appropriate, proper fitting and, where required, CSA-approved apparel to protect them from the possibility of illness or injury from skin contact with any hazardous substance or physical agent.

2. Protective clothing and safety devices worn next to the skin and are required by more than one person shall be either disposable or cleaned and disinfected prior to being worn by another person.

3. Where skin contact with a potentially harmful material has occurred, affected body parts shall be thoroughly washed without delay.

4. A quick acting deluge shower shall be provided in areas where workers are exposed to potential injury to the skin due to contact with a substance.

5. Where solar ultraviolet light exposure is a potential hazard OHSH-22 should be consulted for general safety precautions.

6. Wearing of long sleeves, pants and using gloves is recommended where contact with poisonous plants is a potential hazard. Where skin contact with poison ivy, poison oak or other poisonous plants has occurred, affected body parts should be thoroughly washed without delay. All clothes, shoes, etc., should also be washed (refer to OHSH-16).

OHSH-13

GENERAL DESCRIPTION OF HAZARD

Workers working near traffic are at risk from being struck by vehicular traffic or debris. Risks to both drivers and workers from vehicular traffic can be reduced by the provision of a predictable, familiar Roadway environment. Worker safety in Roadway work zones depends on the application of a number of key components that work together as a system. If one component of the system is absent, the safety of the worker may be compromised. These components include, but are not limited to, the:

a) Design of the road;
b) Traffic control plan;
c) Traffic protection plan;
d) Safe work habits of the workers;
e) Appropriate police enforcement;
f) Signs and other traffic control devices that are used in the work zone (Proper signs, appropriate positioning); and
g) The condition of the signs and traffic control devices (reflectivity).

In some instances the following components are also required:

a) Blocker / crash trucks;
b) Barriers;
c) Buffer areas; and/or
d) Buffer vehicles.

REFERENCES

- OHSA - Construction Projects regulation 213/91
- MTO Guideline - Personal Protective Equipment
- Ontario Traffic Manual Book 7 - Temporary Conditions (Office Edition)
- Ontario Traffic Manual Book 7 - Temporary Conditions (Field Edition)
- Construction Safety Association of Ontario - Handbook for Construction Traffic Control Persons

GENERAL SAFETY INFORMATION

1. When workers are exposed to a hazard from vehicular traffic, a traffic protection plan shall be implemented identifying the traffic control plan and associated set-up and taken-down procedures.

2. The traffic protection plan shall be kept at the work site and made available to a Ministry of Labour (MOL) inspector or worker upon request.

3. Traffic control devices shall be used consistently and appropriately to ensure worker safety and increase the probability of Roadway users exhibiting the desired behaviour.

4. In determining the layout of the work zone, attention shall be given to the provisions for the safe access to, and egress from, the work area for work vehicles.

5. A worker who is required to set up or remove the measures designed to protect the workers shall:
   a) be a competent worker;
   b) not perform any other work while setting up or removing the measures; and
   c) be given adequate written and oral instructions in the procedures to be used in setting up or removing the measures as identified in the traffic protection plan.

6. Workers who may be endangered by vehicular traffic shall wear a retro-reflective nylon vest (fluorescent blaze or international orange) that covers the upper half of the body and that has a side and front tear away feature.

7. During night-time hours workers shall also wear retro-reflective arm and leg bands or 50cm^2 equivalent side visibility enhancing strips to increase their visibility to the Roadway users.

8. A worker who is required to direct vehicular traffic shall:
   a) not direct traffic for more than one lane in the same direction or when the normal posted speed is more than 90 kph;
   b) be a competent worker;
   c) not perform any other work while directing vehicular traffic;
   d) be positioned in such a way that he/she is endangered as little as possible by vehicular traffic; and
   e) be given adequate written and oral instructions in the procedures to be used in directing vehicular traffic as identified in the traffic protection plan. Those instructions shall include a description of the signage and signals to be used.

OHSH-14

GENERAL DESCRIPTION OF HAZARD

Operating specialized vehicles and equipment requires special skills and training to ensure personal safety and to ensure the safety of the public. Used irresponsibly, any equipment can be dangerous.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- Highway Traffic Act (HTA)
- MTO Handbook for Equipment Operators
- Administrative Directive QST-C11 - Licensing and Training Operators and Drivers of Ministry Equipment
- MTO Directive ASA C-22 - Reversing Vehicles Back Up Program

GENERAL SAFETY INFORMATION

1. Operators have a responsibility to operate equipment:
   a) According to the training provided for the equipment;
   b) According to MTO policies and directives;
   c) In compliance with legal requirements; and,
   d) In accordance with the manufacturer's instructions.

