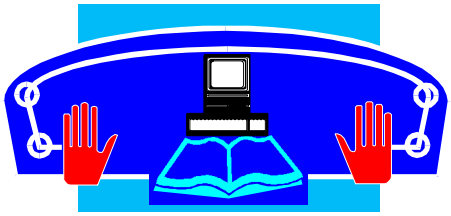

Environmental Operating Guidelines: Access Roads And Trails
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Author: Canada - Indian & Northern Affairs
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Environmental Operating Guidelines: Access Roads and Trails

Prepared by

Hardy BBT Limited
Calgary, Alberta

for:
Land Resources, Northern Affairs Program

Published under the authority of the
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Northern Development,
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Addendum

1. Readers are advised that the responsibility for the administration and management of the forest resources in the Northwest Territories has been transferred from the Minister of Indian Affairs and Northern Development to the Minister of Renewable Resources, Government of the Northwest Territories. To obtain detailed information concerning timber licences and permits to cut trees, please contact the Forest Management Division, Department of Renewable Resources, Government of the N. W. T., in Yellowknife.

2. Page 3, column one, 3rd paragraph - “suggest alternatives” should read “suggests alternatives”.

3. Page 11, 1st paragraph - “they may prove uneconomical . . . “ should read “that may prove uneconomical...”.

4. Page 38, column one, last paragraph - “In same cases...” should read “in some cases...”

5. Page 38, second column, 3rd paragraph - "vegetaion" should read “vegetation”.

6. Page 45, first column, 8th address - Frobisher Bay, N.W.T. has been renamed to Iqaluit, N.W.T.

7. Page 48, 10th question - “abandoment” should read “abandonment”.

8. The reader is advised that permits and licences required for operations which need access to or across Inuvialuit lands are available from the Inuvialuit Lands Administration. These lands are located in the northwest sector of the Northwest Territories. For detailed information on location of Inuvialuit lands and the regulations which apply to these lands contact the Inuvialuit Lands Administration, located in Inuvik, N.W.T.

Table of Contents

Preface

This handbook presents land use guidelines for the planning, development, operation, and abandonment of access roads and trails in Northwest Territories and Yukon. It explains the rationale behind many of the terms and conditions attached to Land Use Permits for roads, and demonstrates that procedures considerate of the environment can also be efficient for the operator. What has often been considered as the high cost of environmental protection is shown to be an investment requiring a relatively small outlay in the form of environmental planning that pays off in large savings on road construction and maintenance.

These guidelines are the third in a series designed to assist operators in assessing environmental impacts and mitigative measures associated with land use activity in Northwest Territories and Yukon. Certain aspects of the other two handbooks, "Land Use Guidelines Mineral Exploration" and "Environmental Guidelines Pits and Quarries", are included here, but the reader should refer to the original documents for a more complete discussion on the appropriate topics.

The information presented in this handbook was obtained through discussions with several administrators and operators in Northwest Territories and Yukon. We would like to thank personnel from the offices of Indian and Northern Affairs Canada in Yellowknife, Fort Simpson, Fort Liard and Whitehorse for their time and assistance. Personnel from Environment Canada, Fisheries and Oceans Canada, and Yukon Department of Renewable Resources also provided information and comments and we thank them for these. Thanks is also extended to the following operators and consultants who made time to discuss their experiences constructing and operating roads and trails in northern Canada: Clive Boyd, Mike Phillips, Dick Robinson, John Staples, J.J. Van Bibber and Steve Van Bibber.

The study team received valuable assistance and guidance from the Steering Committee composed of Chris Cuddy, Floyd Adlem, and Perry Savoie from Land Resources Northern Affairs Program, Indian and Northern Affairs Canada.

This handbook was prepared by the Environmental Division of Hardy Associates (1978) Ltd., Calgary, Alberta.

GUIDELINES PRESENTED HEREIN ARE SUBORDINATE TO ALL ACTS, ORDINANCES AND REGULATIONS.

Chapter 1
Introduction

PURPOSE OF THE BOOK

This handbook is written for contractors, operators, and inspectors of access roads and trails in Northwest Territories and Yukon. It is intended to provide an understanding of the impacts and mitigative measures associated with road and trail construction and operation, and to show that protection of the environment and cost-efficient road construction and maintenance are compatible, Engineering design information and the results of environmental impact studies of roads are not presented, and the reader is referred to the recommended references at the back of the book for direction in this regard.

CLASSIFICATION OF ROADS

Roads can be classified in several ways: by season of use, complexity of design, proposed purpose, materials composition, governmental administration, and others. This handbook uses a classification based on a combination of complexity of design and season of use, as shown in the table on page 2.

. a narrow trail

The classification of a road is not necessarily permanent. A road originally constructed to provide access for resource exploration may later be upgraded to serve as a haul road or even a secondary road. The potential for upgrading becomes an important factor in road planning, as is discussed below.

The roads and trails discussed in this book are those in Classes 6 to 4. Roads in these classes require limited engineering design, and generally provide access to resource exploration and development areas.

.a mining access road in mountainous terrain

As is evident from the table, some road classes have several common names. It is often the case, that a road name in one area may mean something quite different in another area. For the purposes of this book, the following common names will be used for Class 6 to 4 roads:

Multi-season access:	Class 6- Trail Class 5- Access Road Class 4- Haul Road
Winter access:	Class 6- Winter Trail Class 5- Winter Access Road Class 4- Compacted Snow Road

. an access road

ROAD AND TRAIL CLASSIFICATION AS USED IN THIS HANDBOOK

Multi-Season Access[1]		Winter Access[2]		
Common Names	Characteristics	Common Names	Characteristics	Road Class
TRAIL Off-road access, push trail.	– Provides access for a limited duration or to a site not serviced by a road. – Degree of clearing varies from merely pushing down vegetation to clearing a narrow right-of-way.	**WINTER TRAIL** Off-road access, push trail	– A trail established for winter use by a single pass of a tracked vehicle, using a blade, if necessary.	6
ACCESS ROAD Pioneer road, service road, tote road, fire road, skid road, spur road.	– Provides initial access to resource areas for exploration and delineation purposes. – Provides access to borrow pits, garbage dumps, water supply facilities, etc. – Minimum of design work carried out. – Designed to carry low traffic volumes at low running speeds. – Traffic volumes, running speeds and load weights are greater than for trails.	**WINTER ACCESS ROAD**	– An access road established for winter use by dragging and levelling the surface to allow smoother travel. – Depressions are filled with snow, but snow does not serve as the principal road surface.	5
HAUL ROAD Logging road, forest road, local road.	– Connects developed or producing resource areas to collector and arterial roads. – Designed to carry heavy trucks at speeds from 40 to 80 km/hr.	**COMPACTED SNOW ROAD**	– A winter use haul road built with snow as a cut and fill material. – The road surface is compacted snow.	4
COLLECTOR ROAD Secondary road.	– Connects local and arterial roads. – Carries light to medium traffic at speeds of 60 to 80 km/hr. – Access to lands and movement of vehicles are of equal importance.	NO EQUIVALENT		3
HIGHWAY Arterial road	– Joins major development areas and connects with local and collector roads. – Carries medium to heavy traffic at speeds of 65 to 80 km/hr. – Movement of vehicles is the mam function, access to lands is limited. – Intersecting roads are controlled at grade.	NO EQUIVALENT		2
FREEWAY	– Moves large volumes of traffic at high speeds. – Connects major population centres and expedites through traffic. – Does not provide access to lands. – Intersections are fully controlled by grade separations.	NO EQUIVALENT		1

1. Multi-season access refers to roads and trails that are in operation for more than one season or for only one season, but that season is not winter. Examples are haul roads and access roads that are open year-round and mountain trails that may be passable only during the summer. Class 6 and 5 multi-season roads are not normally associated with permafrost areas but may be constructed to provide access to garbage dumps or water supplies in those areas.

2 Winter access refers to roads and trails that are in operation only when the ground is frozen. In Northwest Territories and Yukon, winter access occurs from December until early April, for the most pad. Winter access does not occur above Class 4 with respect to complexity of design.

Roads and trails discussed in this handbook.

• a winter trail

• a winter access road

STRUCTURE OF THE BOOK

This handbook is laid out as follows:

- Chapter 2 presents the government administrative structure and the regulations that must be followed when constructing and operating a road. It also describes how a Land Use Permit application is reviewed.
- Chapter 3 discusses permafrost and how it results in road construction and operation activities in northern Canada differing from those in southern Canada.

  Chapter 4 poses the question “IS a road really necessary?” and suggest alternatives to the practice of constructing an overdesigned road when it is not required.
- Chapter 5 addresses the most important step in road construction - the planning stage.
- Chapter 6 is concerned with guidelines for clearing the right-of-way for a road.

  Chapter 7 describes construction, operation, and abandonment activities specific to multi-season access.

  Chapter 8 covers the same topics as Chapter 7, but addresses winter access.
- Chapter 9 deals with facilities ancillary to the road itself. These are borrow pits, camps, and fuel storage facilities.

  Chapter 10 discusses contingency planning - what to do in the case of fuel spills and wildfires.
- The book is completed by a list of recommended references which provide more detail on northern roads, a list of government contacts in Northwest Territories and Yukon, and a checklist for use when planning an access road or trail.

Chapter 2
Administration and Regulations

Throughout the life of a road, from planning to closure, contractors and operators must interact with government agencies. Regulations concerning the construction and operation of roads are established by the government, and the enforcement of these regulations is carried out by government inspectors representing several departments. A lack of understanding of government jurisdiction and the permitting process often makes the red tape involved in building a road seem more onerous than it really is. In this chapter, the structure of the government in the North and the Acts and Regulations applicable to road construction will be outlined, and the procedure to follow in obtaining permits will be explained.

GOVERNMENT IN THE NORTH

Most of Northwest Territories and Yukon is Federal Crown Land, called "Territorial Lands", administered for the Federal Government by Indian and Northern Affairs Canada (INAC). Around many of the communities, the land has been transferred from the Federal Government to the Territorial Government. These lands, known as Commissioner's Lands, were set up to allow territorial and community jurisdiction of matters affecting the community. Thus it is possible for part of a private road to fall under the jurisdiction of INAC and part under the Territorial Government, A public road, once completed, is under the jurisdiction of the Commissioner (Territorial Government).

For INAC administrative purposes, Northwest Territories and Yukon have been divided into resource management areas as shown on the map. The two regional offices are located in Yellowknife and Whitehorse.

Each resource management area has an office where Land Use Permit applications are reviewed and assessed, and where contractors and operators can seek advice on road planning and construction. The addresses of these offices are listed at the back of this handbook.

ACTS AND REGULATIONS

There are numerous pieces of government legislation (Acts, Ordinances and Regulations) which control land development in the North; however, only a few Acts and Regulations apply to road development. The following are brief summaries of these.

