CONTRACTOR'S MANUAL FOR THE CONSTRUCTION AND MAINTENANCE OF MANITOBA INFRASTRUCTURE & TRANSPORTATION WINTER ROADS

EIGHTH EDITION

OCTOBER 2012

Manitoba

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I.

DISCLAIMER

This manual highlights some common issues when constructing and maintaining winter roads; however, it is the responsibility of each and every employer/contractor involved in the construction and maintenance of winter roads pursuant to The Workplace Safety and Health Act, Manitoba Regulation 217/2006 to take the necessary steps to ensure the safety, health and welfare at work of all his workers and others. Therefore while the Department believes that this manual provides good insights in what is required to safely construct and maintain winter roads, each and every employer/contractor must review this manual to determine if additional safeguards are needed given their particular workplace and workers. It cannot be assumed that ALL acceptable safety measures are contained this manual or that additional measures are not required.

It is your responsibility to develop your own specific documents and policies related to your own needs when involved in the construction and maintenance of winter roads.

In the event that there are any discrepancies or inconsistencies between this Manual and the Contract, you are bound by the requirements of the Contract.

Information presented has been compiled from sources believed to be current and reliable; however, it cannot be assumed that all acceptable safety measures are contained in this document or that other additional measures may not be required under particular or exceptional circumstances. Contractors, employers and workers are responsible to familiarize themselves and comply with all legislation and safe work practices applicable to the work being performed.

II.

INTRODUCTION

This information manual has been prepared by a Winter Road Safety Committee. The intention of this manual is to provide information for safe working practices and help decrease the risk of accidents occurring on ice roads.

Committee members are comprised of representatives of the Manitoba Infrastructure & Transportation, Department of Labour and Immigration, and private industry involved in the construction and maintenance of winter roads.

This manual is intended for use on winter road alignments built in the same general vicinity each year. Experience and historical data is very important when working with inexact foundations and materials. Extra precautions must be taken when on a new, unfamiliar alignment.

The Contractor's Manual for the Construction and Maintenance of Winter Roads and the information detailed in the Winter Roads Contract should be referred to as references for constructing and maintaining winter roads.

Refer to the most current version of the Manitoba Infrastructure & Transportation Standard Construction Specifications Manual for detailed winter road construction and maintenance standards.

METHODOLOGY

The 1992 Manual was developed by using a Winter Roads Questionnaire that was sent to 224 agencies across Canada, of which 27 responses were received and reviewed by the committee.

These responses played a large part in the development of this manual.

Our thanks to the agencies who responded. The agencies that responded are listed in Appendix A.

General Safety Information and Keys to Survival is useful to winter road builders as well as the general public. This information is included in Appendix B.

III.

CONSTRUCTION STANDARDS OVER ICE

The objective of this section is to provide information so that winter roads over ice can be safely constructed and maintained. When working on ice you must never take for granted any single factor, as construction and maintenance of an ice road involves many variables that do not remain constant. Remember, you are constructing an ice road that is entirely subject to the fluctuations and unpredictability of the weather.

Ice roads can be constructed across rivers, streams and lakes. If water levels remain constant it is advisable to construct the ice roads in the same location every year. Some sections may form ice slower if they are near islands, sand bars, reefs and river bends as these areas produce currents that prevent ice from forming naturally. Lakes that are shallow or ice roads that approach shore lines must be constructed and tested with care as there could be gas producing muskeg that slows natural ice formation. Sharp curves on ice roads should be avoided as they are hard to locate if visibility is reduced.

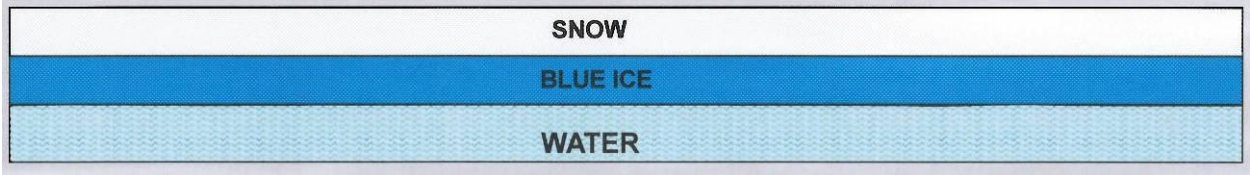
Where possible ice roads should meet the shoreline at an angle of greater than 45 degrees to allow the hydrodynamic wave generated by on ice traffic to reflect off the shoreline away from the ice crossing.

The main concern when constructing an ice road is to ensure there is good quality solid ice of sufficient thickness to support the equipment being used. Once this has been established you can begin construction activities.

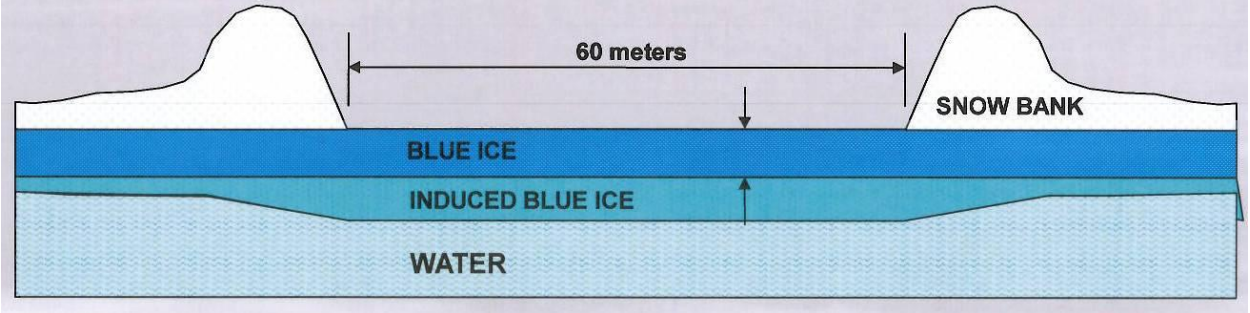
The initial step is to check for adequate allowable load capacity. This can be accomplished using amphibious equipment and Ground Penetrating Radar, or drilling by a worker wearing a CSA approved harness and lifeline (i.e. 15mm nylon rope) in addition to required Personal Protective Equipment for working on ice. All safety equipment should be inspected prior to use. Once there is sufficient bearing capacity, mark the outside limits of the ice road with markers approximately two metres in height, so the operators know the exact location that was checked and needs to be cleared. No equipment or personnel should travel beyond the outside limits. Once the clearing has been completed the markers are then placed at regular intervals of 100 meters on the inside edge of both outside banks. The markers act as a guide to prevent any traffic hitting the banks when visibility is reduced by sun glare, ground drift, or in white out conditions.

The Manitoba Infrastructure & Transportation standard clearing width on large lakes is sixty (60) meters. In areas where ground drift is prevalent, extra width clearing may help reduce accumulating snow during maintenance as the wind has a tendency to blow the ice road clean. Extra width clearing also allows for storage of snow during maintenance. The contractor shall take care to construct the snow storage banks to a reasonable height to minimize overloading the ice cover and ice cracking.

The Manitoba Infrastructure & Transportation standard cleared width on rivers, streams and smaller lakes where drifting is not a problem, is thirty to sixty meters depending on the length of the ice road. The normal sequence of construction of the winter road on ice includes the natural freeze of the ice and snow cover.



When conditions permit, check ice for thickness, quality and allowable load capacity to determine the suitable method of snow removal and hence reducing the insulating effects of the snow cover.



The exposure to cold ambient temperatures and the reduced insulating effect of the snow cover cause the ice to thicken under that portion of the ice road.

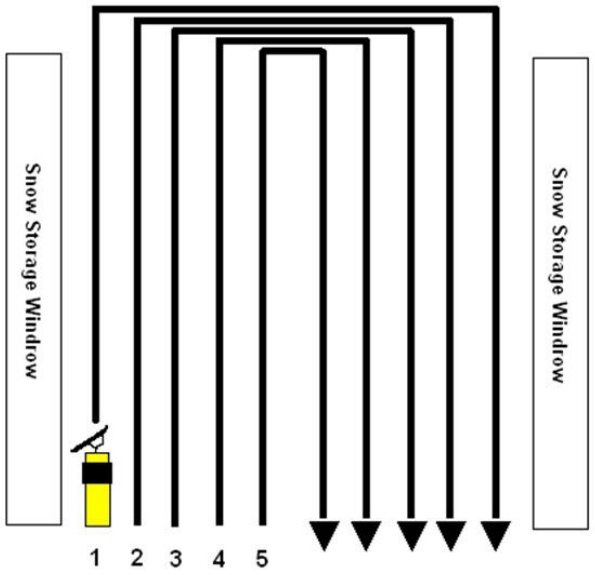
Once the ice has thickened sufficiently and has been cleared off, it develops a shape as shown in the diagram below. This occurs because the outside snow bank acts as an insulator. This insulation prevents the ice under the extreme edges of the road from getting thicker.



Source: Best Practice for Building and Working Safely on Ice Covers in Alberta - Government of Alberta 2009

The bearing capacity of a floating ice road is largely derived from the buoyancy of the ice. The importance of initially constructing the specified ice road width is vital as future widening is considered unsafe.