2. Equipment shall not be operated when the operator's ability is impaired by illness, fatigue, or attention-altering medications.

3. Safety features built into equipment shall not be abused, neglected or removed.

4. Seat belts shall be used in all vehicles.

5. Equipment shall not be left in such a way that it can pose a hazard to others.

6. The MTO Daily Inspection Book and Service Record shall be used to ensure vehicle inspections have been carried out in accordance with the HTA.

7. Defects observed during daily inspections shall be reported to the supervisor.

8. Vehicles shall not be overloaded.

9. Loads shall be placed in a balanced manner.

10. Loads shall be secured.

11. Equipment shall not be operated beyond legal limits.

12. Vehicles, machines and equipment should not be operated in reverse unless there is no practical alternative to doing so.

13. When reversing a vehicle or machine where the operator's view of the intended path of travel is obstructed or a person could be endangered by the vehicle, machine or its load, the following rules shall be followed:
    a) Use a competent signaller, who knows proper hand signals;
    b) Whenever possible, reverse with the clearance on the driver's side; and
    c) Always keep the signaller in sight when reversing.

14. All personal injuries/incidents shall be reported without delay to the supervisor.

15. All accidents, either directly or indirectly involving Ministry vehicles and/or equipment, shall be reported without delay to the supervisor.

OHSH-15

GENERAL DESCRIPTION OF HAZARD

There is risk of drowning when working around water. The risk of falling into water is minimized if:

a) Workers stay at least 2m away from the edge of water or the edge of a steep slope leading into the water;
b) Workers employ a fall-arrest or travel restraint system preventing them from reaching the water; or
c) There is a guardrail or safety net between the worker and the water.

REFERENCES

- OHSA - Construction Projects regulation 213/91
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- Canada Shipping Act - Small Vessel Regulations and Collision Regulations
- Canadian Coast Guard - Safe Boating Guide
- MTO Guideline – First Aid

GENERAL SAFETY INFORMATION

1. Supervisors are responsible for recognizing the hazards of drowning, monitoring changing conditions and ensuring the appropriate safety equipment is used.

2. Where workers are exposed to the risk of drowning:
   a) Approved lifejackets must be worn by workers (All Transport Canada approved lifejackets meet the criteria for lifejackets stated in the construction regulations);
   b) Two or more workers must be available for a rescue operation;
   c) An emergency action plan should be in place at the work site; and
   d) A boat must also be available and furnished with the following rescue equipment:
      - A ring buoy with 15m of polypropylene rope 9.5mm in diameter;
      - A boat hook;
      - Lifejackets for each person on the boat;
      - Two oars or paddles;
      - One bailer or one manual pump;
      - One Class B1 fire extinguisher; and
      - A sound-signalling device (whistle, horn, etc.).

3. Training is required for work around water including training for operating a boat.

4. Where there is a current in the water, a single length of line shall be extended across the water downstream from the work location and fitted with buoys or similar objects to keep a person afloat.

5. Where the water may be swift or rough, the rescue boat shall be power driven.

6. Rescue equipment such as boats shall be stored in or near the work area.

7. An alarm system shall be installed and maintained to alert workers to the need for a rescue operation.

8. Outside communication shall be available in case emergency services need to be contacted.

GENERAL DESCRIPTION OF HAZARD

Biological hazards can result from contact with particular living organisms that can cause an adverse response in humans. The hazard may also exist from contact with non-living objects, contaminated through contact with the living organism.

When performing cleaning operations on outside structures, workers may be exposed to bird droppings and feathers. These materials may carry spores of infectious diseases such as Histoplasmosis or Psittacosis. Other examples of biological hazards include exposure to:

a) a rabid animal (e.g.: bat, fox, racoon, etc.) or the carcass of a rabies-infected animal;
b) a tetanus-contaminated object or animal (if worker's tetanus immunizations are not current);
c) bird droppings in enclosed areas;
d) poison ivy, poison oak or other poisonous plants;
e) wild animals such as racoons, skunks, bears, or other large animals;
f) poisonous reptiles;
g) used syringes or condoms in public areas or trash containers;
h) potentially disease-carrying insects such as ticks and mosquitoes; and
i) mould or fungi.