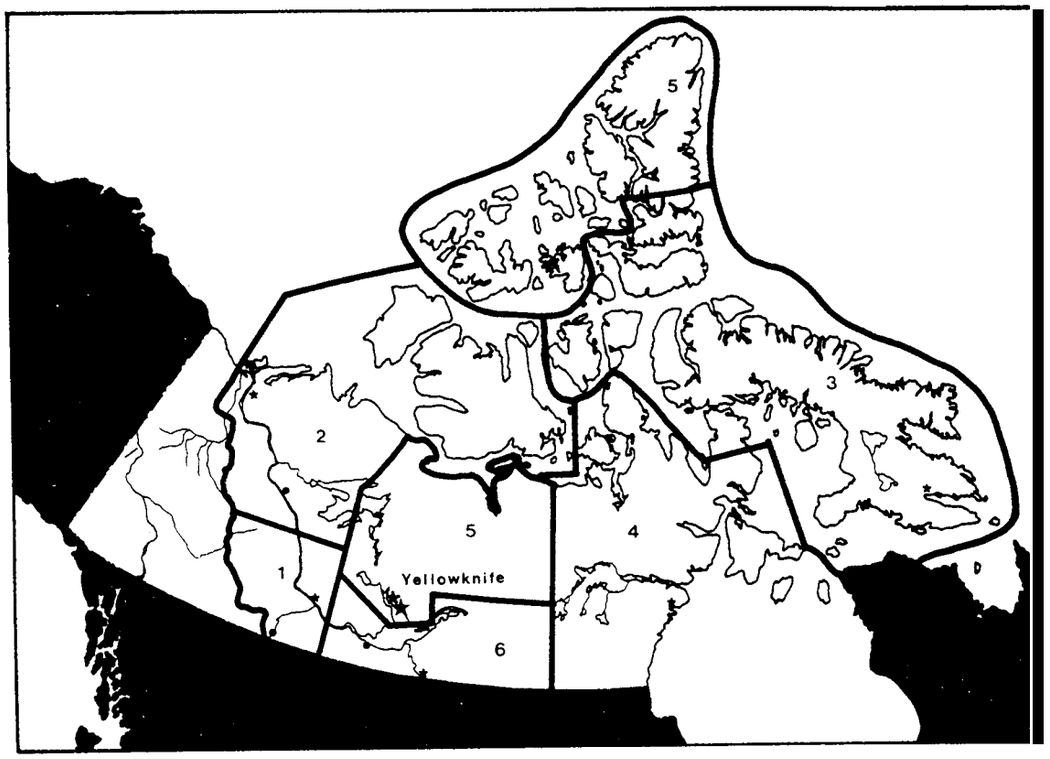
Territorial Lands Act - provides the authority for dealing with the administration and protection of Territorial (Federal Crown) Lands, which are under the direct control of the Minister of Indian and Northern Affairs.

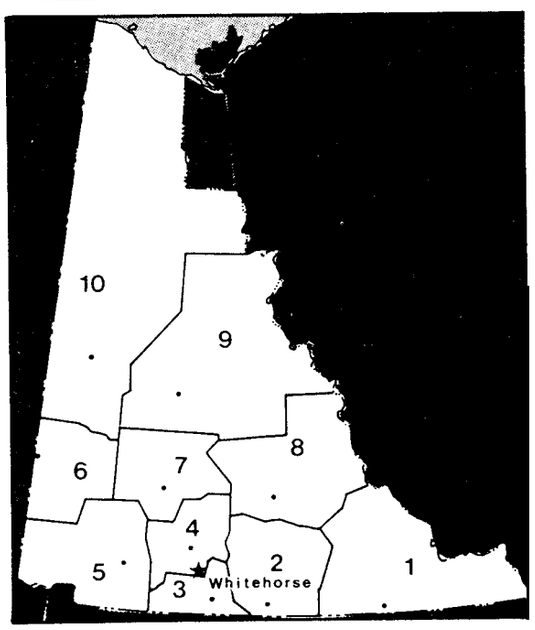
Territorial Land Use Regulations - provide regulatory control for maintaining sound environmental practice for any land use operation on lands under INAC control in theTerritories. These Regulations require that Land Use Permits be issued for, amongst other things, all work involving the use of heavy equipment, establishment of camps, use of explosives and clearing of lines, trails and rights-of-way. The Regulations are administered by INAC Land Use Engineers, who review land use applications and issue Land Use Permits, and Land Use Inspectors, who conduct field inspections to ensure compliance with the Regulations and Land Use Permits.

Territorial Quarrying Regulations - set out the fee schedule and the procedures for extracting Crown-owned limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay or stone in territorial lands. The regulations specify permits, applications, staking and dimensions of quarries.

Fisheries Act - provides for the protection of fish and fish habitat from any interference through pollution, or any structure that impedes or blocks fish movement.

Northern Inland Waters Act - provides for the licensing of water use, which serves as a means of controlling pollution by prohibiting waste deposition in any water body, and supporting the establishment of a comprehensive water management program.





INAC RESOURCE MANAGEMENT AREAS

Northwest Territories:

1. Ft. Simpson
2. Inuvik
3. Baffin
4. Keewatin
5. Yellowknife and Arctic Islands
6. Ft. Smith

INAC RESOURCE MANAGEMENT AREAS

Yukon

1. **Watson** Lake
2. Teslin
3. Tagish
4. Laberge
5. Haines Junction
6. Beaver Creek
7. Carjacks
8. Ross River
9. Mayo
10. Dawson

Most of the requirements relating to these Acts and Regulations will be included in the terms and conditions attached to the permits required for road construction and operation. Their inclusion does not mean, however, that the Acts and Regulations themselves can be ignored. The contractor and operator should become familiar with these pieces of legislation. The INAC publications "A Guide to Territorial Land Use Regulations" and "Northern Natural Resource Development: Requirements, Procedures and Legislation" are good starting points for this purpose.

• these INAC publications help explain some of the legislation you will have to follow

PERMITTING PROCEDURES

CONTACT YOUR LOCAL RESOURCE MANAGEMENT OFFICE (LAND USE OFFICE) TO FIND OUT WHAT PERMITS YOU WILL REQUIRE, TO OBTAIN APPLICATION FORMS, AND FOR INSTRUCTIONS ON COMPLETING THE FORMS

Before any clearing or construction activity commences, the contractor has to obtain certain permits. A Land Use Permit issued by INAC will be required, Others that may or may not be required include Water Authorizations, Timber Permits, Burning Permits and Quarrying Permits.

Once the application is submitted and accepted as being complete, it maybe passed on to members of the Land Use Advisory Committee and to potentially interested communities for review. Following this review, the recommendations go to the Land Use Engineer who does one of three things with the application. The Engineer may:

1) issue a Land Use Permit with appropriate conditions for environmental protection, or

2) refuse to issue a permit and provide the reasons therefore, or

3) place the application on hold while the project is studied in more detail.

in most cases a Land Use Permit is issued within 42 days of submission. If, however, further time is required for studies, especially field studies, the decision maybe delayed up to 12 months. If possible, it is a good idea to make your application in the spring or summer so that if field studies are required they can be carried out under optimum conditions.

READ YOUR LAND USE PERMIT

One final word on permits. Once you have received your permits, make sure you read them. The terms and conditions attached to the permits are intended as practical methods of protecting the environment and the permit holder is responsible for seeing they are adhered to. If,' for whatever reason, circumstances prevent you from complying with a term or condition, notify your Land Use Officer and your situation will be assessed. The Land Use Regulations provide a process for appealing any decision of a Land Use Inspector or Engineer.

• get to know your Land Use Inspector and keep him informed of any problems

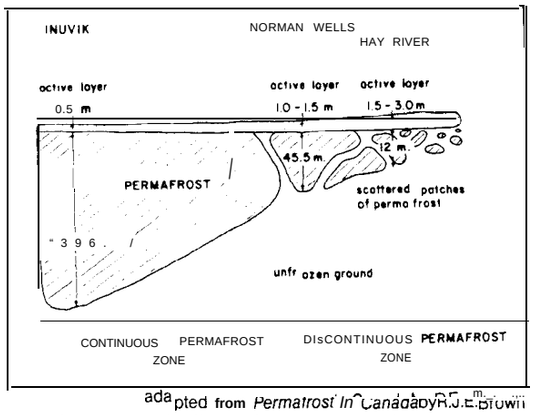
Chapter 3
Permafrost and Travel in the North

The presence of permafrost in northern Canada necessitates an approach to road construction and operation different from that followed in southern Canada. In this chapter, the characteristics of permafrost that have an effect on roads will be addressed.

DEFINITIONS

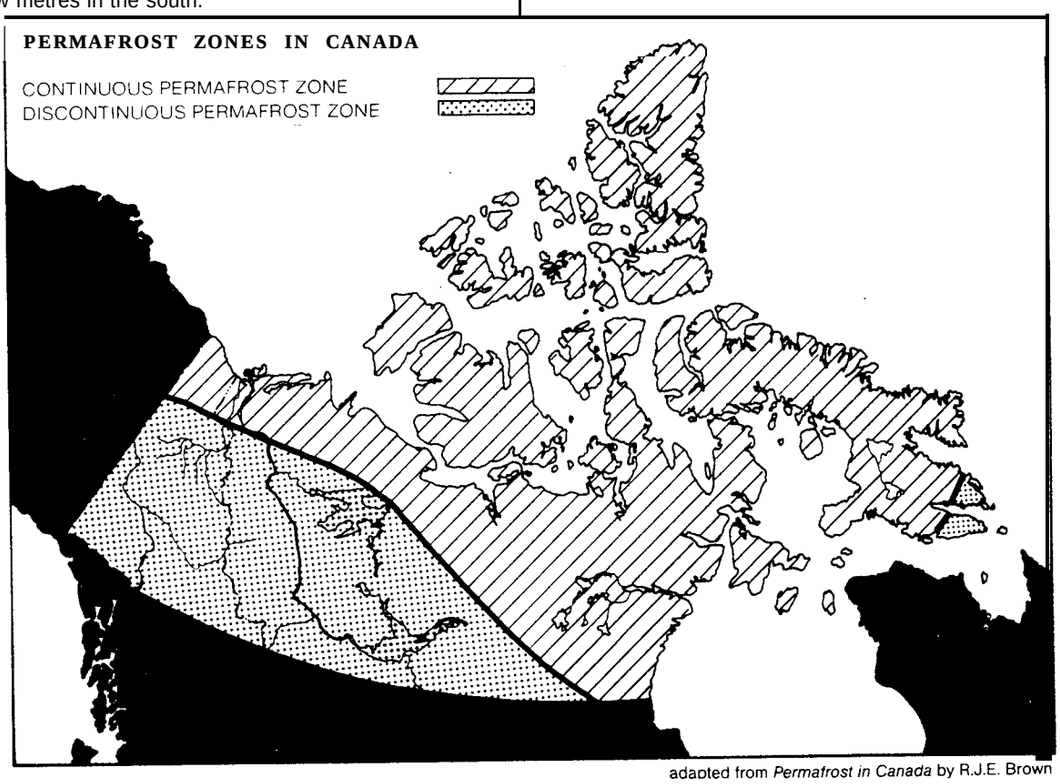
Permafrost is ground that remains frozen through at least two consecutive winters and the intervening summer. It can consist of mineral soil, organic soil, or rock, and can be either ice-free or ice-rich. Permafrost varies in thickness from a few centimetres near the southern limit of its range to several hundred metres in the north. The top of the permafrost layer is called the permafrost table.