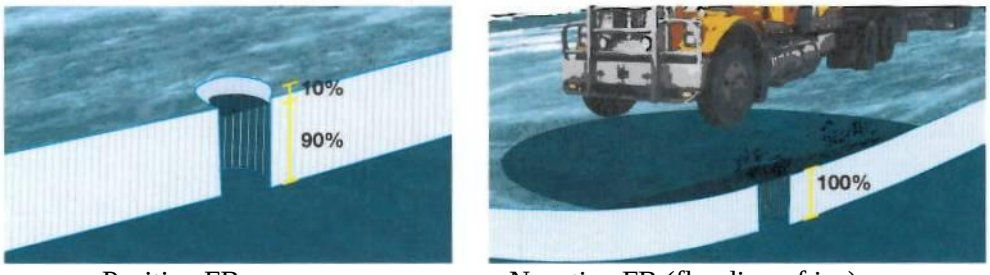
Clearing on ice should start on the outside edges and continue towards the centre if the snow is heavy. The equipment should only move as much snow as it can safely handle. To prevent ice failure from wave action the clearing equipment should follow each other and clear in the same direction. Once the clearing operation has started it should not be delayed until full width is reached on the length being cleared. Care must be taken not to create large snow banks on the sides of the snow storage area and not to leave large windrows in the area to be cleared as slush could occur making it impossible to move the snow storage banks safely.



Source: Guidelines for the Construction and Operation of Winter Roads – Transportation Association of Canada 2011

Slush occurs when the weight of the banks forces the ice down and water comes up through the cracks. If the water is forced up quickly it could erode the ice forming air holes under the banks or along the edge of the traveled surface. Clearing equipment should not be allowed to work or travel close to large banks or in areas where visible slush and wet cracks have occurred.

An ice cover, when subjected to a load, deflects downward at the location where the load is applied resulting in a decrease in freeboard. Freeboard amounts to about 10% of the ice thickness and is the distance between the top of the ice cover and the water level. Moving or short-term loads (less than two hours) cause elastic deflections resulting in a nearly complete rebound. Loads left on the ice for more than two hours result in permanent deformations which could ultimately lead to flooding of the ice (negative freeboard). Ice roads are generally subjected to moving loads resulting in small freeboard losses. Freeboard measurements should be included in the monitoring program.



Positive FB Negative FB (flooding of ice)

Source: Best Practice for Building and Working Safely on Ice Covers in Alberta - Government of Alberta 2009

The maximum speed limit on all ice roads for construction equipment weighing over 7000 kg GVW is 15 km/h. This speed should be reduced when approaching land or meeting other construction equipment. The stopping ability of all vehicles is dramatically reduced on ice roads especially if there is no snow cover. Due to this variable in the surface, all users should drive with extreme caution.

Hazards created by drifting snow can be reduced by blading snow guards approximately 30 metres from each side of the road. The guards will trap blowing snow before it reaches the road surface. This will keep the road open longer during drifting conditions and also reduce maintenance costs. Care must be taken to ensure that the ice beyond the edge of the cleared road surface is sufficient to support the equipment being used.

When constructing the road, a narrow lane may be initially compacted or cleared on the edge of the designated ice road to allow the movement of equipment to locations within the limits of the project.

Once the full width of the ice road has been cleared or packed, the contractor should consider flooding to increase ice thickness. Flooding using 60 cm augers attached to a sleigh or the rear of a bombardier are recommended for longer ice roads. 10 cm pumps can be used for short ice roads. Ice cuttings from drilling the hole should be placed around the hole prior to flooding to prevent backflow. Care should be taken to "plug" each hole after flooding is completed or the water will flow back into the hole.

The initial flood should be of sufficient depth to soak the remaining snow layer completely. This will allow colder temperatures to transform any packed snow into solid ice. Each layer has to freeze completely to the previously flooded layer before the next layer can be placed. Under normal winter conditions, average daily build up rates of 3 to 5 cm may be accomplished by flooding.

Flooding operations should commence prior to excessive snow accumulation as this condition could create slush areas and impede ice formation.

ICE TESTING

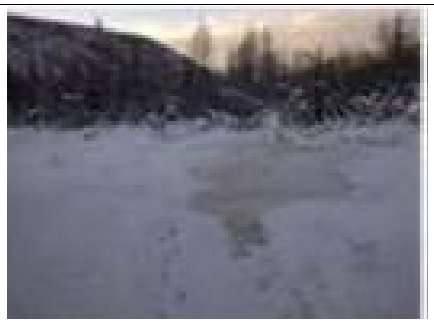
It is very important to document all ice readings carried out on the project. The use of the Ice Thickness Report in this manual is required. Only staff trained in ice testing and experienced in determining ice textures shall be assigned to this task.

Ice is generally unpredictable and thickness or consistency should never be taken for granted. Variables in thickness may be caused by air temperature, currents, snow cover and uneven flooding.

A good method to determine the safe allowable load capacity of ice and ensure all layers are solid and bonded together, is to drill holes in it using an ice auger. The holes allow you to check the ice for bonding, texture and thickness. Another method is using a Ground Penetrating Radar (GPR) profiler which gives you a continuous readout indicating total ice thickness.

Using a 10 cm ice auger, drill the hole clearing the ice chips periodically to allow for visual inspection of the ice until you reach water. As soon as your auger reaches water continue drilling until all the loose ice has been removed from the hole. The total ice thickness can be measured by placing the measuring stick at the bottom of the ice and recording the measurement at the top of the ice. Freeboard can also be determined at this time. Freeboard is the distance between the top of the water level and the top of the ice surface. Freeboard of unloaded, good quality solid ice amounts typically to 8-10% of the ice thickness. If no freeboard is encountered or if flooding occurs (negative freeboard) it must be recorded on the ice report and the area must be evacuated immediately and be re-evaluated prior to further construction activities. Once the test hole is complete, plug the hole with snow.

Ice Types and Their Variability

Ice Type	Ice Thickness	Strength
 Freshwater lake (blue) ice	Low Variability	Uniform ice quality Higher strength
 River (blue ice)	Medium to high variability More prone to losing underside ice thickness to currents	More variable strength
 Natural flood or overflow (white) ice	High variability More potential for water pockets	Variable strength Higher air content
 Constructed flood ice (white)	Good practices build uniform ice	Uniformity and quality depend on construction practices

Source: Guidelines for the Construction and Operation of Winter Roads – Transportation Association of Canada 2011

Ice Testing Information

The Metric Gold formula used for computing the allowable load capacity of an ice road is not meant to give the true measure of the allowable load capacity of an ice road. Rather, it provides the load limit below which failure of any ice road is unlikely, and it takes into account many of the variables which may exist in ice.

Manual testing on streams and rivers to determine the allowable load capacity of the ice road shall consist of a set of three bore holes; (left, centre and right) taken at a maximum of 30 meter intervals from shoreline.

Manual testing on lakes to determine the allowable load capacity of the ice road shall consist of a set of three bore holes; (i.e. left, centre and right) taken at a maximum of 200 meter intervals. When testing the first 250 meters from each shoreline, tests should be taken at a maximum of 30 meter intervals. Testing at fixed distances will enable subsequent retesting, in the event of low ice readings.

When an area of low ice readings is encountered or there is any indication of a change in the ice texture, test intervals should be shortened to 30 meters or less depending on the total length of the area involved.

STEPS TO FILL OUT THE CONTRACTOR ICE REPORT

I. Top of the Sheet

1. Fill in the date.
2. Record the temperature.
3. Record the sheet number.
4. Record the Contractor's name.
5. Record the name of the person conducting the ice test.
6. Record the name of the water body.
7. Record starting shoreline.

II. Centre of the Sheet (Start on the Left Hand Column)

1. Record the distance from shoreline.
2. Record the thickness for Left, Centre and Right for this location. The Thickness would also be recorded if you did not reach water and hit frozen ground or mud. This must be noted in the comment section as Frozen to bottom.
3. Record any comments.
4. Move to next Distance from Shoreline interval and repeat procedure.
5. When you have completed all of your ice tests on the sheet, circle the lowest reading

III. Bottom of Sheet

1. Go to the box on the bottom left hand of the sheet and record the lowest ice reading circled on the sheet. Match the ice thickness reading to the corresponding loading on the Contractor's Allowable Load Capacity of Ice Chart Record this weight in the allowable loading space in the box.
2. Fill in the name of the person testing the ice, and have the sheet signed by the Contractor's representative.
3. The Contractors Representative shall then forward them to MIT in accordance with the Specifications.

CONTRACTOR ICE REPORT

DATE: _____ **TEMP:** _____ **C** **SHEET:** _____ **OF:** _____

CONTRACTOR: _____ **WATER BODY:** _____

TESTED BY: _____ **STARTING SHORELINE:** _____

Distance from Shoreline (km)	Total Ice (cm)			Comments
	Left	Centre	Right	Note cracking / freeboard / snow cover

Lowest ice reading this sheet: (Circled above) _____ cm.

Using an A Value of 4 the allowable loading for this test area is: _____ kg.