REFERENCES

- OHSA - Industrial and Construction Regulations, General Duty Clause
- Local Public Health Departments
- MTO Bulletin, Blood-Borne Pathogens - Contact with Blood and Body Fluids on the Job
- MTO General Procedures for Handling Road Kill

GENERAL SAFETY INFORMATION

1. To control exposure, biological debris (e.g. bird droppings, animal excrement) should be wetted before sweeping. Workers should wear appropriate protective clothing such as disposable gloves and coveralls. If it is not possible to wet biological debris, workers should wear a respirator with a high efficiency particulate air (HEPA) filter to control exposure to airborne contaminated dust. Before leaving the worksite, protective clothing should be removed and dust should be washed from footwear.

2. Workers should consider the possibility of dog or wild animal attacks and refer to appropriate emergency response procedures.

3. In areas where poisonous snakes exist, workers shall ensure that appropriate CSA-approved footwear is worn, medical supplies are available and the emergency plan can address this hazard.

4. Where contact with poisonous plants is a possibility, workers should wear long sleeves, pants and gloves. If contact is made with poison ivy, poison oak or other poisonous plants, the affected skin should be washed without delay. All clothes, shoes, etc., should also be washed.

5. Road-killed animals can be contaminated with a variety of bacteria, viruses, moulds and fungi. All carcasses should be handled as if infected. Direct contact with the carcass shall be avoided by using gloves and a shovel. Carcasses shall be disposed of by burying, or in accordance with local regulations.

6. Workers should cover all open sores or wounds and wear heavy gloves, long sleeves, pants and safety boots when contact with used syringes or condoms is a possibility (e.g.: working in roadside rest areas/picnic sites). Potentially contaminated materials should be disposed of as hazardous wastes and all used syringes should be disposed of in puncture-proof containers.

7. Workers should never compact waste by hand or reach into waste receptacles that may contain syringes or other biological hazards.

8. Insect repellent should be used and proper clothing worn where exposure to biological hazards such as poisonous plants, insect bites, etc., is possible:
   a) If both sunscreen and insect repellent are required, apply the sunscreen first and wait 10 - 20 minutes before applying the repellent.
   b) Precautions may be needed in areas prone to ticks. Insect repellent, tight fitting clothing and tucking pants into boots is recommended. Workers should inspect their skin after working in wooded areas for the presence of ticks and remove ticks with tweezers. Care should be taken so as not to detach the head of the tick from the body.
   c) In areas prone to biting insects, insect repellent, long sleeve clothing and pants are recommended. Special bug jackets and/or hats may be used where the conditions warrant.

9. Workers should address their personal allergy requirements before going on-site and ensure they have the appropriate treatment materials on hand in case of allergic reactions to insect stings, pollen or other conditions.

GENERAL DESCRIPTION OF HAZARD

Chemical hazards can result from inhalation, ingestion or contact with chemical agents in the form of vapours, gases, dusts, fumes and mists.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - WHMIS regulation 860/90
- OHSA - Control of Exposure to Biological or Chemical Agents, regulation 833/90
- OHSA - Construction Projects regulation 213/91
- OHSA - Designated Substance Regulations
- NIOSH Pocket Guide to Chemical Hazards
- MTO Personal Protective Equipment Guideline
- Safe Workplace Associations (SWA's)
- Canadian Centre for Occupational Health and Safety

GENERAL SAFETY INFORMATION

1. Workers shall be informed of the chemicals they are working with and receive training on their hazards, required Personal Protective Equipment (PPE) and safe work practices (i.e. use, storage, and disposal). Workers shall be informed of appropriate first aid measures for adverse health effects from exposure and shall have access to first aid supplies and a competent first-aider. Workers have the right to access a chemical's Material Safety Data Sheet (MSDS), as per the WHMIS regulation.

2. The appropriate MSDS should be referred to for first aid procedures.

3. Workers shall have easy access, as required, to eye wash stations and deluge showers.

4. Clothing contaminated with chemicals should be removed without delay to minimize chemical contact with the skin. If removal of contaminated clothing will damage the skin, the MSDS should be consulted and medical attention sought without delay.

5. All handling of chemicals shall occur in well-ventilated areas.

6. Decanting of flammable liquids can result in an electrostatic discharge. Proper grounding and bonding procedures should be followed whenever transferring chemicals from one container to another.