A zone called the active layer overlies permafrost. It consists of soil or organic matter that freezes and thaws with the season. Active layer thicknesses vary from a few centimetres in the north of the permafrost zone to a few metres in the south.



adapted from *Permafrost in Canada* by R.J.E. Brown

- **continuous and discontinuous permafrost**
- **active layer**



adapted from *Permafrost in Canada* by R.J.E. Brown

DISTRIBUTION

Permafrost is found across northern Canada, It is divided into the continuous zone and the discontinuous zone. In the continuous zone, permafrost is present under all land surfaces - active layers are thin and permafrost is thick. In the discontinuous zone, permafrost is found under certain conditions only. Its occurrence varies from the northern portions of the zone, where islands of non-frozen soil interrupt the permafrost, to the southern fringes where islands of permafrost interrupt the non-frozen ground. The typical locations of permafrost in the discontinuous zone are on north-facing slopes, within muskeg, and on shaded terrain with minimal snow cover.

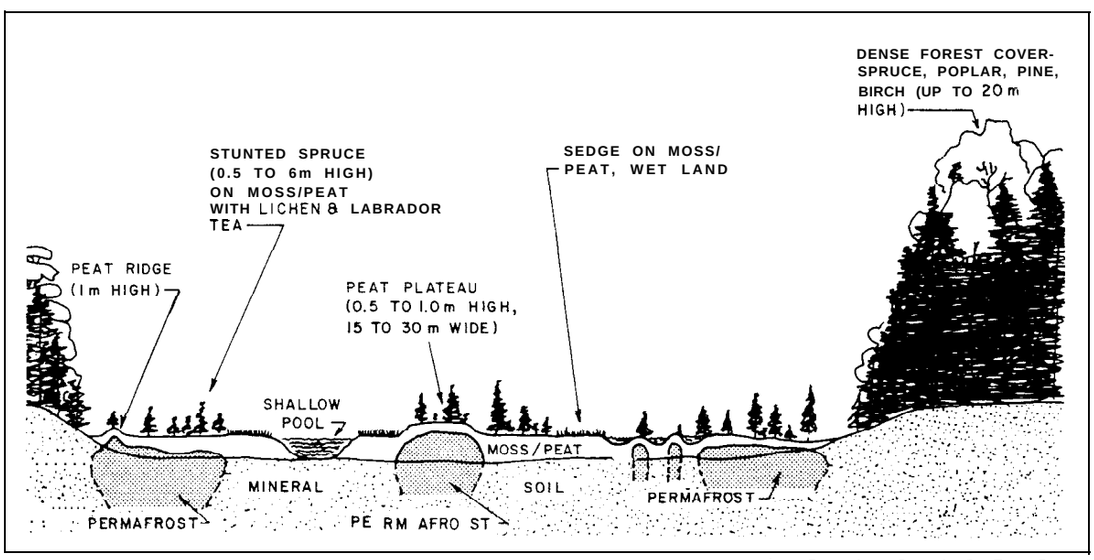
CHARACTERISTICS

Permafrost is sensitive to changes in ground and air temperature. It is protected from these changes by the organic mat which acts as insulation and by the shade provided to the surface by trees, shrubs and grasses. Snow is also an excellent insulator, However, the effect of snow on permafrost can be two-fold; in the early fall, snow can insulate the ground surface from the cold and retard the penetration of frost; in late spring, snow can delay frost leaving the ground.

The insulative characteristics of peat result in a close association between permafrost and muskeg in the North. During the summer, the surface layers of peat, when dry, are good insulators, and warming of the soil is impeded; in the fall, when there is more moisture in the surface layers, these layers become poorer insulators. By this time of year, the air is colder and the underlying soil is cooling. As a result, the ground temperature below the peat is colder than that of the adjacent areas without peat,

• **surface rutting on tundra causes distrubance to the organic mat**

When the insulative layer is disturbed, permafrost thaws, If the soil is ice-rich, slumping, sliding and other forms of erosion may occur. Ice-free soils show little physical change if permafrost thaws



adapted from *Permafrost in Canada* by R.J.t. Brown

• **permafrost distribution in peatlands in the southern**

Because it acts as a conductor of heat, water greatly influences the distribution of permafrost, and as a result the permafrost table is depressed under lakes and streams. Water is also an effective erosive agent of frozen soils. In winter, the blockage of subsurface drainage by frozen soils or roadbeds can force groundwater to come to the surface, resulting in a build-up of ice and the consequent formation of icings or “glaciers” as they are sometimes called.

PERMAFROST AND ROADS

PRESERVE THE PERMAFROST DURING ROAD CONSTRUCTION AND OPERATION

The interaction between permafrost and roads results in special problems, both in protecting the road from the effects of permafrost and in protecting the permafrost from the effects of the road. In most cases, efforts are made to preserve the permafrost. However, under special conditions, such as the presence of a small patch of permafrost in an otherwise permafrost-free area, removal of the permafrost may be more appropriate. The preservation of permafrost is accomplished by minimizing the disturbance to the insulative organic mat,

• placing fill on top of the organic mat will protect the permafrost

Opportunities to break or destroy the organic mat occur throughout the life of a road. Uprooting of trees during clearing, cutting into the surface during grading, snow ploughing off the road grade, and rutting of a soft surface by vehicle tracks area few examples. The following chapters will present suggested road construction, operation, maintenance, and abandonment procedures to minimize such disturbances.

Chapter 4
Is a Road Really Necessary?

CONSIDER THE ALTERNATIVES TO ROAD CONSTRUCTION

When access to an exploration or development site is needed, the initial reaction is usually to call for the construction of a new road. In many cases, however, a new road is not the only or the best option.

A new road, especially an access road (Class 5) or haul road (Class 4), has severs{ environmental and economic ramifications, It creates what is, in most cases, a permanent disruption to the landscape, opens an area to increased hunting and fishing pressures, and represents a considerable outlay of money, When access to an area is required, the following options to a new road should be considered:

• a little forethought may have eliminated one of these roads

Can an Existing Road or Cleared Right-of-Way be Used?

ASK YOUR LAND USE OFFICER ABOUT THE LOCATION OF EXISTING ROADS AND RIGHTS-OF-WAY

There may already be a road that runs close to the site requiring access. If this road is designed to carry at least the same type and volume of traffic required for access to the new site and need only be extended, considerable savings, both environmental and economic, can be realized if the existing road is used. Even if upgrading is required to carry new traffic loads, it is still more advantageous to use an existing route than to construct a new one, where this is economically, socially and environmentally feasible.

• a communications line used as a right-of-way

In a similar vein, if a right-of-way for another linear facility, such as a transmission line, is present, consideration should be given to using that right-of-way as a road, providing permission from the Land Use Office can be obtained.

Can Access be Obtained Without Road Construction?

WALK IN A CAT; FLY IN SUPPLIES

• consider flying-in supplies rather than building a road

The option of avoiding road construction applies mainly to resource exploration access. Rather than building a road into an area they may prove uneconomical to develop, an operator can walk a cat in, clear an airstrip to bring in supplies, carry out the exploration activities, and, if the area is not to be developed, walk the cat out. This method minimizes unnecessary disturbance to the environment and may save money. It may take a considerable number of aircraft flights, whether fixed-wing or helicopter, to spend the amount of money required for road construction, maintenance, and restoration. An additional benefit of flying in men and equipment is that seasonal restrictions on road travel can be respected, while maintaining year-round access.

4

Chapter 5
Planning

Planning is the most important step in the construction of any road, regardless of its location. Unfortunately, it is also the step that is often treated the most lightly. In this chapter the procedures for planning a successful road are outlined.

•proper planning when locating a route would have avoided this drainage problem

RATIONALE - WHY PLAN AHEAD?

PLANNING PAYS FOR ITSELF IN THE LONG RUN

Proper planning saves both time and money and will minimize the chances of adverse environmental impacts. A well planned road will virtually eliminate false starts and the abandoned stretches of roads associated with them. In addition, a planned road will generally be useable for longer periods than one that isn't planned. This is especially true of winter access where good route planning may extend the life of a road into the spring. Whenever Federal funding (such as the Tote Trail Assistance Program) is provided for a road, INAC Roads Policy requires that the road be planned. Road planning assistance is available from your local Land Use Office.

Several commonly-used terms and conditions in Land Use Permits, such as "avoiding sensitive terrain", "constructing approaches to other roads and streams", and "marking the route" are addressed during the planning stage. It is more cost-effective and easier at this stage to have professional surficial geologists, engineers and biologists plan the route, than to encounter unforeseen problems (for example, losing a cat in a bog) or to have the operation shut down for non-compliance, putting crews and equipment on stand-by.

Ensure that the entire route is planned. Any benefits of partial planning will be eliminated if that one valley crossing that wasn't planned proves to have an impassable bog or non-negotiable grades.

• a lack of planning has resulted in a road through an ice lens and the beginning of a borrow pit on the ice lens

DETERMINE THE USE OF THE ROAD

PLAN FOR THE FULL LIFE OF THE ROAD

Once the need for a new road has been identified, decisions must be made as to the type of road wanted and the kind of design required. These decisions will depend on what the road will be used for, when it will be used, how much it will be used, and what its future use may be. The road classification table in Chapter 1 can give some guidance as to what type of road may be required.

During the planning stage the potential future use of a road is an important consideration. If a road initially used as a trail may later be upgraded to a haul road, additional time spent on finding a route with gentle grades, stable terrain, and a minimum of stream crossings may eliminate the need for constructing a new road at the later date,

COLLECT EXISTING DATA

To plan a road, information on climate, terrain, permafrost, and other environmental conditions along the tentative route, must first be acquired. With this information, a cost-efficient road requiring a minimum of maintenance can be planned.

Information concerning a potential route can be derived from a number of sources:

- topographic and geologic maps provide terrain and drainage information;
- INAC Land Use Information Series maps provide information on renewable resources and related human activities;
- an examination of existing roads in the area gives an indication of the kinds of problems to expect and the types of terrain to avoid;
- discussions with the local Land Use Officer can provide information on past problems with roads in the area, the location of special areas such as game sanctuaries and archaeological sites along the route, and recommendations as to other information sources and persons knowledgeable of the area;
- aerial photographs can be used to locate the route, provide information on potential areas of concern such as sensitive slopes and muskegs, and delineate possible sources of borrow;
- the best source of information is to personally examine the route, both by air and on the ground. It is only by conducting a field check that many small-scale terrain and drainage problems can be identified.

. examine the route by air and on the ground in order to recognize small scale, site-specific problems

PREFERRED TERRAIN

When planning a road, the goal is to locate it on as stable terrain as possible.

High, dry, flat-lying ground is the ideal location for most roads. Roads on high ground are blown clear of snow in the winter and are usually well drained in summer and fall.

Because of their better drainage and stability, coarse-grained deposits such as moraines and outwash are preferable to fine-grained deposits. Sand hills, however, are prone to erosion if disturbed and should be avoided. Active floodplains should be avoided for multi-season roads.