Contractor Allowable Load Capacity of Ice Chart A Value = 4

10 cm	400 kg	40 cm	6400 kg	70 cm	19600 kg
11 cm	484 kg	41 cm	6724 kg	71 cm	20164 kg
12 cm	576 kg	42 cm	7056 kg	72 cm	20736 kg
13 cm	676 kg	43 cm	7396 kg	73 cm	21316 kg
14 cm	784 kg	44 cm	7744 kg	74 cm	21904 kg
15 cm	900 kg	45 cm	8100 kg	75 cm	22500 kg
16 cm	1024 kg	46 cm	8464 kg	76 cm	23104 kg
17 cm	1156 kg	47 cm	8836 kg	77 cm	23716 kg
18 cm	1296 kg	48 cm	9216 kg	78 cm	24336 kg
19 cm	1444 kg	49 cm	9604 kg	79 cm	24964 kg
20 cm	1600 kg	50 cm	10000 kg	80 cm	25600 kg
21 cm	1764 kg	51 cm	10404 kg	81 cm	26244 kg
22 cm	1936 kg	52 cm	10816 kg	82 cm	26896 kg
23 cm	2116 kg	53 cm	11236 kg	83 cm	27556 kg
24 cm	2304 kg	54 cm	11664 kg	84 cm	28224 kg
25 cm	2500 kg	55 cm	12100 kg	85 cm	28900 kg
26 cm	2704 kg	56 cm	12544 kg	86 cm	29584 kg
27 cm	2916 kg	57 cm	12996 kg	87 cm	30276 kg
28 cm	3136 kg	58 cm	13456 kg	88 cm	30976 kg
29 cm	3364 kg	59 cm	13924 kg	89 cm	31684 kg
30 cm	3600 kg	60 cm	14400 kg	90 cm	32400 kg
31 cm	3844 kg	61 cm	14884 kg	91 cm	33124 kg
32 cm	4096 kg	62 cm	15376 kg	92 cm	33856 kg
33 cm	4356 kg	63 cm	15876 kg	93 cm	34596 kg
34 cm	4624 kg	64 cm	16384 kg	94 cm	35344 kg
35 cm	4900 kg	65 cm	16900 kg	95 cm	36100 kg
36 cm	5184 kg	66 cm	17424 kg	96 cm	36864 kg
37 cm	5476 kg	67 cm	17956 kg	97 cm	37636 kg
38 cm	5776 kg	68 cm	18496 kg	98 cm	38416 kg
39 cm	6084 kg	69 cm	19044 kg	99 cm	39204 kg
				100 cm	40000 kg

The Metric Gold Formula has been developed for a moving load. The Contractors Allowable Load Capacity is not for the use of stationary equipment or storing materials. In addition, allowable load capacity does not take into consideration the following conditions: excessive snow cover, slush, water on ice roads, abnormal cracking. Allowable load capacity should be reduced should any of these conditions be encountered.

METRIC GOLD FORMULA, A VALUE = 4

$P = A \times h^2$

$P = 4 \times h^2$

P = Allowable Load Capacity (kg)

A = dimensionless A Value

h = Total Solid Ice Thickness (cm)

ICE CRACKS, POP-OUTS AND FAILURES

Cracks may form in the ice as a result of snow storage bank loading, variations in water levels, temperature or frequent heavy loading. Additional monitoring of the ice road should be scheduled during these situations. Surface cracks les than 5 centimetres deep are not considered serious, but cracks that pass completely through the ice road permitting water to rise to the surface requires the road to be closed or the area barricaded if it is an isolated section.

Construction and Maintenance in the area of wet cracks should be suspended until it is determined travel in that area is safe. In time wet cracks in the ice usually heal and refreeze. After a thorough inspection and it is determined travel is safe the ice road can be reopened.

It may be difficult at times to identify cracks especially if there is snow cover. During the initial stage of clearing, cracks may be located in areas where the snow is depressed or cracks are visible in the snow.

Dry cracks that exceed 5 cm but do not pass through the ice road can be packed with snow and flooded, or drilled and flooded. Operation can continue in this situation if the work area is blocked off until the water has frozen. The ice road should refreeze faster if snow is mixed with the water to form slush. Large diamond cracking in the ice surface indicates an unstable ice surface and the road should be closed.

Vehicles that exceed the speed limit can cause a wave movement in the ice that can rebound or cause the ice to flex and produce a complete failure. Vehicles over 7,000 Kg that exceed the recommended 15 km/h speed limit could also cause ice pop-outs. Ice pop-outs are pieces of surface ice located at the junction of two cracks that come loose from the vibration on the surface. They can be repaired by chopping up the ice pop-out, adding snow and re-filling the hole. If the ice pop-out is large they can be refilled with the ice and snow and flooded.

Excessive loads are those that are too heavy for the floating ice and exceed the available strength of the ice. Field studies have shown that gradually overloading an ice road leads to three stages of cracking: radial cracks, circumferential cracks and intersecting radial and circumferential cracks.



Radial & circumferential cracking leads to imminent breakthrough

Radial cracks, like those on a spoke of a wheel, may be observed originating underneath the load. These usually form at about the halfway point of the breakthrough load. These cracks are a warning the ice is overloaded and the load should be moved off immediately.

Circumferential cracks are those that form a circle around the load some distance from it. They are a Warning that the load is about to break through the ice and personnel should be evacuated from the area.

Intersecting radial and circumferential cracks form pie-shaped wedges underneath the load. These indicate the ice has failed and the load can fall through at any time. Although thicker ice may provide warning time, thinner ice can progress so quickly through these three stages that radial cracking cannot be relied on for any warning.

When large windrows exist on the ice road, water and slush may accumulate under the banks. The ice can crack and fail from the weight of the snow and slush along the snow storage banks. When the ice cracks and drops extensively on the traveled surface, the road should be closed if the ice failure area cannot be blocked off safely.

After the ice road has been cleared to the appropriate width heavy equipment should not park, travel or work close to the snow storage banks. The ice beneath the snow storage banks is thinner than the ice road, and widening the road at a later time with heavy equipment could result in a breakthrough. During the maintenance period the width of the cleared ice surface allows adequate space to travel close to the centre or safely store any further accumulations of snow.

The extra weight of the water and slush under the bank forces water up through the cracks and could erode the ice. These erosion holes can cause flooding along the snow storage banks. These flooded areas should be blocked off to prevent access.

Effects on River Ice

River ice can be less predictable than lake ice. It is affected by fluctuating water levels, under-ice currents and potential river bed changes. Confirmation of river ice should include monitoring for any loss of ice thickness due to these variables.

Temperature Change Effects on Ice

Rapid Cooling

Sudden drops in air temperature (e.g., more than 20^{o}C over 24 hours) produce severe thermal stressing as ice contracts. Ice contraction can either initiate new cracks or extend existing cracks, each with a risk of growing to the bottom and becoming wet cracks. The ice road should be checked for cracks after such episodes and determine if any repairs or maintenance are needed to keep the road open to loads. Snow cover on the ice may slow down thermal changes and can hide cracks.

Warming of the Ice

When air temperatures are above freezing for more than 24 hours, the ice begins to warm rapidly from the surface down. These effects are greatest on bare ice as snow insulates the ice. Even though the ice may have adequate thickness, ice strength can be substantially reduced by exposure to above freezing temperatures and sunlight. If the daily average air temperature exceeds 0^{o}C for more than 48 hours, then the following steps should be taken:

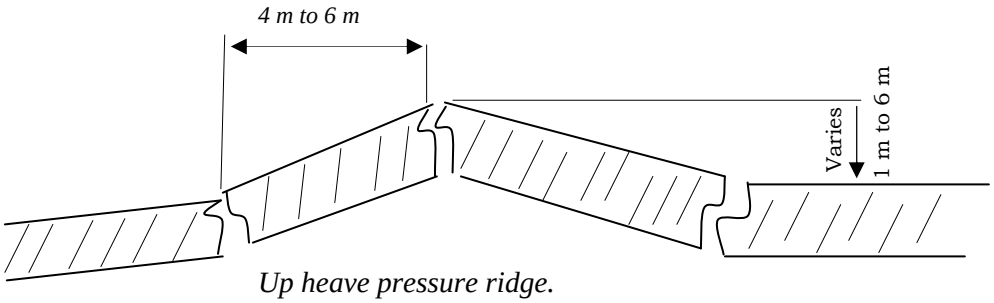
- Measure the minimum ice thickness,
- Monitor the ice conditions for signs of decay, cracking and water,
- Recalculate the allowable weight for the measured minimum ice thickness and reduce it by 50%, and
- Re-evaluate the allowable weight if the average daily air temperature remains below 0 degrees Celsius for more than 24 hours and the ice conditions meet the requirements for strength and quality (cracking).

Ice bearing capacity can reduce rapidly when the ice road is subjected to above freezing temperatures and sunlight associated with the lengthening daylight during the spring season. Ice road operations should be terminated well before ice road decay sets in.

Ice is constantly moving and has hairline cracks running though all levels. During extended periods of mild weather water will start flowing through these cracks. This can be determined by drilling part way into the ice to see if water comes into the drill hole. If water flows through the ice for an extended period the texture will turn grey and crystallized or honeycombed. This ice texture does not have any bearing capacity and the ice road should be closed.

PRESSURE RIDGES

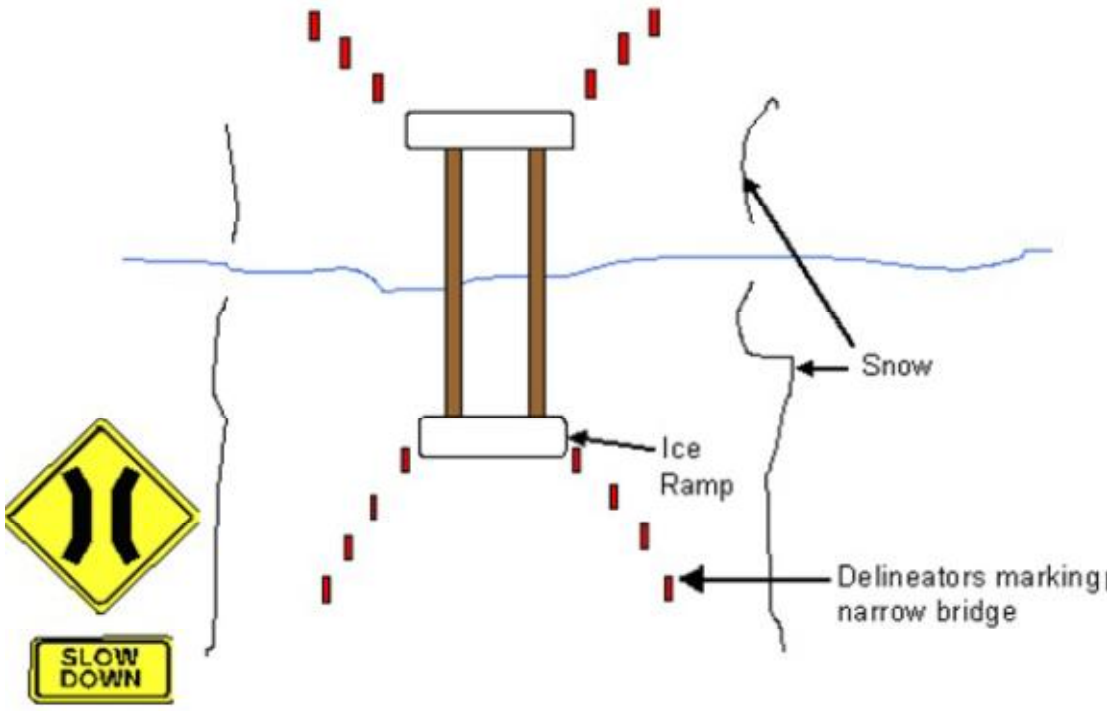
Pressure ridges are usually upheavals of the ice as shown in the figure below. They can occur on a small or large scale.