7. All sources of ignition shall be eliminated when working with flammable or combustible chemicals.

8. Workers shall not smoke, eat or drink while working with chemicals.

9. Workers should always wash their hands and face thoroughly before eating and after working with chemicals.

10. Work areas shall be assessed for airborne exposures to chemicals and suitable ventilation provided. If ventilation cannot adequately control the hazard, the workers must be provided with appropriate CSA or NIOSH-approved respirators.

11. Chemicals shall be stored in approved containers and facilities.

12. Pavement marking materials may contain hazardous materials such as lead pigments and flammable/combustible solvents. The MSDS should be referred to for product-specific safe work procedures.

13. Bridge coatings can contain lead pigments. Where the work is likely to create exposure to dust from lead containing coatings (e.g.: sanding, cutting and welding), the OHSA - Designated Substance regulation for Lead, should be consulted for the required measures to mitigate worker exposure.

GENERAL DESCRIPTION OF HAZARD

Vibration hazards can result when a worker comes in contact with operating machinery or equipment or the surrounding structures the vibrating machinery contacts. Noise and vibration frequently come from the same source. Physical contact with vibrating machinery transfers vibration to the worker's body. Vibration can be transferred to the worker at levels that are disturbing to comfort, health, safety and efficiency. Vibration may affect a worker's whole body (whole body vibration) or only the part of the body at the point of contact (segmental vibration). Hand-arm vibration (segmental) can affect operators of hand-held, vibrating equipment such as chain saws, jackhammers and grinders. The greater the grip strength needed to operate a vibrating hand tool, the greater the transmission of vibration energy to the hand. Whole body vibration energy enters the body through a seat or the floor. The risk of injury depends on the intensity and frequency of the vibration energy. Intense or prolonged exposure to vibration has been shown to affect the neurological, circulatory and musculoskeletal systems in the body.

REFERENCES

- International Standards Organization (ISO) - "Guide for the Evaluation of Human Exposure to Whole-Body Vibration"
- ISO - "Guides for the Measurement and Evaluation of Human Exposure to Vibrations Transmitted to the Hand"
- NIOSH - publication No. 83-110 (www.cdc.gov/niosh/83110_38.html)
- American Conference of Governmental Industrial Hygienists (ACGIH) - Threshold Limit Values (TLVs) and guidelines for vibration.
- Canadian Centre for Occupational Health & Safety (CCOHS) (www.ccohs.ca/oshanswers/phys_agents/vibration/)

GENERAL SAFETY INFORMATION

1. Protection from vibration usually requires a combination of appropriate tool selection, the use of appropriate vibration-absorbing materials (i.e. gloves), good work practices and education for the workers.

2. Anti-vibration or vibration-damped tools should be considered when purchasing tools.

3. Poor tool maintenance can increase the amount of tool vibration.

4. Conventional protective gloves (cotton, leather) will not reduce vibration transmission. Anti-vibration gloves have a limited effect in reducing low frequency vibrations and in protecting hands from cold temperatures that may compound the physical effects of the vibration.

5. Risk of hand-arm vibration damage can be reduced by following good work practices:
   a) Using the loosest hand grip possible for safe tool operation;
   b) Wearing sufficient clothing, including gloves, to keep warm;
   c) Avoiding continuous exposure to vibration;
   d) Avoiding use of faulty tools; and
   e) Maintaining properly sharpened cutting tools.

OHSH-19

GENERAL DESCRIPTION OF HAZARD

The main hazards associated with hot work, welding and cutting include:
a) Chemical exposures (e.g.: metal fumes, Phosgene);
b) Fire and explosion hazards associated with compressed gases or from surrounding combustible or flammable materials;
c) Burns to the skin and eyes from molten metal, flames or non-ionizing radiation (e.g.: UV and IR); and
d) Electrical hazards from high voltage welding processes.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- MTO Guideline - Personal Protective Equipment
- Construction Safety Association of Ontario - Construction Health & Safety Manual
- CSA Standard "Safety in Welding, Cutting and Allied Processes"
- CSA Standard “Industrial Eye and Face Protectors”
- CSA Standard "Rubber Insulating Gloves and Mitts"
- CSA Standard "Selection & Care of Respirators"

GENERAL SAFETY INFORMATION

1. Workers using welding and flame-cutting equipment shall be trained in safe work procedures. Training shall include the proper use of personal protective equipment and the proper storage, handling and use of compressed gas cylinders and welding equipment.

2. Compressed gas cylinders shall be stored upright at all times and with the protective caps in place over valve assemblies.