In valleys and on slopes, roads should be located in areas where there are adequate building materials, good cross drainage, and low gradients. Areas with seeps should be avoided, as these may undermine the road. Except for crossings, waterbodies should be avoided by at least 30 metres to reduce the possibility of erosion and deposition of material into the stream or lake. There may be cases, however, where waterbodies are too numerous for the 30 metre buffer to be established.

• do not locate your road too close to waterbodies
•note washed-out road and lack of a buffer between the road and waterbody

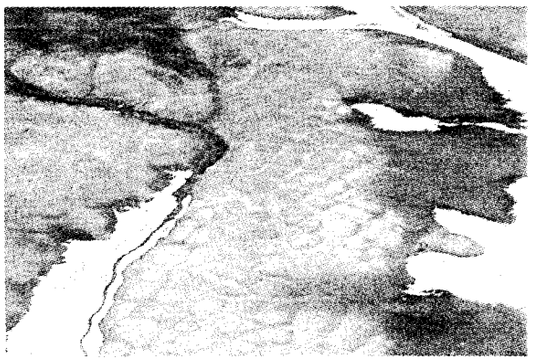
LOCATE ROADS ON SOUTH-FACING SLOPES WHEREVER POSSIBLE

In the discontinuous permafrost zone, permafrost should be avoided wherever possible. In valleys, this may be accomplished by locating the road on south-facing slopes which are likely to be both permafrost-free and drier than north-facing ones. For multi-season roads, areas of black spruce and muskeg should be avoided because they are wet and probably contain permafrost. Likewise, recently burned-out areas in permafrost are prone to erosion, although older, stabilized burns may be suitable.

• **this road, through poorly drained black spruce, will experience slumping and drainage problems throughout its life**

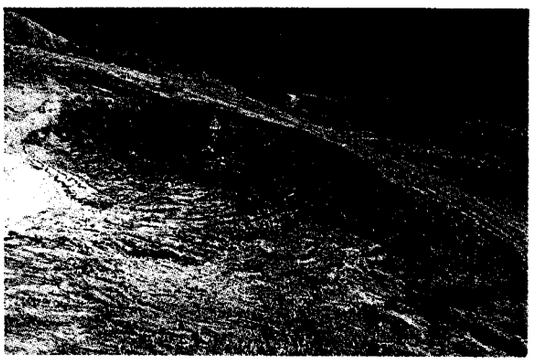
AVOID PATTERNED GROUND
AVOID ICE-RICH TERRAIN

When planning multi-season access roads and trails in the continuous permafrost zone, choose low-ice-content soils and avoid patterned ground, unstable slopes, and mud flows. If access is required across unstable permafrost terrain, detailed studies of the subsurface materials may be required.



•**avoid patterned ground in route selection**

Winter roads should make use of ice surfaces wherever possible. In some areas, lakes may constitute the greatest portion of the route,



•**avoid unstable slopes and mud flows**

MINIMIZE GRADES
FOLLOW CONTOURS

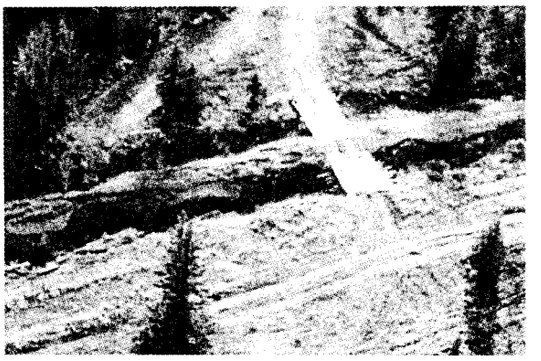
The most efficient, maintenance-free road is one with minimal grades. Don't be afraid to make the route longer in order to maintain a gentler grade, as the savings in maintenance costs will usually outweigh the expense of constructing a longer road.

STREAM CROSSINGS

MINIMIZE M OSSINGS

When planning a route, the fewer the stream crossings, the better. The best crossings are those that approach the stream at right angles and cross where the channel is straight, unobstructed, and well-defined. This approach minimizes contact with the stream and its banks, and decreases the likelihood of erosion. Selecting level stream approaches also helps to reduce erosion.

Fisheries habitat must be considered when planning a stream crossing. To avoid disturbance and possible sedimentation of spawning beds, the route should cross downstream of such areas.

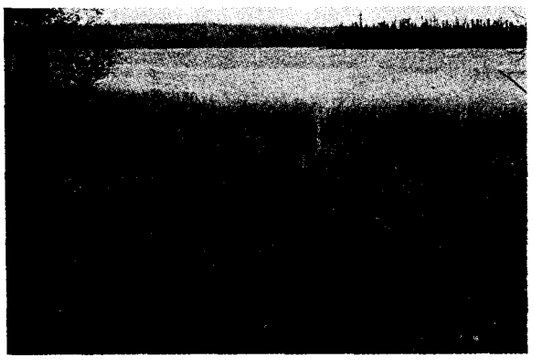


• **streams should be approached at right angles**
•**minimize the number of stream crossings**

DO NOT USE STREAMBEDS AS ROADWAYS

Stream beds cannot be used as rights-of-way for multi-season roads. The presence of vehicles in the stream, together with the increased potential for toxic spills and sedimentation, can cause serious impacts to fish. In addition, the water quality of the stream, or of a larger stream which receives its flow, may be affected. Ultimately, community water supplies may be impaired.

Some winter access roads and trails do follow streambeds or cross lakes. Once again, level approaches to the waterbodies are preferred in order to avoid erosion and allow easy passage of vehicles. On lakes, crossing narrows should be avoided because of the presence of faster water there which results in poor ice conditions.



•choose gentle approaches to lakes and streams when routing winter access roads and trails

SPECIAL AREAS AND CONCERNS

If a road crosses especially sensitive or unique areas, there will be certain terms and conditions in the Land Use Permit addressing these. Permafrost, lakes, and streams can be sensitive, and these have been discussed above. Other potentially sensitive areas that should be considered at the planning stage are:

. critical wildlife habitat;
• unique geographical features;
• archaeological sites and monuments;
. recreational areas; and
• commercial forests.

Critical Wildlife Habitat

AVOID IMPORTANT WILDLIFE HABITAT

Roads should be planned to avoid important wildlife habitat. Critical areas include nesting, rearing and staging areas for waterfowl and other birds, migrating and calving areas for moose and caribou, denning areas for bears, and rearing areas for some animals. The local Land Use Office can direct you to the appropriate government departments to obtain more information on the locations and restrictions of these areas. Access through game and bird sanctuaries may be restricted. These restrictions are necessary to avoid disturbing wildlife during activities such as egg incubation and rearing of young.

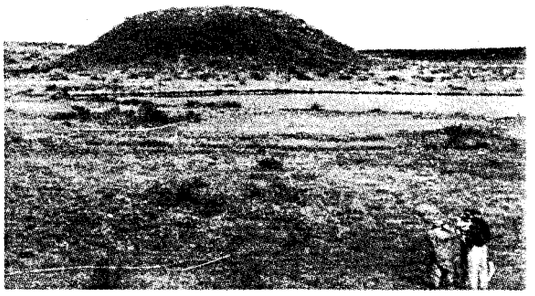
•minimize disturbance to economically important fur-bearing species

Special measures may be required to minimize disturbance to economically important fur-bearing species such as beaver and muskrat.

Unique Geographical Features

AVOID PINGOS

One of the unique permafrost landforms is a pingo - a round, ice-cored hill formed as a result of water and ice pressures in permafrost terrain. Pingos are few in number. They are most common on the Mackenzie Delta, but the chances of a potential road being near one are remote. Nevertheless, machinery, vehicles and equipment are prohibited within 150 metres of these landforms. This restriction is necessary because of the sensitivity of the ice-cored features to surface disturbance.



. machinery, vehicles and equipment are not allowed within 150 metres of pingos

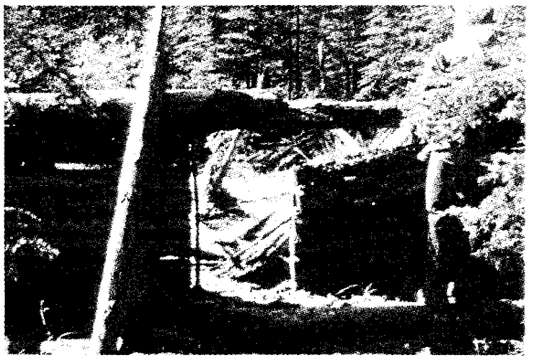
Archaeological Sites and Monuments

AVOID ARCHAEOLOGICAL SITES

Because evidence of past cultures helps us to understand our heritage, land use operations in proximity of known or suspected archaeological sites and burial grounds are prohibited. Known sites are registered, and routing assistance to avoid them can be obtained through the local Land Use Office.

REPORT ARCHAEOLOGICAL FINDS

Many archaeological and historical sites have yet to be discovered. If artifacts, such as arrowheads and pottery, old encampments, or buildings, are encountered during road construction, operations must be stopped and the Land Use Inspector notified,



• avoid archaeological sites
. inform your Land Use Inspector of any heritage resources encountered along the route

DO NOT TOUCH BOUNDARY MONUMENTS

A boundary monument is a fixed point which is used to of ficially mark the boundary ofanysurveyed lands, or is established for any surveying purpose. Monuments are labelled and can be a post, stake, peg, mound, pit, trench or any object. Monuments must never be moved, knocked over, damaged, or destroyed, but if by accident they are, the incident must be reported at once to the Surveyor-General at the office of Energy Mines and Resources Canada in Yellowknife or Whitehorse. The Surveyor-General will require payment for the investigation and restoration of the monument.

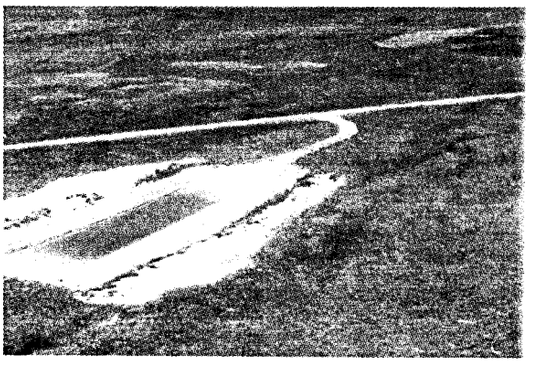
Recreational Areas

AVOID RECREATIONAL AREAS

Because unspoiled scenery and the natural landscape are important resources for the tourist industry, present and proposed recreational sites should be avoided when routing a road. The local INAC office can provide information on the location of such areas. If possible, areas used by outfitters should be avoided because the presence of a road detracts from the wilderness experience they promote.

DOGLEG APPROACHES TO STREAMS AND PUBLIC ROADS

The presence of a new road can detract from the aesthetic appeal of the scenery along a stream or public road and contractors are required to dogleg approaches to these. Public road approaches also have to be approved in writing by the Territorial Government Highways Department. This requirement ensures that approaches are located a safe distance from corners and curves, and that the proper size of culvert is installed for drainage purposes at the approach



• dogleg approaches to public roads

Commercial Forests

AVOID COMMERCIAL FORESTS

Routes should be planned to avoid cutting through commercial forests and woodlots because the right-of-way would take part of these areas out of production. If routing through such an area is necessary, arrangements will have to be made for the salvage of merchantable timber.