Up heave pressure ridge.

These areas should be avoided if possible due to their unpredictable nature. While it is preferable to avoid ice road locations historically prone to developing bad crack or pressure ridges, this is not always possible. Large lakes often develop pressure ridges during sudden temperature changes, and re-routing the road may not be feasible.

Bridging cracks and pressure ridges require the same type of solution. A bridge should be put across the work area to allow safe passage of traffic as shown in the figure below.



Construction of a crossing consists of cutting out and levelling the actual pressure ridge so twin timber or steel ramps can be pulled in. The weight of the ramps must be taken into account when determining the allowable bearing capacity of the ice once completed. If the ramps are unstable, any attempt to access the ramps could injure the occupants of the vehicle and damage the vehicle or ramps. Extra caution shall always be used around pressure ridges.

Pressure ridges can move frequently and the ramps should be attached with tow hooks so they can be pulled out and replaced if the ice heaves again. If the ramps lift in the air there should be no attempt to cross until they have been levelled. Any attempt to access the ramps if they are unstable could injure the occupants of the vehicle and damage the vehicle or ramps. When determining the G.V.W. of a vehicle allowed on a ramp bridge on an ice road the weight of the ramp bridge must be included in the G.V.W. Flooding 30 metres on either side of the pressure ridge may be required at the location of the ramp bridge. The ramp bridge should be removed during the flooding operation and replaced when the flood has frozen solid.

Pressure ridges may occur in the same general location every year and should be anticipated when deciding the ice road route.

EQUIPMENT FOR WORKING ON ICE ROADS

It is important to use appropriate equipment, ice thickness permitting, so the ice roads can be cleared safely in a timely manner and natural ice formation can take place. Snow clearing operations are best performed when accumulations are low and should commence in a timely manner. In all cases clearing equipment must not exceed the allowable loading. If the equipment is moving a heavy concentrated snow load, additional ice thickness requirements should be considered.

Equipment Operators must have the ability to exit the vehicle quickly in event of an ice failure. When the equipment has an enclosed cab an alternate means of escape is strongly recommended. This could mean a specially designed "pop-out" window or an escape hatch in the top of the equipment without enclosed cabs or canopies provide an immediate escape alternative and should be considered.

Outriggers have been used for equipment working on ice roads. Outriggers are projecting supports extending from the main structure of the machine to provide additional support and stability and may be in the form of heavy timbers, logs or steel beams. The purpose of outriggers is to slow or prevent equipment from breaking through the ice in event of an ice failure and may allow additional time for the operator to escape from the equipment should this occur.

When working on ice roads during construction and maintenance, the use of approved floatation clothing listed in the Workplace Safety & Health Act is required and no seat belts should be worn. The weight of the equipment and the minimum required ice thickness the equipment can safely operate on must be clearly visible on the equipment and to the operator.

Steel track dozers or other such equipment are NOT allowed to clear ice roads as the vibration from the steel track and the equipments concentrated weight distribution could create a complete ice failure.

Light weight equipment is recommended for initial ice road clearing, providing snow accumulations are minimal and the allowable load capacity is adequate to carry the weight of the equipment. As the allowable load capacity increases, heavier equipment can be used for subsequent clearing.

Clearing equipment should not exceed the maximum speed of 15km/h.

When using tire chains on ice the operator should ensure they are not causing damage to the road surface.

Care must be taken when using short wheel based equipment such as loaders and skidders due to their concentrated load and abrupt movements.

Equipment that has hydraulic buckets, blades, plows or wings (e.g. graders, truck plows, loaders, backhoes, skidders) should not drop their attachments onto the ice in a sudden motion as this action and pressure could create an ice failure.

Flex track equipment (e.g. Bombardiers or groomers) should operate smoothly and not move in short stop and start motions when they are flooding, clearing or when you are stuck as this sudden movement can add additional stress to the ice and could create an ice failure.

It is required that the equipment working on ice be accompanied by an escort vehicle at all times. This will allow for immediate assistance and communication in the event of an injury, accident or ice failure.

For safety and environmental reasons, the servicing and refuelling of all equipment must take place on land.

The loading and unloading of all trucks and storage of material must take place on land.

IV.

CONSTRUCTION STANDARDS OVER LAND

The winter road shall be constructed so that it can withstand constant hauling by normal highway-type vehicles of up to 37,500 kg gross loads. The road surface is to be constructed to a standard that allows loaded trucks to travel safely at an average speed of not less than 35 km/hr on land. A lower standard may be accepted where severe ground conditions prohibit this speed.

Winter roads should be cleared of surface snow and compacted by the contractor to the widths required in the most current version of the Manitoba Infrastructure Transportation Standard Construction Specifications Manual.

Sites for turnaround areas should be cleared of snow and compacted during the initial phase of road construction. The turnaround areas are to be of such a size that a semi-trailer unit may make an unhindered U-turn, and of sufficient length to allow two semi-trailer units to park without obstructing traffic.

Initial compaction for frost penetration shall commence as soon as the bearing capacity of the terrain permits the use of lightweight low ground pressure equipment. Snow mobiles may be required to accelerate frost penetration prior to the use of lightweight equipment. The ultimate objective is to achieve compaction to the full road width.

Shaping the winter road should commence as soon as the frost has penetrated sufficiently to permit the use of heavier equipment and motor graders. Excess snow and debris are to be bladed to the tree lines. Preliminary levelling should also be performed at this time. Fresh fallen snow or previously windrowed snow should be bladed and compacted to create a reasonably level and smooth road surface.

The Contractor is responsible for cleaning up camps and equipment servicing sites and leaving them in as good a condition as existed prior to the commencement of construction.

Beaver dams are hazardous to cross as they could drain and collapse when the road is being used. In order to accommodate traffic, they should be flattened during the first stages of construction to allow for removal of hanging ice and frost penetration. The work must be done in accordance with environmental regulations.

For detailed Winter Road Construction Standards refer to the most current version of the Manitoba Infrastructure Transportation Standard Construction Specifications Manual.

EQUIPMENT FOR WORKING ON LAND ROADS

Light weight low ground pressure packing equipment such as snowmobiles are used initially to pack the snow to reduce its insulation value and induce frost into the ground. Heavier packing equipment such as bombardiers or flex-tracks can be mobilized as soon as it is determined the frost has penetrated sufficiently to provide adequate support.

In the land areas that are muskeg additional care must be taken while operating all equipment due to the high water content of this type of material. There are also creeks and drains running through muskeg that could create an unstable load bearing surface. When equipment is used in muskeg the same standards that are used to construct an ice road may apply as the results of equipment breaking through the muskeg could have the same life threatening results as equipment breaking through an ice road.

Equipment such as wide pad crawler tractors, motor graders, skidders and groomers with blades, loaders, wood, steel and screen drags can be used to clear the packed snow base and induce additional frost, creating a smooth level surface for public use.

V.

SAFETY

WORKING ALONE or in ISOLATION

Working alone or in isolation on the winter road system increases the inherent risks. Manitoba Regulation 217/2006 requires that a "Working Alone or in Isolation Policy" be cooperatively developed by employers and workers in situations where workers are required to work or travel alone. The intent of "the policy" is to identify and minimize the hazards of the work or activity being performed by a lone worker. A worker is considered to be "working alone or in isolation" when not in the presence of another person directly associated with the work.

For further information refer to Manitoba Regulation 217/2006 Part 9 or contact the Manitoba Labour Workplace Safety and Health Branch.

WORKER SAFETY

Workers involved with the construction and maintenance of winter roads are the first people on the roads.

Working on ice is inherently dangerous. Failure can occur so quickly that rescue is impossible. It is therefore imperative that all workers are aware of the potential danger and take the necessary steps to protect themselves. Workers shall observe all Workplace Safety and Health Regulations as well as other standards, procedures and practices relating to their work.

The five main reasons for on-ice accidents are:

- Communication gaps
- Don't know the ice thickness
- Don't know the load
- Wandering off the established road
- Placing and leaving loads on the ice

Ice Conditions

- Seek approval from the work crew supervisor before going on any winter land or ice road.
- The worker is required to know the current allowable loading capacity and if it is sufficient to carry the equipment they are operating.
- Variations in ice thickness are more critical when working on thinner ice and river ice.

Weather Conditions

- Evaluate weather and ice conditions, prior to venturing onto the winter road and follow Guidelines for Working in a Cold Environment.
- Cancel or postpone travel on a winter road if the weather is unsuitable or if deterioration in the ice is apparent.

Procedures

- On winter ice road construction an escort vehicle "buddy system" is required. This means that a person working on winter ice roads will be visible to the escort vehicle at all times. The escort vehicle driver must have reliable communication equipment to call for assistance and safety equipment at all times.
- If machine operators are working alone on a land road it is required they have reliable communication equipment and contact the work crew supervisor at the beginning and end of each shift and give their location and direction of travel. During the shift, they are required to call in on a regular basis. Wherever possible, workers should not work alone.
- Observe and report hazardous conditions and near misses.
- Contractors must follow all procedures in accordance with their own Project Safety Work Plan.