3. Compressed gas cylinders shall be stored separately and isolated from other flammables.

4. The contents of compressed gas cylinders are under high pressure. Cylinders shall never be struck, rolled or exposed to extreme heat.

5. Torch tips should be kept clean of grease, oil, and slag. Clogged torch tips should be cleaned with suitable cleaning wires, drills or other devices designed for this purpose.

6. Proper fitting wrenches should always be used when making connections. Vise grips or pipe wrenches shall not be used.

7. A reverse flow check valve in conjunction with a flash arrestor should be incorporated into the welding or flame-cutting system to prevent dangerous flashbacks.

8. All portable electric arc welding equipment shall be properly grounded.

9. The appropriate type of fire extinguisher shall be available whenever oxyacetylene cutting, welding, soldering or brazing is done.

10. Adequate ventilation and a near-by exit shall be provided when using a torch in a confined area.

11. Welding machines should have properly connected cables that are in good condition and kept away from wet ground.

12. Appropriate personal protective equipment for arc welding, (e.g.: CSA-certified leather gloves, full-length workpants and a shirt with sleeves) should be worn.

13. CSA-certified flash goggles, helmets and face shields designed with the appropriate optical filter for the welding/cutting process shall be worn. Welding or cutting shall never be carried out near flammable or combustible materials.

14. Adequate ventilation should be provided to prevent the accumulation of toxic gases and fumes.

15. Respiratory protection should be provided as a backup for worker protection from toxic gases and fumes.

GENERAL DESCRIPTION OF HAZARD

Regular exposure to hazardous noise levels over many years can result in noise-induced hearing loss. Noise can be experienced as continuous, impulse or impact noise.

REFERENCES

- OHSA - Construction Projects regulation, 213/91
- OHSA - Industrial Establishments regulation, 851/90
- MTO Directive B-2
- MTO Personal Protective Guideline
- CSA Standard “Hearing Protectors”

GENERAL SAFETY INFORMATION

1. Efforts shall be undertaken to reduce the sound level where workers are exposed to sound levels of 90 decibels (dBA) or greater for an 8-hour period. If reduction is not possible, exposure time should be reduced or hearing protection shall be worn.

2. Although the legislated sound level limit is 90 dBA, worker exposures should be reduced to 85 dBA for an 8-hour exposure period.

3. CSA-certified hearing protection shall be provided to workers who are exposed to noise levels in excess of the standards.

4. No worker shall exceed the duration of exposure specified in the Occupational Health and Safety Act without wearing hearing protection.

5. Unprotected continuous noise exposure greater than 115 dBA shall not be permitted.

6. All hearing protection shall be inspected regularly, and kept clean and in good condition by the worker.

7. Workers should have awareness training around the hazards of noise exposure and the potential consequences to their health.

8. Sound level readings should be conducted in areas where workers may be exposed to high noise levels. Controls should be implemented if noise levels are above the recommended standards, and workers may be exposed.

9. Regular audiometric testing should be carried out to monitor hearing acuity of those workers exposed to noise hazards.

OHSH-21

GENERAL DESCRIPTION OF HAZARD

Respiratory or breathing hazards can include, but are not limited to, particulates, gases, vapours, mists, fumes and oxygen-deficient environments or other atmospheres that are considered dangerous to life or health.

REFERENCES

- OHSA - Industrial Establishments regulation 851/90
- OHSA - Construction Projects regulation 213/91
- Respiratory Protection Administration Safety Directive C-21
- MTO Confined Space Entry Protocol
- MTO Personal Protective Equipment Guideline
- CSA Standard "Selection & Care of Respirators"
- CSA Standard "Compressed Breathing Air Systems"
- OSHA - Control of Exposure to Biological or Chemical Agents regulation 833/90

GENERAL SAFETY INFORMATION

1. The use of respiratory protective devices shall be restricted to times of intermittent hazardous exposures or when such exposures are impractical to fully control by engineering or administrative controls.

2. Any worker required to enter or work in an area where they are likely to be exposed to a respiratory hazard shall wear CSA-certified respiratory equipment appropriate for the hazard which may be encountered.

3. Workers shall not be assigned to work which requires the use of respirators unless they are physically able to perform the work while using the equipment.

4. Respirators shall be used in accordance with the procedures specified by the equipment manufacturer.

5. Workers using a respirator are to be instructed in the limitations, inspection, maintenance, fitting, cleaning and disinfecting of the respirator being used.