FLAG THE ROUTE

ELIMINATE FALSE STARTS

Once the route planning is complete and the Land Use Permit has been obtained, the route must be flagged. This procedure, which will require walking the route, will serve asa check on the appropriateness of the selected route and offer the opportunity to examine drainage conditions.

Flagging the route has economic as well as environmental benefits. Flagging should eliminate false starts and therefore minimize the impact of the road on the environment. Since even an experienced cat skinner can see terrain conditions only a short distance ahead of his machine, flagging is necessary when constructing any road. Obstructions such as a bog or steep slope may not be apparent far enough in advance to avoid having to backtrack and clear an additional length of right-of-way.

• **the false start on the left could have been avoided with proper planning**

Flagging is required above tree-line and in non-wooded areas as well as in forests.

SCHEDULING

IN PERMAFROST TERRAIN, CONSTRUCT AND OPERATE ROADS AND TRAILS ONLY WHEN THE ACTIVE LAYER IS FROZEN

Scheduling road construction and operation has to take into consideration the condition of the ground surface. In general, the surface must be strong enough to support the activity without allowing excessive rutting or tracking to occur.

Because of the sensitivity of permafrost terrain to disturbance, and because a large proportion of Northwest Territories and Yukon is covered by permafrost, most overland movement, except on multi-season roads, is restricted to times when the ground is frozen. As a result, most road construction must take place between the months of December and April. In these areas, off-road travel in the summer is prohibited unless special permission has been obtained from the Land Use Office, Exceptions to these regulations do exist, and in areas of stable surficial materials and ice-free permafrost, off-road travel may be allowed in the summer months. The local Land Use Office will be able to assess specific cases.

AVOID DISTURBANCE TO WILDLIFE DURING CRITICAL PERIODS

•**do not disturb wildlife during critical periods**
• **avoid habitats of endangered species**

Wildlife must not be disturbed during critical periods. Critical times in wildlife cycles are:

- nesting (waterfowl, birds);
- migrating (caribou);
- calving (moose, caribou);
- rearing (all animals);
- denning (bears); and
- staging[1] (waterfowl).

These periods occur during the spring, summer and fall. in most cases, winter access roads and trails will not be in operation at these times. However, because the construction and operation of multi-season access may occur at any time of the year, the contractor or operator must be aware of these critical times.

1 **Staging occurs during spring and fall migration periods and refers to waterfowl stopping to rest in an area during their flight.**

Chapter 6
Clearing

Once planning has been completed, the Land Use Permit and any other required approvals obtained, and the route flagged, the first step in construction will normally be clearing. The importance of this phase will depend upon the type of road being constructed and the nature of the existing vegetation, If an existing right-of-way is being used, clearing may be minimal or not required at all. Some winter-use roads where lakes are used extensively for the right-of-way may require little clearing. Since clearing is not required beyond the tree-line or on untreed terrain, the first step following planning in these areas is surface preparation.

• trails need only a narrow clearing width

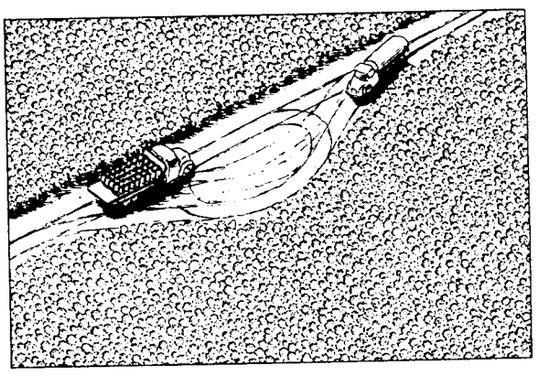
. do not clear more than is necessary; the area on the left should not have been cleared

, a cleared right-of-way for a haul road

WHERE TO CLEAR

RESTRICT AREA CLEARED TO THE APPROVED WIDTH

Clearing should be carried out only along the approved right-of-way. The width of the right-of-way will depend upon the type of road being constructed and the sensitivity of the terrain. Trails need only be cleared the width of the vehicles travelling the road. Haul roads, on the other hand, may require a single lane supplemented by turn-outs, or a right-of-way wide enough to handle traffic in two directions.



. clear turn-outs on single-lane roads

On haul and access roads, cleared widths should be sufficient to allow road surfaces to dry quickly. If the right-of-way is too narrow, the road surface will be shaded, and the slow rate of drying can result in poor drainage and unsatisfactory road conditions.

Clearing of trees may be prohibited in certain areas. There are two potential reasons for this restriction:

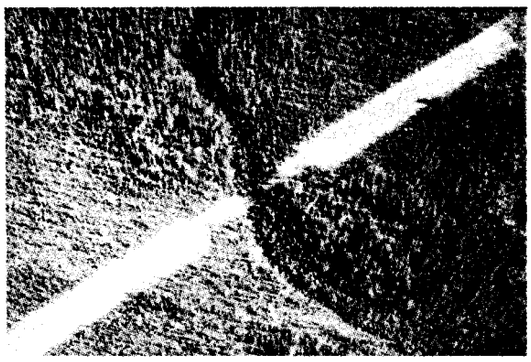
. the trees may provide shade to an area of permafrost which would thaw if the shade were removed; and

• the trees may act as a buffer, screening a road from a public highway.

• trees are left standing to serve as a buffer between an access road and a public road

For similar reasons, restrictions may be put on the size of the area cleared. This would apply in areas of unstable or high ice content soils where removal of vegetation may result in subsidence and erosion, in areas of merchantable timber, and in areas visible to the public.

Buffers of uncleared land must also be left along waterbodies, both for erosion protection and for aesthetic reasons. The width of the buffer zone will depend on soil characteristics, the steepness of the slope leading to the stream, and the type of road being constructed. On navigable streams and lakes, a 100 metre buffer is often required as a condition of the Land Use Permit.



.maintain narrow clearing widths on sensitive slopes

HOW TO CLEAR

MINIMIZE SURFACE DISTURBANCE AND EROSION

Clearing should be carried out in a manner that will minimize surface disturbance and prevent erosion. As discussed in Chapter 3, permafrost is sensitive to any disruption of its insulative surface layer. Even in non-permafrost areas, disruption of the surface by improper clearing practices can result in erosion.

DO NOT BREAK THE ORGANIC MAT IN PERMAFROST AREAS

When clearing in areas of permafrost, care should be taken not to break the organic mat which acts as insulation for the frozen ground. This insulative property also holds true for hummocks, and they should not be cut during clearing activities. In some cases, disturbance to the organic mat may be minimized by placing shoes on the blade of the bulldozer to raise it off the surface; however, this practice is not always successful, nor can it take the place of an experienced operator.

. blade shoes are designed to raise the cutting edge to protect the organic mat

PRESERVE GROUND VEGETATION

Ground vegetation loss should be kept to a minimum, and low shrubs should be preserved along the right-of-way. This vegetation preserves soil stability and acts as a sediment filter near waterways.

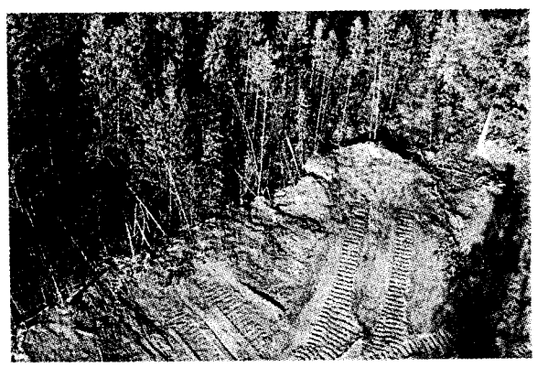
The simplest form of clearing in sparse forest cover is to walk down the vegetation. This consists of pushing down trees and shrubs by traveling the route with the bulldozer blade at a fixed height and allowing the weight of the machine to compress the felled vegetation. This method of clearing is common for trails where conventional wheeled vehicles will not be used.

Spray cutting is also used for clearing trails. Trees are pushed down into the adjoining forest with an angle blade, keeping the alignment width to a minimum. Use of the angle blade allows vehicles to travel back along the route without being speared.

• a right-of-way cleared by walking down the vegetation during winter

DO NOT USE U-BLADES

The use of U-blades for clearing access roads and trails is prohibited because of the high number of pushouts that result. Fires in the brush and debris covered by the pushouts are difficult to extinguish.



. U-blades result in numerous push-outs; fires in brush covered by push-outs are difficult to extinguish

Except when the technique of spray cutting is used, trees should be felled onto the right-of-way to minimize disturbance to the adjoining forest. in all cases, trees should be felled away from water courses.

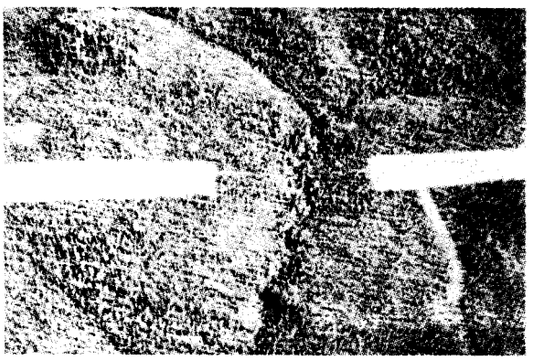
• **trees should be felled onto the right-of-way**

REMOVE LEANERS

When clearing, care should be taken to ensure that leaners are not left along the right-of-way. Leaners are trees that have been partially knocked over during clearing, but which are left leaning over the right-of-way or hanging in the surrounding forest. The weight of the leaning tree may cause the organic layer to rip, removing insulation for the underlying permafrost. These trees can also act as a safety and fire hazard.

• **these leaners should be removed to prevent ripping of the organic mat**

Sensitive slopes, unstable soils, and water crossings require special clearing procedures to prevent surface disturbance and reduce erosion. In these cases, machine clearing may be prohibited and hand clearing required.



. in sensitive permafrost terrain, leave water crossings to be cleared by hand

BRUSH DISPOSAL

FOLLOW THE DISPOSAL METHOD INDICATED IN YOUR LAND USE PERMIT

'There are several ways to dispose of the brush from clearing operations, and your Land Use Permit will specify which method is applicable to your road. Typical methods used on access roads and trails in northern Canada are:

- using brush for erosion control and insulation;
- lopping and scattering;
- windrowing; and
- complete disposal by burning.

Use Brush for Erosion Control and Insulation

On unstable soils and slopes, brush from clearing operations spread on the downhill side of the right-of-way can act as a sediment trap and prevent sedimentation in streams.

If fill is going to be used in road construction across muskegs with permafrost, brush may be spread on the right-of-way before the fill is dumped. This brush will act as added insulation to the underlying surface and help preserve the permafrost,

•brush may be used as added insulation under fill
•note end-dumping technique to protect the permafrost

Another disposal method used in permafrost regions is the spreading of brush on the right-o f-way following the abandonment of the road. This technique also protects sensitive slopes. Care must be taken to ensure that machinery does not leave the alignment or breakthrough the organic mat, because thawing of the permafrost and the creation of a mire could result.