Protective Clothing and Safety Equipment

All contractors' staff working on the ice will wear high visibility floatation clothing, one or two piece floatation and survival suit as per Manitoba Regulation 217/2006.

A lifeline (i.e., 15 millimetre thick nylon rope) is required for workers who are doing the initial testing of an area or suspect that they may be near the load limits given the equipment they are using (i.e., snowmobile, bombardier or pickup truck). The lifeline must be inspected for damage before and after each use. The lead worker during testing must wear a CSA approved harness to which the lifeline is secured.

Inspect all personal safety equipment daily.

If operating a vehicle, obtain an emergency kit. Store it securely in the vehicle to protect it from damage, theft and direct sunlight. If items from the kit are used, they should be replaced or the kit exchanged for a fully equipped one at the end of the shift.

All vehicles used on winter road construction and maintenance should be equipped with fire extinguishers, first aid kits, and warning devices such as flares, reflectors and flags.

Wear warm clothing and footwear appropriate for the conditions encountered or anticipated. Ice cleats are recommended safety footwear on slippery surfaces.

HAZARD ASSESSMENT, ELIMINATION AND CONTROL

Eliminating or controlling hazards is the key to providing a relatively safe work place and a relatively safe roadway environment. Safety is relative to the surrounding environment because, although all incidents are preventable, the road authority and its employees cannot control or influence all factors contributing to the frequency or severity of an incident. Through planning, education, and communication, some hazards can be controlled so an incident is less likely to occur or the severity of the incident that may occur is significantly reduced. If the likelihood of an incident occurring is very high and/or the severity of the incident could be very high, then steps are necessary to not just control the hazard but to eliminate it.

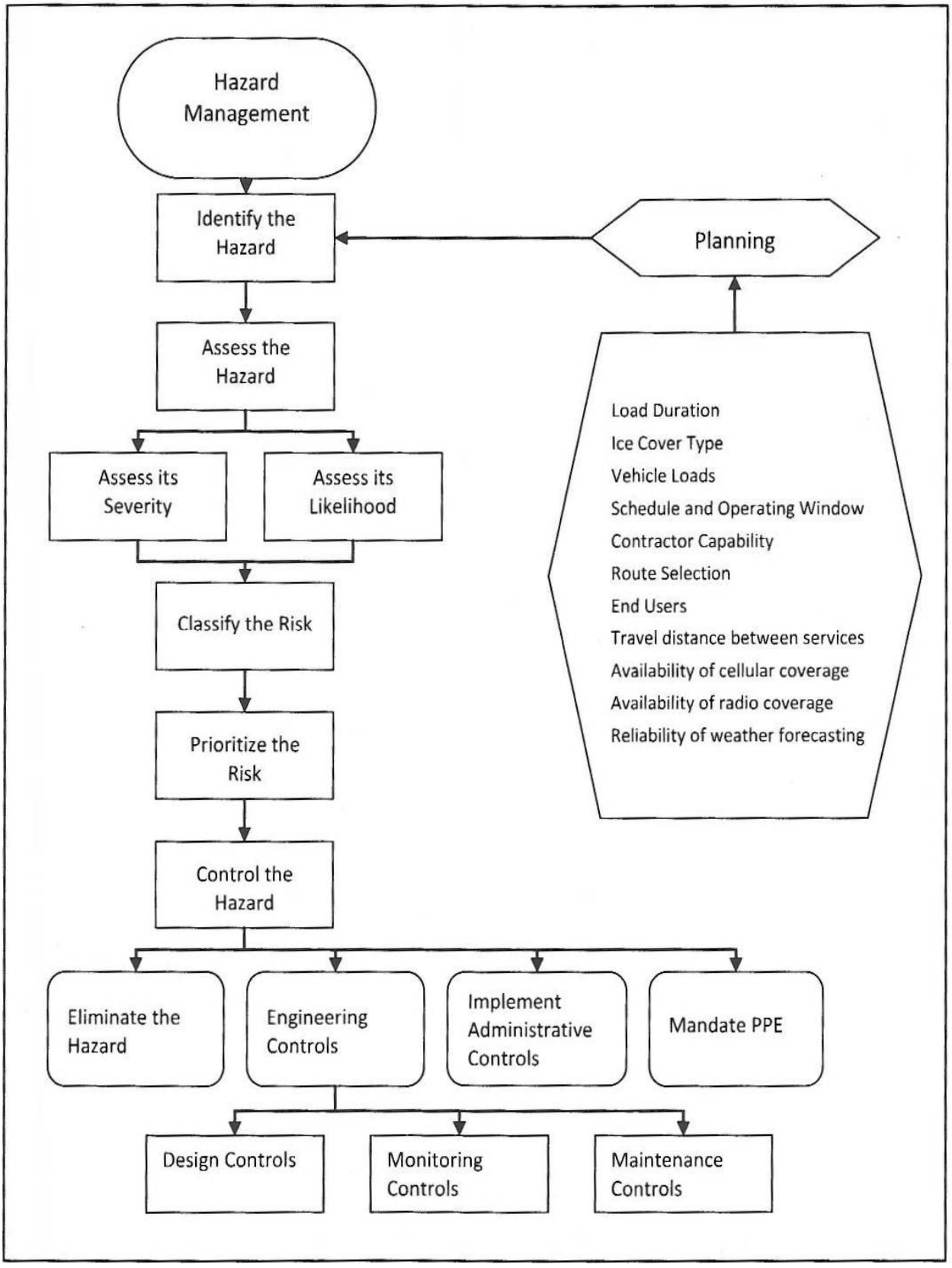
For example, ice and winter roads are operated in cold weather conditions and remote areas. The regional weather forecast for a particular day may be good, but weather conditions are not predictable and could change for the worse. A worker venturing out on the roadway for a regular inspection or patrol could run into poor weather conditions that limit visibility and travel, forcing him to stop. Even worse, he could suffer a vehicle breakdown and be stranded with the weather closing in, resulting in a potentially life-

threatening situation. The weather cannot be controlled, but a worker's preparedness for such an event can be. Even though the risk of the incident occurring is low, the worker can reduce the severity by knowing how to survive in cold weather conditions, understanding the need to stay with the vehicle, and keeping appropriate survival gear and personal protective equipment in the vehicle at all times. Ensuring the vehicle and communication equipment is well maintained, reliable, and in good working order before departing will also control the hazard of being stranded and in a potentially life-threatening situation.

Another example is when poor weather conditions are in the daily forecast or are already occurring. In this case, the likelihood of a worker being stranded is much higher than in the example above, and the severity (potentially life-threatening situation) is also high. The hazard needs to be eliminated by the worker choosing not to travel. An organization would assist the worker in making this decision through education and awareness training, but may also have standard operating procedures or administrative controls in place that allow the worker to systematically come to the decision not to travel.

The Government of Alberta guidelines entitled "Best Practices for Building and Working Safely on Ice Covers in Alberta" present a flow chart for hazard assessment, elimination, and control. The flow chart (and the guide) is specific to a hazard management approach to working on floating ice covers. With minor adaptations, it is applicable to winter roads as well. The flow chart presented below presents this hazard management approach.

Hazard Management Approach Flow Chart



Identifying the hazards is the first step, and planning for the operations at each stage of the construction and operation of the winter or ice road is necessary for the hazards to become apparent before they are physically realized. The parameters associated with the development and operation of the winter and ice road must be identified at the outset. These include such elements as:

- Travel distance between services,
- Availability of cellular coverage,
- Availability of radio coverage,
- Reliability of weather forecasting,
- Load duration,
- Type of ice cover,
- Schedule and operating window,
- Contractor capability, and
- Route selection.

The planning stage must also consider or identify who is being exposed to the hazard: the worker, the driver or the travelling public. The activities implemented to eliminate or control the hazard will be undertaken by the road authority or the agents and employees, but the nature of the activity will depend on who is being exposed to the hazard (i.e., the end user). The examples presented above identify the worker as the one exposed to the hazard. If the first example is presented with the travelling public in mind, the road authority does not have the ability to control the hazard by dictating how a private operator maintains or equips their vehicle for travel on a winter road. The road authority can, however, provide road reports, weather forecasts, and public education to encourage private operators to be prepared. In the second example, if the weather conditions are extremely poor and create a high risk for the travelling public, the road authority could choose to close the road thereby eliminating the hazard. The road authority would need to communicate this closure to the public through road reports, public announcements, and traffic control devices such as signing and barricades.

Further discussion related to each of the three end users (worker, commercial driver, and public) is provided in the sections below.

The hazard management approach uses the flow chart to guide the identification and assessment of hazards and the associated consequences. What is required further is to document this in a "hazard management plan" or a "safety plan", communicate it to workers, and periodically review, revise and update as required. The guidelines from the Government of Manitoba (2007), noted in Section 10.1, include a tabulation of construction and maintenance activities, the associated risk or hazard, and the actions taken for a safe work requirement. A similar tabular format could be used to document a hazard management plan more thoroughly, including documentation of the elements in the flow chart.

Vehicles and Equipment

- Equipment operators will decide whether the doors and/or hatches on equipment working on ice will be removed or lashed open during the construction phase. Wherever practical, canopies must be removed and panic bars or hatches will be installed on equipment doors so that operators can quickly exit in case of breakthrough. All equipment in the cab shall be secure. At the first sign of break-through the operator is to abandon the vehicle immediately.
- Tools, equipment and materials must be stowed neatly and securely in the vehicle.
- Visibility from the vehicle should be unobstructed (i.e., clean windshield).
- No equipment will be used on winter roads if it is not in proper running order.