6. Respirators shall be fitted so that there is an effective seal between the respirator and the worker’s face. Respirator fit testing should be performed on these workers every two years.

7. Breathing gases used for respirators shall meet CSA standards for air quality.

8. All Self Contained Breathing Apparatus (S.C.B.A.) bottles should be recharged every 6 months.

9. Workers shall clean respirators after each day's use or more often if necessary.

10. Worn or deteriorated parts shall be replaced with identical parts produced by the original manufacturer.

11. Assessment of the level of the contaminant through air sampling shall be done to ensure the appropriate protection is provided.

12. Mechanical filters or chemical cartridge respirators shall not be used in areas where concentrations of dust, mists, or vapours exceed the respirator’s designed limitations or where there are no warning properties (i.e.: odour or taste).

GENERAL DESCRIPTION OF HAZARD

Working out of doors may result in exposures to weather conditions that may result in heat stress, frostbite, hypothermia and sun or wind burn.

REFERENCES

- OHSA - Industrial Establishment regulation 851/90
- OHSA - Construction Projects regulations 213/91
- MTO "Guideline on Solar Ultraviolet Radiation"
- CSA Standard "Industrial Eye and Face Protectors"
- CSA Standard "Non-Prescription Sunglasses"
- MTO Local Health and Safety Offices
- ACGIH TLVs for Heat/Cold

GENERAL SAFETY INFORMATION

1. Workers should gauge weather conditions and limit exposure to the sun by wearing sunscreen and/or a hat, long sleeved clothing and pants.

2. Workers at risk of over exposure to solar UV radiation should use sunscreen, UV blocking safety glasses and receive awareness training on the hazards associated with exposure to solar UV radiation.

3. Sunscreen and/or sun block with a sun-protection factor (SPF) of 15 or higher and effective against UV-A and UV-B radiation should be used on all exposed skin. The product should be PABA free and unscented to reduce the risk of allergic reaction.

4. UV blocking glasses must meet the specifications of CSA Standards (Industrial Eye and Face Protectors) and provide absorption of 99% of the solar UV radiation. The glasses must also meet the requirements in the CSA Standard for Non-Prescription Sunglasses.

5. Work in hot environments can lead to physical illnesses such as heat stroke, heat exhaustion and dehydration. Three factors impact the possibility of heat stress: the ambient temperatures, the degree of physical work demands and the amount of protective clothing that is required.

Work in cold environments can lead to physical illnesses such as frostbite, vascular constriction and hypothermia. Dry, insulated clothing to maintain the employee's core temperature above 36ºC should be worn when working in ambient temperatures below 4ºC. Wind chill cooling rate and the cooling power of air should be taken into consideration.

GENERAL DESCRIPTION OF HAZARD

Workers perform widely differing tasks in daily work situations. These tasks must be matched with human capabilities to avoid "overloading", which may cause the worker to suffer reduced performance capability or even permanently damage their muscles or other soft tissues. Awkward positioning and repetitive movements can put workers at increased risk of muscular strain. Any body position can cause discomfort and fatigue if it is maintained for long periods of time. In addition, improper layout of work areas and certain tasks can require unnatural working positions. Work-related factors impacting the incidence of muscle injuries include the weight of the object being lifted, the range of the lift, the location of the load in relation to the body, the size and shape of the load and the number and frequency of lifts performed. Excessive bending and twisting can also increase the risk of injury. However, the number and severity of manual handling-related injuries can be reduced by following safe work practices.

REFERENCES

- Canadian Centre for Occupational Health & Safety (CCOHS) – (www.ccohs.ca/oshanswers/)
- MTO "Lifting Safely Guideline"

GENERAL SAFETY INFORMATION

1. A load lifted too far from the body imposes more stress on the muscles of the arms and back than a load lifted close to the body. Loads should be lifted as close to the body as possible.

2. A bulky object is harder to lift than a compact one of the same weight because its centre of gravity cannot be brought close to the body. If possible, the shape of the load should be changed so it can be carried close to the body.

3. The weight of handled objects should be decreased to within acceptable limits by having two or more people lift the load, or dividing the load into two or more sections.

4. The preferred range for lifting is between knee and waist height. Lifting above and below this range is more hazardous.

5. Frequently repeated and long-lasting tasks are the most tiring and therefore the most likely to cause muscular injury. Work flow should be properly planned to avoid needless and repeated handling of the same objects.