Lop and Scatter Cleared Trees

When spray cutting has been used as a clearing technique and the trees do not fall flat on the ground, branches must be removed and the stems cut into lengths, so that all parts of the tree lie on the ground. This contact with the ground will speed up decay of the brush and debris.

• limb and buck trees to ensure they lie flat on the ground

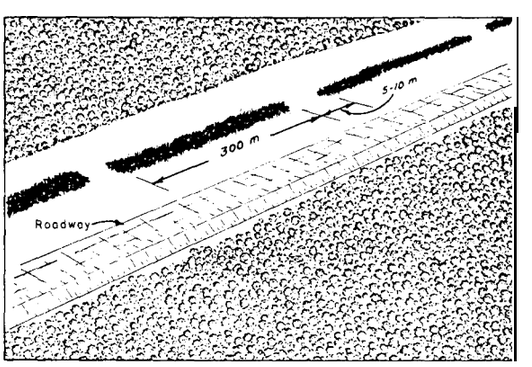
Windrow Brush

Where windrowing is the disposal method, the brush is piled at the side of the right-of-way and heavy machinery used to compact the windrow to promote quicker decay.

•ensure that windrows are not pushed against standing timber

The placement of windrows may alternate from side to side of the right-of-way. If placed on the downhill side, however, the windrow has the advantage of acting as a sediment trap.

To reduce the fire hazard, windrows should not be pushed against standing timber and breaks of from 5 to 10 metres should be made at intervals of about 300 metres. Fires have been known to spread by traveling along an unbroken windrow.



•ensure breaks in windrows to reduce fire hazards

Burn Debris for Complete Disposal

Complete disposal of brush, debris, and timber is often a requirement where a new road will come close to a public road or a waterway. Usually, only the first 100 metres or so need to be disposed of in this way. Where burning is carried out, the burning must be monitored, and the piles should be located in the centre of the right-of-way to prevent damage to the surrounding vegetation. Burning may not be allowed on sensitive slopes or in high-ice-content permafrost soils; it is not allowed during periods of high fire risk. Check with your local INAC Forestry Office for advice on burning.

• **locate burn piles in the centre of the right-of-way to avoid burning standing vegetation**

• **complete disposal is usually required at approaches to public roads**

DO NOT DISPOSE OF BRUSH IN WATERBODIES
DISPOSE PROGRESSIVELY

In no case is disposal of brush in waterbodies allowed. Disposal should be carried out progressively with clearing. Proper disposal along the whole route must be completed prior to the expiration of the Land Use Permit.

• **debris and brush must not be disposed of on the edge of lakes or streams**

Chapter 7
Multi-Season Access

Differences between multi-season and winter access roads and trails with respect to construction, operation and abandonment procedures necessitate discussing the two separately. In this chapter, multi-season access will be addressed; winter access will be covered in Chapter 8.

Multi-season access will be discussed in terms of:

- surface preparation;
- stream crossings;
- erosion control;
- maintenance; and
- putting the road to bed.

As has been stated earlier, the level of effort required to construct a road depends on its use. For example, surface preparation for an access road will be much simpler than surface preparation for a haul road. Where practices outlined below are peculairto certain types of roads, they will be indicated

SURFACE PREPARATION

Surface preparation includes all activities between clearing the right-of-way and opening the road. For trails, surface preparation may not be necessary; however, access and haul roads usually require some type of surface preparation. The establishment of road grade, and the use of cuts and fills are both examples of surface preparation.

Road Grade

MINIMIZE ROAD GRADES

Minimizing road grades can have advantages with respect to both environmental concerns and road operation. Low grades lessen the opportunity for water to erode the road surface and, at the same time, make vehicle travel easier. Nevertheless, because the establishment of low grades may increase the number of fills required, each one offering the potential for shoulder erosion, both the advantages and disadvantages of low grades must be considered.

In general, grades should be below 10 percent on long stretches, but may be as high as 15 percent for short distances.

.large fills offer the potential for shoulder erosion

Cuts and Fills

AVOID CUTS IN PERMAFROST TERRAIN

Cuts should not be made on slopes in ice-rich permafrost nor in loose materials, In the former case, the permafrost will quickly melt and the slope may slump. In the latter, the materials are naturally unstable and may fail if cut. A fill on the downhill side should be used instead.

USE DRY, ICE-FREE FILLS

Fills on slopes may utilize cut material from upslope or borrow from an approved borrow pit (see Chapter 9).

Fills are also used in constructing roads across muskegs and ice-rich permafrost. To avoid disturbance of the sensitive terrain, the fill should be end-dumped from the already-established road bed.

Cuts and fills on slopes should be stabilized to reduce the risk of erosion, Except in solid rock, the side slope of the cut or fill should be at least 2 horizontal to 1 vertical. Cuts may be stabilized by constructing benches or breaks in slope to act as surfaces for revegetation. Compaction of fills further increases their stability.

•cuts may be stabilized by constructing benches or breaks in slope

STREAM CROSSINGS

An important aspect of road construction is the interaction of the road with stream crossings and drainage lines. When crossing a stream, there are two environmental goals:

- the prevention of bank erosion and sedimentation into the stream; and
- the protection of fisheries and wildlife habitat in and along the stream,

Several Land Use Permit and Water Authorization conditions are directed toward these goals. The general content of these, together with other suggestions, are presented below, These conditions and suggestions refer to streams with flowing water for at least part of the year.

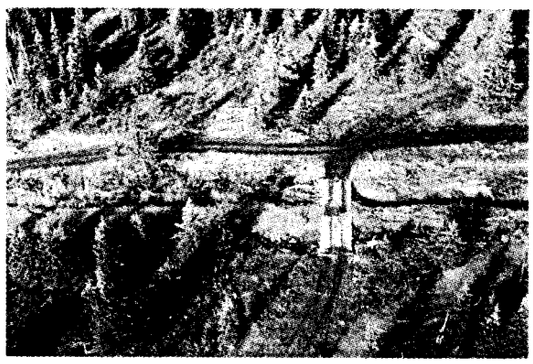
Some problems with stream crossings can be solved at the planning stage and these have been discussed in Chapter 5.

MINIMIZE STREAM IMPACTS BY GENTLE APPROACHES, BANK PROTECTION AND RESTRICTED IN-STREAM ACTIVITY

To minimize environmental impacts at stream crossings:

- select gentle approaches, whether naturally-occurring or' constructed. If construction of approaches is necessary, coarse-grained material should be used;
- avoid cutting stream banks as this results in sedimentation of the stream;
- minimize or eliminate in-stream activities as these can stir up sediment, restrict stream-flow, injure or kill fish, beaver, and muskrat, and divert the course of a stream; and
- prevent the deposition of debris, soil and organic material in the stream. Do not fill an intermittent stream channel or gully with soil to serve as a crossing.

Streams can be crossed by creating a ford, by installing a culvert or by constructing a bridge.



• select gentle approaches to stream crossings

Fords

Fords across streams may be acceptable for trails providing the following conditions are met:

- fish populations in the stream are low;
- traffic volumes on the trail are low;
- the approach to the stream is gentle; and
- the stream bed is composed of coarse-grained material.

. fording streams is acceptable under certain conditions

Fording may be allowed on streams with fish, butrestrictions during certain periods may be imposed. These include spawning and migration periods which usually occur in early spring (May 1 - June 30) and prior to freeze-up (August 1- November 1). Specific times will be noted on the Land Use Permit. No material should be deposited in a stream while fording. If material is inadvertantly deposited, it should be removed immediately.

Culverts

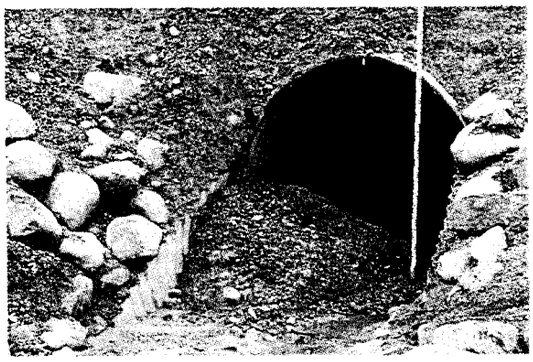
On lower class roads, culverts are the most common method of crossing a stream. They must be installed in such a manner that disruption to the stream bed and streamflow is minimized and fish passage is not obstructed.

To maintain the gradient of the steam, culverts should be installed at or below the natural level of the stream bed. The best method is to set the entire length of the culvert 15 to 30 centimetres into the stream bed. Setting the culvert in the stream bed will also help to reduce the formation of icings in the winter by promoting a continual flow of water,

•set culverts into the stream bad to maintain natural stream gradient

The original velocity and direction of streamflow should be maintained by the culvert. These conditions are controlled by culvert size, interior lining, and alignment, Guidelines on culvert design and size can be found in the publications “Design of Culverts for Fish Passage” by C. Katopodis and “fisheries Habitat Protection Guidelines” by Alberta Energy and Natural Resources.

Culverts should be of sufficient length to extend a short distance beyond the toe of the fill material to prevent blockage of the culvert ends by erosion.

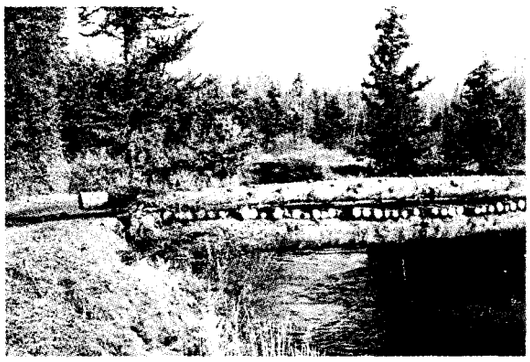


• culverts should extend beyond the toe of the fill to prevent blockage of the culvert ends by erosion

Bridges

Larger, faster-flowing streams may require the construction of a bridge in order to cross them, Portable bridges, such as native timber bridges, are the most appropriate types for lower class roads. They are the simplest to construct and cause a minimum of disturbance to the stream. These bridges offer the additional advantage of being able to be removed and re-used when a road is abandoned. Bailey bridges are also portable and suitable for lower class roads, but the metal may become brittle with the cold temperatures experienced in the North, and the bridge may have to be replaced.

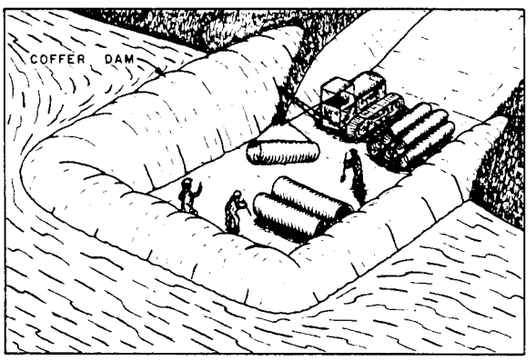
Bridges should be high enough to permit free passage of water and ice during periods of peak flow and break-up.