- Vehicles operating close to the load bearing capacity of the ice during construction must not exceed 15 kilometres per hour and not be parked on the ice
- If required, materials and equipment will be repaired, replaced or modified. This may include the installation of snowploughs and wings.
- Each piece of equipment will be weighed and the minimum ice thickness necessary to support it will be calculated according to the formula presented on the Allowable Load Capacity of Ice Chart. In those communities without permanent weigh scales, the equipment must be weighed at a permanent weigh station prior to transporting to the community. Each piece of equipment, including attachments, shall have the gross vehicle weight documented in the Operational Equipment Listing of the Contract. The weight of the equipment and minimum ice thickness the equipment can safely operate on must be clearly visible on the equipment and to the operator.
- Operators will be responsible for the care of their equipment and for reporting any equipment problem to their work crew supervisor. The work crew supervisor will arrange for repairs.
- An operational check of all equipment will be done and proper training for all personnel carried out.
- The escort vehicle should be equipped with all required safety equipment. The lifeline should be a flotation rope that is readily accessible in the case of an ice failure.

PUBLIC TRAVEL

Public travel is not approved when the winter road is officially closed.

While officially open unexpected delays may occur in these remote and isolated areas. The public should be prepared for extended trips as there is always the possibility of being stranded.

The maximum speed limit on all ice roads for vehicles weighing over 7000 kg GVW is 15 km/h. This speed should be reduced when approaching land or meeting other trucks. The stopping ability of all vehicles is dramatically reduced on ice roads especially if there is no snow cover. Due to this variable in the surface, all users should drive with extreme caution.

Overweight loads over 37,500 kgs are approved in special cases and require approval from Manitoba so all ice roads can be checked to the final destination point on the overweight permit. As well, over width loads require approval from Manitoba so road users can be notified in advance that a wide load is anticipated. Permits are required so the width can be checked, as some rivers and streams have restricted widths due to bridge and corduroy construction. Some sections have tight corners and steep grades that could affect an over width move.

It is advised to travel close to the centre portion of the ice road. Do not travel, stop or park close to the snow storage banks as this is the weakest area of the ice road due to the additional weight of the banks.

All loads with a G.V.W. of 7 tonnes or greater should be spaced 1.0 km apart and should not pass each other when travelling in the same direction. When meeting, the empty vehicle moves over and both should decrease speed.

Stopping or parking loaded trucks on the ice is not recommended at any time due to the concentrated pressure it causes. The sight of one truck parked on the ice could lead to other trucks stopping adding to the concentrated pressure. The weight of one or more trucks stopped on the ice could create an ice failure.

All employees on the project, in addition to their regular duties, are responsible for monitoring road conditions. If an employee sees a situation that is a danger to the public, they have the responsibility to take corrective action. For example (i.e. mark off problem area and notify supervisor).

Winter roads are unique in that even minor accidents or delays have the potential to create a life-threatening situation. Anything, therefore that interferes with the steady flow of traffic is a public safety concern and should be reported immediately so changes can be made to the road report.

Highway Information Services provides winter road information such as route maps, safety pamphlets, safety information and road conditions on its Website at http://www.manitoba.ca/mit/roadinfo/or you can call 511 or 1-877-MB-ROADS for a recorded announcement on road conditions.

OCCUPATIONAL SAFETY, HEALTH AND RISK MANAGEMENT

It is the responsibility of the Contractor to develop their own Project Safety Plan and undertake a Job Hazard Analysis to establish Safe Work Practices on the project. The following is a partial list of activities and the associated potential risks or hazards that an employee may encounter on a Winter Road Project and the safe work requirements that are recommended for each risk or hazard. The construction and maintenance hazards will change from project to project and must be revised by the Contractor as required.

Construction Risk

Activity	Risk or Hazard	Safe Work Requirement
1. The Contractor's equipment is the first to drive on an ice road during the construction phase. Extensive ice testing during this phase is required as the ice thickness is less during the construction phase and the possibility of an ice failure is increased.	Ice failure Personal/Public injury Equipment damage Equipment stranded	The Contractor's Representative that tests and documents the ice reading must ensure all operators are aware of the current ice readings and the allowable load capacity of the ice road. The employee testing the ice must be trained and knowledgeable of all ice testing equipment and procedures and know how to identify solid, bonded ice. All equipment, including attachments, should have the G.V.W. (min ice thick) clearly visible to prevent any misunderstanding. Equipment should not stop on the ice or drop any hydraulic attachments onto the ice in a sudden motion. All operators are required to wear flotation clothing at all times when working on an ice road.
2. Construction of a winter road over a beaver dam or creek requires removal or bridging to prevent a possible collapse during the season.	Ice failure Personal/Public injury Equipment damage Equipment stranded Road blockage Environmental damage	The possibility of water draining or dropping in these areas and creating hanging ice with no allowable load capacity should be identified to prevent a possible collapse during the season. Beaver dams must be removed in accordance with the latest Department of Fisheries and Oceans Canada operational statements. Beaver dams must be removed and levelled to the elevation of the surrounding terrain. Creeks must be bridged in accordance with the Manitoba Stream Crossing Guidelines.
3. Encounter leaning trees or trees that have fallen onto the roadway.	Personal/Public injury Equipment stranded Road blockage	The leaning tree and all debris should be removed from the roadway using a chain saw or axe. Follow all safe work practices and wear the appropriate safety gear to reduce the chance of injury.
4. Contractor packing with snowmobiles or bombardiers on a muskeg land road.	Ice/Muskeg failure Personal/Public injury Equipment damage Equipment stranded Environmental damage	The land road should be packed full width to induce frost and allow heavier clearing equipment access to the project. If the land road is not packed full width there is a possibility of equipment breaking through, injuring the operator, damaging equipment and delaying the construction.

5. Storage of snow on an ice road creating cracking and ice sloping towards the snow storage banks.	Ice failure Personal/Public injury Equipment damage Equipment stranded Environmental damage	There should be no equipment allowed in the snow storage area due to the possibility of an ice failure. It is important that snow removal starts from the outside edges and continues towards the centre moving the snow to the outer limits of the cleared surface so equipment does not have to work outside the snow storage banks in slush. Clearing to full width should be completed as soon as possible to prevent slush from forming under the banks being moved.
6. A new or experienced labourer/operator working on the project is required to operate equipment or complete labourer duties as assigned.	Personal/Public injury	All employees are required to read and understand all project related Workplace Safety and Health Regulations, the Contractors Safety and Health Program, receive adequate training and have competent supervision. The employee is also required to be knowledgeable and trained in the safe use and operation of all safety gear and equipment they will be using and that is available to them. The employee should also understand the capabilities and requirements of the equipment and be able to identify the potential hazards that they may encounter in their day to day activities and the remedial action they must take to eliminate the hazard. If the employee does not feel comfortable or safe when working on the project they should contact their supervisor for direction as to the safest method to carry out the required task. At no time should the employee feel intimidated by other experienced employees or delay contacting their supervisor for direction as safety related issues are a priority in all health and safety programs. The employee should document their safety concern; forward it to their supervisor and it should be discussed at the tailgate meetings that are to be held regularly on the project.

Maintenance Risk

Activity	Risk or Hazard	Safe Work Requirement
1. Driving slow moving maintenance equipment on a land road with tight corners and curves. Other road users are also driving on the system.	Personal/Public injury Equipment damage Equipment stranded Road blockage	Ensure that there is adequate advance warning for the Public that could be approaching or coming up behind the slow moving maintenance equipment on tight corners or curves that have reduced advance visibility.
2. Working in a remote area on a land or ice road with the possibility of an ice failure, accident or breakdown.	Ice Failure Personal/Public injury Equipment damage Equipment stranded Road blockage Environmental damage	The Contractor is required to have an escort vehicle in attendance at all times when working on an ice road. Adequate communication, survival and safety equipment should be available to all employees on the project.
3. Heavy equipment clearing snow on an ice road after the full cleared width has been reached.	Ice Failure Personal/Public injury Equipment damage Equipment stranded Road blockage Environmental damage	Ensure that all employees are aware that heavy equipment is not required to work, travel or park beside the permanent snow storage banks on an ice road. The combined weight of the equipment and banks could create an ice failure. The size of the snow banks being moved or stored is a critical factor and should always be a size that can be managed safely. There should be adequate room on the permanent cleared width to safely store any further snow accumulation. All employees should be aware of the projects limits on all ice roads and that working outside these limits is not approved.

COMMUNICATION

When travelling on winter roads in northern Manitoba, you may require communication equipment if you happen to come upon an accident site, or if your vehicle has a mechanical breakdown. The injured victims of an accident may be beyond your first aid abilities, and you may need to summon medical aid or even extraction equipment. With the Citizen Band (CB) communication equipment that most truckers have, the range is limited to a few miles. The trucking industry has agreed to use Channel One on the C.B. as the designated public channel.

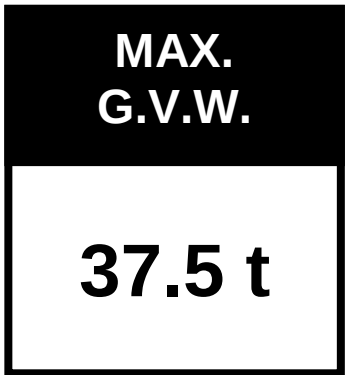
The most effective method of communication in Manitoba's north is the satellite phone. It can be mounted in the cab of a truck or in a suitcase for use in vehicle to vehicle communication. For information on current telephone use in remote, isolated areas contact Manitoba Telecom Services.

VI.

SIGNAGE

Signs are an important part of safety. Those who use ice crossings for transportation are cautioned that the bearing capacity of ice depends on the quality of the ice, the presence of cracks and other properties

Signs placed at the approaches to the ice crossings will indicate the speed which must not be exceeded when travelling or hauling freight across ice roads over frozen lakes, rivers and streams.