• native timber bridges are recommended for lower class roads
. note that the stream bank has not been disturbed

LOCATE BRIDGES AND CULVERTS ON STABLE SOILS AT NARROW SECTIONS OF STREAMS

Bridges and culverts should be located on stable soils at narrow, straight sections of streams. When work on stream crossings is in progress, flumes or coffer dams may be required to separate work areas from the stream. These structures should not block more than one-third of the stream width at any one time, and should be removed upon completion of the bridge or culvert.



• use coffer dams when working in streams

PROGRESSIVELY INSTALL CULVERTS AND BRIDGES

Culverts and bridges should be installed as construction progresses to limit the need for fording the stream and to minimize the time spent in the water by machinery.

EROSION CONTROL

Erosion control is required in some form on all classes of roads. An investment in erosion control in the early stages of a road will pay for itself with savings on maintenance and repairs.

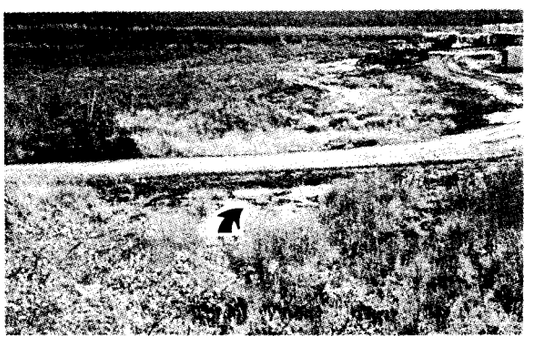
Erosion control activities should concentrate on providing adequate drainage for the road and the area it crosses, The extent of erosion and drainage problems depends on the class of road, topography of the area, vegetation present and amount of precipitation. Erosion control will be discussed in terms of general guidelines which are applicable to most roads in the North, followed by variations to these guidelines for roads in tundra environments.

•a lack of drainage control can result in your road becoming a drainage channel

General

MAINTAIN NATURAL DRAINAGE

Erosion control begins at the planning stage, at which time roads and trails should be routed so that they do not block natural drainage channels. However, in some areas, natural drainage patterns may not be noticeable until after the road has been constructed and pending occurs. In such cases, drainage structures will have to be installed after the road is operational.



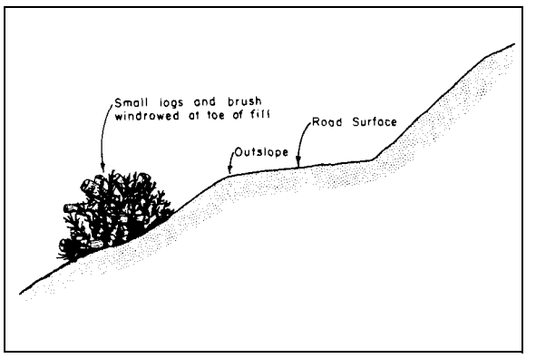
• roadside pending indicates a need for cross drainage structures

PROVIDE CROSS DRAINAGE

Roads running across the natural slope can act as dams and block drainage. This situation is most obvious in mountainous terrain, but can also occur in relatively flat areas, To prevent erosion problems caused by the blocked water, drainage across the road must be provided.

CONSTRUCT OUTSLOPING GRADES

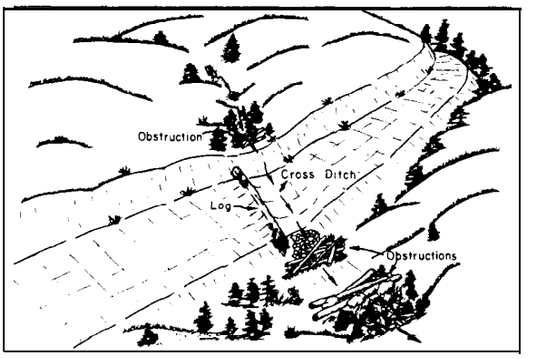
The provision of a gently outsloping road surface is the easiest way of ensuring good cross drainage. Outsloping should not be apparent to the eye, and should not be used in steep areas or where conditions are wet and slippery



- **outslope the road surface to ensure good cross drainage**

CROSS DITCH ON MOST ROADS

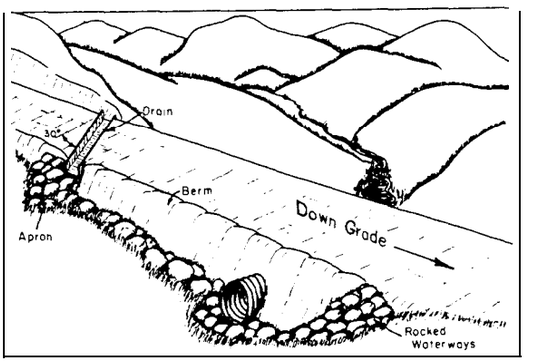
In areas where water collects on the uphill side of the road, cross ditching can be used to transport the flow to the downhill side. Cross ditches can also help collect and drain water off the road surface. A cross ditch is a shallow trench excavated by hand or cat blade across the road in the downslope direction. A log may be placed on the lower side of the ditch to protect it from vehicle traffic.



use cross ditches to carry water across the road

ISE CROSS DRAINS ON FILLS

Cross drains may be used in place of cross ditches on ome access or haul roads where fill is used and side itches are present. The cross drains are merely culerts placed in the road grade. In order to ensure water ill flow through them, culverts should be set below the evel of the side ditches and should be inclined about 2 ercent more than the road grade above. Culverts must ot be allowed to project on the downstream side as the waterfall" formed will result in erosion below the outlet. "he material in the road bed should be coarse and firm nough that water does not erode the fill around the ulvert or that the culvert does not bow from the weight of he fill. Small-diameter culverts should be avoided beause they clog easily and soon become useless.

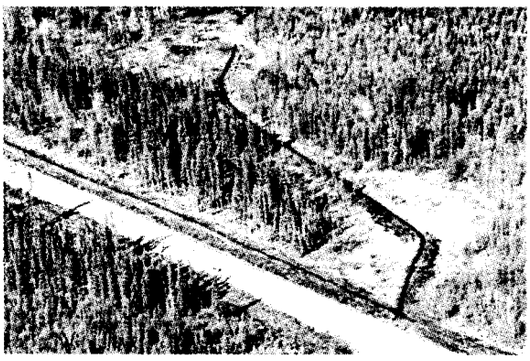


cross drains can be used to protect fills from erosion

• **ensure that culverts do not hang on the downstream side**

USE PARALLEL DITCHES ON ROADS WITH STEEP GRADES

Roads on steep cross slopes and those running upslope may require parallel ditches as well as cross ditches to keep the road surface free of water. Parallel ditches should be constructed at the same grade as the road and should be composed of coarse-grained material. On cross-slopes, ditches should be on the upslope side in order to catch the flow before it reaches the road.



• **use parallel and interceptor offshoot ditches to maintain proper drainage**

USE INTERCEPTOR OFFSHOOT DITCHES

Parallel ditches and cross ditches should not empty directly into streams, but should flow into vegetated areas located upslope of streams where any sediment is trapped prior to the water entering the stream. Interceptor offshoot ditches are used for this purpose. The location of interceptor offshoot ditches may have to be approved by the Land Use Office and their approval may be a condition of your Land Use Permit.

• **remember to follow proper clearing procedures when constructing interceptor offshoot ditches**
• **note leaners and poor disposal practice**

USE DITCH BLOCKS

Water flowing through parallel and interceptor offshoot ditches may reach velocities high enough to erode the ditches. Ditch blocks can help control water speeds and trap sediments. Ditch blocks can be constructed of logs, cleared vegetation, or rocks and coarse-grained materials. If materials are not available on site, sandbags can be used. The spacing of ditch blocks should bedefinedbythedesign engineerand will depend on the gradient and length of the ditch, and on the soil texture and amount of runoff within the ditch.

•use ditch blocks to control water velocities and prevent ditch erosion

• vegetated ditches help control erosion

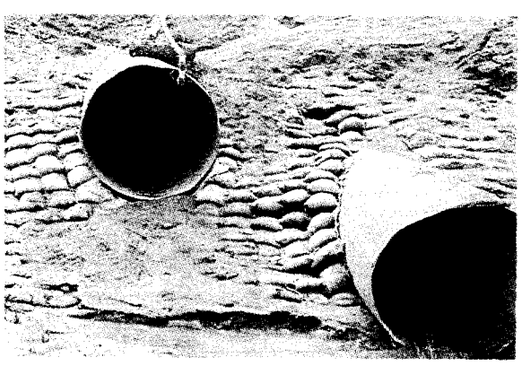
USE BERMS WHERE THE ROAD CROSSES LARGE FILLS

Berms may be required along the road shoulder to prevent runoff from eroding large fills. A berm acts as a dam, and should be periodically interrupted by cross drains to allow water to flow off the road,

. berms on both sides of the road can trap water and result in erosion of the road surface

PROTECT CULVERT ENDS AND BRIDGE ABUTMENTS

Scour around culverts and bridge abutments can be minimized by using riprap to hold the soil in place. Riprap may take the form of large rocks or sandbags placed at the culvert ends or around bridge abutments,



•sand bags prevent erosion around culvert ends

USE BRUSH FOR EROS/ON CONTROL ON SLOPES

In areas where vegetation has been cleared off the right-of-way, or where vegetation cover is sparse, slope erosion can be controlled by spreading brush, produced by clearing, on the slope.

INSTALL DRAINAGE AND EROSION CONTROL DEVICES AS CONSTRUCTION PROGRESSES

To minimize the time surfaces are exposed to erosion, drainage and erosion control procedures should be applied as construction progresses.

Erosion Control in Tundra Environments

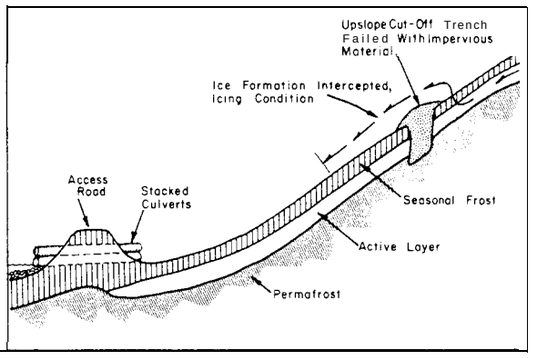
AVOID RUTTING

Multi-season access roads and trails in the arctic tundra are uncommon, but those that do exist have special erosion control problems. These roads are in the continuous permafrost zone, where erosion takes the form of permafrost thawing and sediments flowing. Permafrost thawing can be initiated by vehicles traveling when the active layer is unfrozen, causing the formation of ruts on the surface. These ruts act as drainage channels and promote the thawing of the underlying permafrost.

• traveling when the active layer is unfrozen can cause rutting

BE AWARE OF ACTIVE LAYER SEEPAGE

Drainage patterns in the tundra maybe difficult to determine because of the flatness of the terrain and low precipitation rates. In summer, thawing of the active layer often produces water that cannot penetrate the still-frozen permafrost. This water flows onto road surfaces where it can cause erosion problems. The road builder must be alert to the possibility of drainage from active layer seepage and be prepared to add drainage structures at a later date. In winter, active layer seepage can cause icings on the road. An upslope cut-off trench filled with impervious material can be used to intercept these icings and maintain a clear road.