(black on white)



(black on white)

Signs for winter roads are to inform users of the distance to the next community where fuel, accommodation and food are available. Each vehicle travelling on the winter road should be equipped with survival equipment.

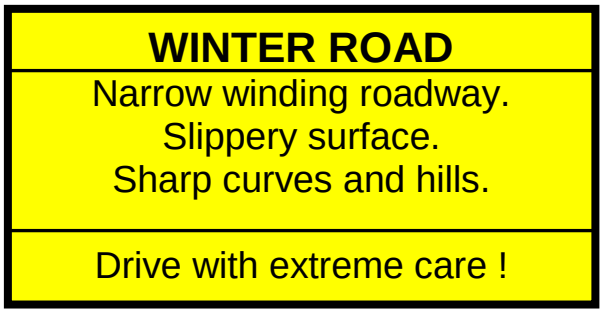


(black on orange)



(black on yellow; black on orange)

Winter road signs are used to inform users of the prevailing winter road conditions.



(black on yellow)

The signs are used to identify river and stream crossings and destination to the next communities. Km markers are placed every 5 km to indicate the distance from start of the winter road section



(white on green)

Signs are used to identify and mark potential hazards on the winter road location. Road users should be alert to speed signs, signs with symbols and reflectorized orange flags. Signs with messages such as steep hills, sharp curve, severe bump, boulders, rough hummocky area or narrow area are very beneficial in assisting to identify hazards and danger areas.

It is the responsibility of Manitoba Infrastructure and Transportation to close a winter road when an emergency situation requires such action. Winter roads may have to be temporarily closed due to early thaws, severe snow storms, or excessive snowfall. Pressure ridges may develop on a location across a lake, river or creek crossing causing it to become unserviceable. Signs and barricades to alert to this condition will be provided by Manitoba Infrastructure & Transportation. The public should be notified of a road closure with as much advance notice as possible as there is no inspection or maintenance provided when a road is closed.

When private winter roads are constructed that branch off Manitoba Infrastructure & Transportation winter roads, it is important for that roads owner to place appropriate signs at the entrance so there is no confusion to road users.

The following sign is recommended at the beginning or end of the system and on either side of any community on the winter road when the winter road is officially closed. For easy placement the sign could be mounted on permanent posts and the sign hinged in the centre allowing the bottom portion to be flipped up covering the sign during the period the winter road is not in use.



(black on white)

VII.

ACCIDENTS

In spite of taking all reasonable safety precautions, accidents and near misses will continue to occur. Near misses can be described as "Unexpected events that could have resulted in injury or damage if circumstances had been slightly different." Whether such accidents or near misses involve the public, government employees or private contractors, it is likely that those involved with highway construction and maintenance will be among the first on site and will be required to respond.

Similarly, regardless of who is involved in the accident, near miss or its severity, it is important to report it to the correct individuals so that follow-up action can be taken and so that information and statistics are available to those with responsibility for establishing design/construction standards and operational guidelines. It is through this process that ongoing problems are identified and corrected.

In the event of an accident the first priority is to secure the site to ensure that no one, including you, is in danger from further accidents. For example, in the case of an ice failure, warning signs, flares or barriers must be used to warn others away from the hole. In an area where visibility is poor and traffic is likely, warnings must again be provided to ensure that those working at the accident scene are not endangered by approaching vehicles.

In the case of an ice failure, approach with extreme caution. No attempt at rescue must be made if it puts the rescuer at risk. Think before you act.

INCIDENT RESPONSE PLAN

Even with a high level of preparedness and training, incidents may still occur. In this case, the objective is to have plans and standard operating procedures in place to:

- Secure the site for the safety of victims and responders,
- Prevent the incident from escalating to a higher severity (i.e., an injury to a fatality),
- Address the incident and return to normal operation, and
- Review the incident and revise the hazard management plan appropriately in an effort to prevent future similar incidents.

Incident or emergency response plans must be prepared, keeping in mind the location and operating conditions under which an incident can occur, and be in accordance with the applicable occupational health and safety legislation. Plans may include:

- Identification of potential incidents or emergencies,
- Procedures for first response to an incident or emergency,
- Procedures for rescue and evacuation,
- Identification of emergency responders,
- Identification, location and operational procedures for emergency equipment,
- Emergency communication and reporting requirements, and
- First aid and emergency response training requirements.

VIII.

ENVIRONMENT

Damage to the environment caused by the construction, maintenance or use of winter roads is considered extremely serious. Prevention is very important and a prompt response is essential to limit adverse effects to the public and the environment. An Environment Act Proposal Form must be filed before any construction is started on any new roads. Construction camps should not be situated on the ice, and fuel and oil contamination should not be allowed.

The R.C.M.P. must be notified if vehicles are abandoned. They will notify the registered owner and arrange to have the vehicles removed.

The Federal Transportation of Dangerous Goods Act requires anyone responsible for the custody and control of any contaminant involved in a transport-related environmental accident to immediately report the accident. All environmental accidents occurring in Manitoba should be reported immediately to Manitoba Environment and Safety and Health by calling 204-944-4888 in Winnipeg and CANUTEC 1-800-667-7525. Both are 24 hour services.

The types of accidents that should be reported include:

- spills, leaks or fires involving chemicals such as pesticides or
- fertilizers,
- accidents involving hazardous wastes or radioactive materials, and
- any other uncontrolled chemical or petroleum spill. Petroleum spills
- over 100 litres must be reported. This is a requirement
- under Manitoba law.

When calling the emergency numbers above the following information should be provided:

- your name,
- telephone number,
- exact location of the accident,
- type of accident (spill, leak, fire, etc.),
- name and spelling of the product or products involved, and estimate
- of the quantity involved.

Also, the person in charge of the dangerous goods at the time of a dangerous occurrence should immediately notify:

- the local police,
- his employer,
- the owner, lessee or charterer of the vehicle,
- the shipper or owner of the dangerous goods.

IX.

MANAGEMENT OF WINTER ICE AND LAND ROADS

The Contractor is typically responsible for:

- Completing the Managing Project Site Safety Plan package and ensuring all employees are aware of and complying with every aspect.
- All maintenance of equipment working on the project. Only equipment that has been previously shown to be safe and effective is to be used.
- The evaluation of ice when checking ice thickness for all construction and maintenance equipment. Only staff trained in ice testing and experienced in determining ice textures shall be assigned to inspecting ice thickness. All ice checks must be documented on the Contractor Ice Reports and submitted to the Manitoba Infrastructure & Transportation Representative as soon as possible.
- Ensuring that the ice conditions are safe and within the ice bearing capacity for all equipment, labourers and operators. Contractor Ice Reports must be filled out and submitted when completed.
- Ensuring the weight of equipment with attachments is clearly posted on the outside of the equipment.
- Ensuring that all employees operating equipment on ice during the construction and maintenance phases of the winter road operation are equipped with approved floatation devices and clothing.
- Ensuring there is an escort vehicle equipped with the required communication and safety equipment for the equipment working on an ice road.
- Inspecting any problem areas on the project or sign a 24 hour work deficiency notice.
- Ensuring that adequate compaction has been carried out on the land portions before heavy equipment is used.
- The training of all labourers and operators so they are aware of all winter road safety procedures.
- ensuring that the same ice and land road routes are used each season, unless otherwise agreed to with MIT
- Ensuring that all equipment is supplied with adequate tools, first aid and survival kits.
- Ensuring the winter road is built to the Construction and Maintenance standards set out in the Standard Specifications and Contract.
- The scheduling of all work and ensuring there is adequate staff to complete all required work.
- Being aware of hazardous areas on the project and explaining hazardous areas to all staff and the consequence of travelling in these locations. This is essential, especially with new employees and equipment operators.
- Knowing the sign and placard requirements for vehicles Transporting Dangerous Goods.
- Assisting the public if they are encountering difficulties reaching their destination, when required.
- Removing garbage from the project when required.
- Immediately notifying the local Police Agency, Department of Labour and Manitoba Infrastructure and Transportation of any near misses, injury accidents and loss of property incidents on the project.

X.

SUMMARY

The Committee trusts that this Contractor's Manual for the Construction and Maintenance of Manitoba Infrastructure & Transportation Winter Roads has been beneficial to you.

With the increased use of the Manitoba Winter Road System and its importance to remote communities, it is the Committee's goal to ensure these roads are safe and as economically viable as possible. The publishing of this manual is a positive step in this direction.

The Committee thanks all those that have contributed to the Contractor's Manual for the Construction and Maintenance of Manitoba Infrastructure & Transportation Winter Roads.

Travel Safely!

WINTER ROAD SAFETY COMMITTEE

RECOMMENDED READING

- Transportation Association of Canada – Guidelines for the Construction and Operation of Winter Roads.
- Best Practices for Building and Working Safely on Ice Covers in Alberta
- Manitoba Stream Crossing Guidelines

RECOMMENDED COURSES

First Aid	St. John Ambulance Red Cross
C.P.R.	St. John Ambulance Red Cross
Wilderness First Aid	St. John Ambulance Red Cross

REFERENCES

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TRANSPORTATION ASSOCIATION OF CANADA
GUIDELINES FOR THE CONSTRUCTION AND OPERATION OF WINTER ROADS
2011

GOVERNMENT OF ALBERTA, BEST PRACTICE FOR BUILDING AND WORKING SAFELY ON ICE COVERS IN ALBERTA 2009.

APPENDIX A

RESPONDENTS TO QUESTIONNAIRE

DEPT. OF NATURAL RESOURCES
BOX 28
59 ELIZABETH DR.
THOMPSON, MB
R8N 1X4
ATT. SYD ROBACK

MANITOBA HYDRO
BOX 751
THOMPSON, MB
R8N 1N5
ATT. BILL SHANKS

RIVERSIDE GRAVEL INC. (1985) INC.
20 STAPLETON ST.
WINNIPEG, MB
R2L 2E2

FIRST POPLAR RIVER VENTURES
GENERAL DELIVERY
POPLAR RIVER, MB
ROB 0Z0

BERENS RIVER BAND
GENERAL DELIVERY
BERENS RIVER, MB
ROB 0A0
ATT. CHIEF LESTER EVERETT

GOD LAKE NARROWS BAND
GENERAL DELIVERY
GODS LAKE NARROWS, MB
ROB 0M0

TRIMAC
955 MAGINOT ST.
WINNIPEG, MB
R2J 0Z7

MAN. HYDRO MAINT. & CONST.
BOX 149
LUNDAR, MB
ROC 1Y0
ATT. KEN ERICKSON

GARDEWINE NORTH
300 OAKPOINT HWY.
WINNIPEG, MB
R2R 1V1

I.D. ENGINEERING
905 WAVERLEY ST.
WINNIPEG, MB
R3C 5P4
ATT. K.M. ADAM

KENASTON CONTRACTORS LTD.
INUVICK, NWT
XOE 0T0

JADE TRANSPORT
963 DUGALD RD.
WINNIPEG, MB
R2J 0G8

DEPARTMENT OF CIVIL ENGINEERING
ROYAL MILITARY COLLEGE
KINGSTON, ON
K7L 2W3
ATT. P.M. JARRETT

SPRUCE FALLS POWER
& PAPER CO. LTD.
BOX 100
KAPUSKASING, ON
P5N 2Y2

LESTERS CARTAGE & CONSTRUCTION
BOX 7 GRP. RR5
WINNIPEG, MB
R2C 2Z2

SOUTH INDIAN LAKE
COMMUNITY COUNCIL
GENERAL DELIVERY
SOUTH INDIAN LAKE, MB
ROB 1N0
ATT. GRAEME MONTGOMERY

DEPARTMENT OF HIGHWAYS
& TRANSPORTATION
THE PAS, MB
R9A 1M4
ATT. A MELNICK

REPAP
P.O. BOX 1590
THE PAS, MB
R9A 1ZA

ALBERTA TRANSPORT AND ULTLITIES
LAC LA BICNE, AB
TOA 2C0
ATT. ED MAZUKEK

GULF CANADA RESOURCES
P.O. BOX 130
CALGARY, AB
T2P 2H7
ATT. GORDON SEABROOK

SASKATCHEWAN HIGHWAYS AND
TRANSPORTATION
BOX 3003
PRINCE ALBERT, SK
S6V 6G1

MOBIL OIL CANADA LTD.
P.O. BOX 209
CONSTUCTION DEPARTMENT
WHITECOURT, AB
TOE 2L0
ATT. P.J. HALKO

HANSEN PETROLEUM PRODUCTS LTD.
BOX 1039
INUVIK, NWT
XOE 0T0
ATT. F.HANSEN

FLEET TECHNOLOGY LTD.
COLD REGION TECH. CENTER
311 LEGGET DR., KANATA, ON
K2K 1Z8
ATT. G. COMFORT

TRIPLE S FUELS/PRAIRIE AVIATION
620 MANITOBA AVE.
SELKIRK, MB
R1A 0Z4
ATT. G. HACKING

NORTHERN AFFAIRS
BOX 29
59 ELIZABETH DR.
THOMPSON, MB
R8N 1X4
ATT. DAVID HILL

ABITIBI-PRICE INC.
PINE FALLS, MB
ROE 1M0

APPENDIX B

GENERAL SAFETY INFORMATION & KEYS TO SURVIVAL

This information has been gathered with the hope that you will never have to use it in a survival or emergency situation. However by having the equipment and knowledge of its use you will have the confidence to cope with any situation should the need arise.

Safety is of fundamental importance when using Manitoba's Provincial winter roads system. The remoteness of the roads, the possibility of severe weather and the danger of an ice failure must be accounted for at all times. It is the intention of this section to provide you with basic information respecting safety, first aid, survival equipment and common sense information on how to cope with an emergency situation.

You should never travel on the winter road system without survival equipment. No one ever plans on going through ice or becoming stranded. However, if you do go through ice or become stranded, an extra set of dry clothing and a survival kit could be the best friend you have. Always carry any PERSONAL MEDICATION with you.

One of the most important factors in outdoor survival is the ability to recognize an emergency and to react appropriately. It is dangerous to have the "IT CAN'T HAPPEN TO ME" attitude. Realizing that "It CAN Happen to Me", prepares you for survival.

Your ability to survive may depend more on your attitude and personality than on other factors such as the weather and terrain. You must be able to make a decision, improvise and adapt, have patience and keep calm. Confidence in your own ability is your strongest ally.

There are other factors that will threaten your ability or will to survive. You must recognize these enemies, the effects they can have on you, and be prepared to cope with them. Above all, you must believe you can survive. The human body is a marvellous machine and can adapt to deal with almost any situation. Don't panic or feel sorry for yourself--Be Positive!

Fear can affect your ability to survive. Fear is normal. Only a fool is never afraid. The energy that fear generates can make you more alert and can be turned into a positive asset. Recognize your fears and deal with them using common sense. Make a plan of action and stick to it. Emotional reactions spurred by fear can lead to disaster.

Fear of the unknown is our most common fear, not only in a survival situation, but throughout our everyday lives. You may worry about your fate, whether or not you can make it, or if someone will find you. You can control your anxiety. Be Positive! Someone will be along to help. Until then, make yourself comfortable and wait.

The fear of death may enter your mind. There's no reason to believe you cannot survive. If you have the knowledge, the ability and the resources to meet the problem head-on. Make a plan and approach it methodically in a step by step manner.

Other fears may include: darkness, animals, and ridicule. Animals such as wolves will avoid you and pose little, if any, threat to you. Look at smaller animals positively, as company or as a food source if necessary. Your companions will likely admire your ability to survive, even if outwardly they joke with you a little.

Pain may go unnoticed if you are busy. But once you sit down to relax or study the situation, it becomes apparent. Treat all wounds immediately but don't dwell on them. Even minor pain can weaken your will

to carry on if you let it get the best of you. Keep busy making plans and carrying them out to take your mind off your pain.

Avoid overexertion and exposure. Exertion from attempting to push your vehicle, shovel heavy drifts or perform other difficult chores during strong winds, blinding snow and bitter cold of a blizzard may cause hypothermia or a heart attack. These conditions may occur even for persons in apparently good physical condition.

Stay in your vehicle. Do not attempt to walk out of a blizzard. Disorientation comes quickly in blowing and drifting snow. Being lost in open country during a blizzard is almost certain death. You are more likely to be found, and more likely to be sheltered in your vehicle.

Engine failure could be caused by gas line freeze-up. Pour the gas-line anti-freeze in your fuel tank, wait 10 minutes and try your engine again.

If your engine still works, run it for short periods just to keep warm. Crack a window open to avoid carbon monoxide poisoning. Make sure your exhaust pipe is free of obstruction. Clear outside heater vents. (The grill under the windshield.)

Keep fresh air in your vehicle. Freezing wet snow and wind-driven snow can completely seal the passenger compartment.

Use the candle to keep warm if your engine doesn't work.

Use the coffee tin and the candle to melt snow to drink. Do not eat snow as it lowers your body temperature when you need to conserve heat.

Do not stay motionless for long periods of time. Clap your hands, wiggle your toes, etc. to maintain circulation.

Avoid alcohol. It lowers body temperature and will cause you to become drowsy.

Turn on dome lights at night, to make the vehicle visible to other vehicles.

Signal other vehicles that you are stranded by using flares, flashlights or by tying a brightly coloured cloth to the antenna or door handle.

Keep watch. Do not permit all occupants of the vehicle to sleep at once.

If it becomes necessary, open your "survival kit" and follow instructions carefully.

The key to handling an emergency situation is being prepared. The following equipment will help you survive should an emergency occur.

CLOTHING

a) winter footwear
b) winter socks
c) winter pants
d) two piece underwear
e) parka or snowmobile suit
f) mitts
g) toque or warm cap
h) extra set of clothing

FOOD

a) chocolate
b) freeze dried food
c) nuts or granola bars
d) salt
e) sugar
f) tea bags, soup, hot chocolate
g) raisins
h) water purification tablets
i) rations
j) hot pac meals

SURVIAL EQUIPMENT

Always carry any PERSONAL MEDICATION with you.

a) blankets, pillow, sleeping bag
b) mirror, newspaper, watch
c) first aid kit, map
d) matches (strike anywhere)
e) flashlight, flares
f) small metal can, plastic jug
g) cutlery, multi-tool with knife
h) sun glasses, survival book
i) hatchet, axe, saw, rope, wire
j) toilet paper, paper towels

VEHICLE EQUIPMENT

a) extra belts, fuel filter
b) snow tires, jack, satellite phone
c) booster cables, ice scraper, brush
d) tools, come-along, fire extinguisher
e) methyl hydrate, anti-freeze
f) tow chain or nylon rope
g) shovel, extension cord
h) candles, supplementary heat source

Always make sure you carry enough fuel to reach your final destination as there are no service stops provided.

FIRST AID INFORMATION

A basic first aid kit must contain the following:

Recent edition of First aid manual
Disposable resuscitation mask with a 1-way valve.
Disposable cold compress
25 antiseptic swabs
Waterproof waste bag
4 pads (75x100mm) non-adhesive
2 large pressure dressings
2 conforming bandages
1 roll 75mm elastic adhesive bandage
Disposable Gloves
Splinter Forceps
1 pair 12cm bandage scissors
Safety Pins(12)
Waterless hand cleaner
16 surgical gauze pads(75x75mm)
32 adhesive dressings (25mm)
3 triangular bandages
2 rolls of 25mm adhesive tape
2 rolls of 75mm tensor bandage