•upslope cut-off trenches and stacked culverts can be used to control icing problems

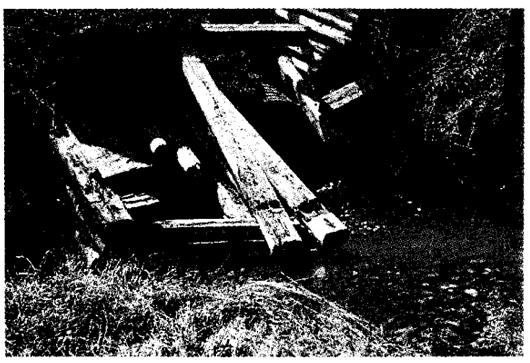
USE CULVERTS FOR DRAINAGE

Water flowing in permafrost areas thaws the frozen ground and rapidly erodes it. Cross-ditching should not be used in these areas. Water should be carried under the road in culverts, Consideration should be given to stacking culverts to maintain cross drainage in the event of the lower culvert freezing-up.

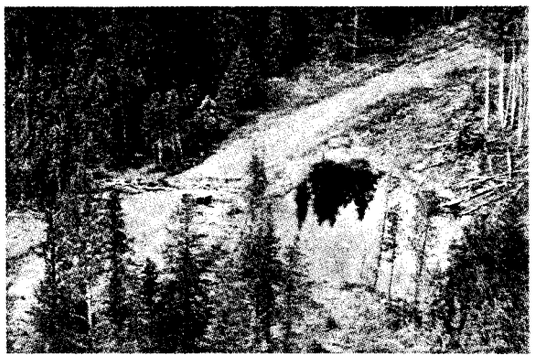
Proper route planning can avoid some of the erosion problems associated with tundra environments. This includes routing alignments upslope of snowbanks and avoiding wet sedge meadows and patterned ground.

MAINTENANCE

Maintenance of a multi-season road will vary with the class of road and season(s) of use. Trails will normally require little maintenance, although if they are used for more than one season, they may require grading or snow removal. Access roads and haul roads will require more extensive maintenance than trails.



•keep ditches and culverts free of debris

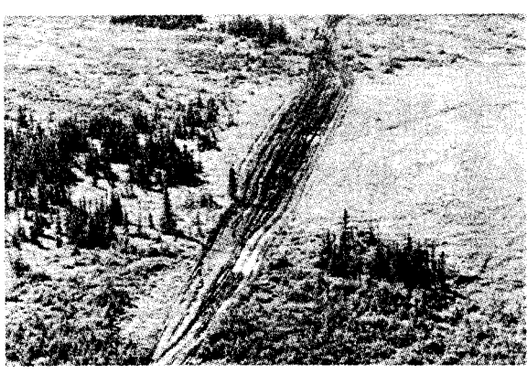


• if drainage is not maintained, road washouts can occur

• vegetation along the right-of-way can act as a means of erosion control

General maintenance activities should include the following:

- inspect drainage and erosion control structures regularly and repair when necessary;
- keep ditches and culverts clean and free of debris;
- clean sediment traps when necessary;
- ensure the road surface is free of ruts; grade if necessary to maintain good drainage;
- if the road surface becomes soft and rutting occurs, suspend traffic;
- minimize shading of roads to improve drying of the entire surface;
- carry out vegetation control along the right-of-way from the road surface; do not totally remove vegetation because it serves as erosion control; and
- keep traffic to a minimum during wet periods.



• if the road surface becomes soft and rutting occurs, suspend travel

If the road is used during the winter months and snow clearing is necessary, the following should be considered:

- do not damage drainage and erosion control structures (berms and culverts) when clearing snow;
- do not create continuous snow banks along the road. Make breaks at intervals to allow wildlife access to and from the road;
- remove snow berms prior to break-up to permit lateral drainage from the road and prevent the concentration of water on the surface; and
- check culverts and ditches for the occurrence of icings. If they are noted, keep small channels thawed to remove water and prevent it from freezing on the road surface.

• excessive snow ploughing has created snow banks along the road; these can disrupt natural drainage

PUTTING THE ROAD TO BED

When an access or haul road is no longer required, it should be restored in accordance with an approved abandonment plan. Abandonment plans are not usually required for trails; however, restoration requirements may be specified in the Land Use Permit.

REMOVE GARBAGE AND ABANDONED EQUIPMENT

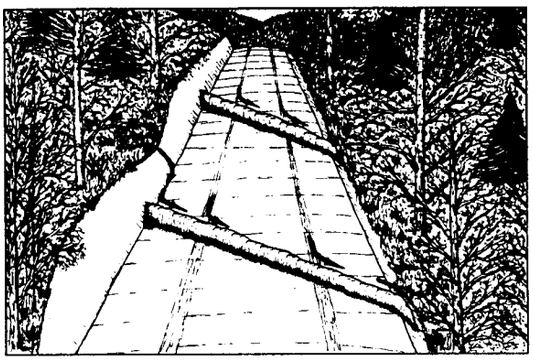
REMOVE CULVERTS

ENSURE THAT EROSION CONTROL DEVICES ARE IN PLACE

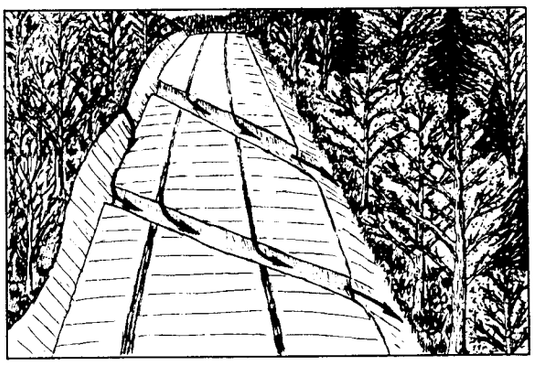
Culverts should be carefully removed from all streams and drainage channnels, and old stream channels should be re-established. Where culverts are removed from drainage channels, cross-ditches should be constructed to maintain adequate drainage along the route.

• provide adequate cross drainage on abandoned roads to minimize erosion and sedimentation

Erosion control devices (including revegetation) and slope stabilization procedures must all be in place prior to abandonment.



• erosion control devices, such as earth breakers on steep slopes, should be in place before abandonment

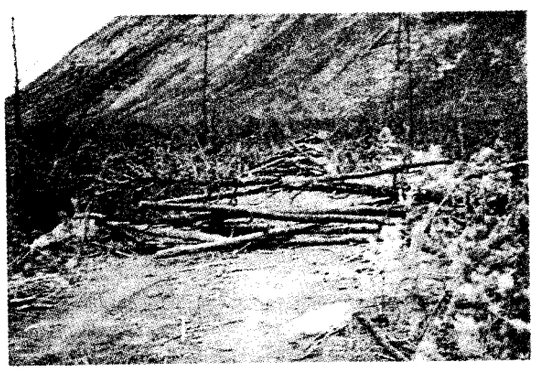


• cross ditching can also be used as an erosion control device on abandoned roads

The objectives of revegetation include both the control of erosion and subsidence while natural recovery is taking place, and the consideration of aesthetics. Disturbed land, especially unstable soils on slopes and stream-banks, and those areas visible to the public, should be revegetated. The percentage of vegetative ground cover required, and the time frame within which revegetation is to be carried out, may be specified by the Land Use Inspector.

•revegetation of the right-of-way should be carried out prior to abandonment

Public use of abandoned roads may lead to disruption of erosion control features and result in further erosion. Where it is desirable to prevent public use of abandoned roads, barriers may have to be constructed at intersections with public access. A more effective way of preventing use of an abandoned road is to spread slash and debris on the right-of-way.



•logs may be used as a barrier to close an abandoned road

Chapter 8
Winter Access

Roads and trails that are used only in the winter are common in the North. The sensitivity of much of the terrain restricts travel to when the ground is frozen and is protected by a layer of snow, Winter also offers the opportunity to utilize the frozen surfaces of numerous lakes and rivers for travel, thus avoiding the potential disturbance to the terrain that would be caused by a road on land.

In this chapter, construction, maintenance, and abandonment procedures peculiar to winter access will be discussed under the following headings:

- surface preparation;
- stream crossings;
- erosion control;
- maintenance;
- when to shut down; and
- putting the road to bed.

For a detailed discussion on winter roads, the INAC Arctic Land Use Research publication "Building and Operating Winter Roads in Canada and Alaska" by K.M. Adam should be consulted.

The roads discussed in this chapter are differentiated on their type of use and, more significantly, on how the frozen ground, snow, and ice is handled during construction and operation.

SURFACE PREPARATION

Surface preparation for winter access differs from that of multi-season access discussed in Chapter 7 in that the surface has to be "re-prepared" each year if the road is used for more than one winter.

The key factor in surface preparation for winter access is that the ground must be frozen before travel is allowed. If the surface is adequately frozen, rutting, channelling of runoff, and thawing of permafrost should not be problems.

The amount of surface preparation required for winter access depends on the class of road being constructed which, in turn, partially depends on the type of vehicle using the road. All-terrain vehicles and tracked vehicles can travel on winter trails, winter access roads, and compacted snow roads. Conventional-wheeled vehicles, on the other hand, will normally travel only on compacted snow roads.

Surface preparation may not be required for all trails in winter; however, overland travel should not be attempted until there is sufficient snow cover to protect grasses and shrubs from the tires or tracks of vehicles. Some winter trails may require blading over certain stretches of the route to smooth the surface.

Surface preparation of winter access roads is similar to that of winter trails, except that depressions on the road are filled with snow using blades or drags.

When roads and trails cross frozen lakes and rivers, surface preparation consists of clearing snow from the ice.

depressions on winter access roads can be filled by using drags

DO NOT CUT HUMMOCKS IN PERMAFROST AREAS

Whenever grading and packing of snow is required, there is a potential for breaking hummocks and disturbing permafrost soils. Care should be taken to ensure that the blades of bulldozers are high enough to prevent disturbance to the organic layer. Blade shoes may serve the purpose here on relatively flat terrain, but the difficulties in Preserving the organic layer in hummockyterrain remain.

• **grading on this winter access road has removed the snow and disturbed the organic mat**

DO NOT MIX SOIL WITH THE SNOW ON ROAD SURFACES

A second reason for not disturbing the organic layer is related to bringing soil to the surface. This can cause problems in permafrost areas because the dark-coloured soil on the snow road will absorb heat and speed the thawing of the underlying frozen surface, reducing the time the road can be used in the spring. Since the soil is often spread along the road by vehicles tires, thawing can become an even larger maintenance problem. Soils should not be mixed with snow for fills in permafrost areas.

• **the dark soil on the surface of this winter access road will encourage early melting**

In mountainous regions, surface preparation for winter access roads and trails may include cuts and fills at some locations along the alignment. If this is the case, the discussion on cuts and fills in Chapter 7, particularly with respect to erosion control procedures, would apply.

Sensitive permafrost terrain may be protected by placing slash from clearing on the alignment, and constructing the snow road on top. However, problems with the movement of conventional-wheeled vehicles may result from this practice if snow depths are insufficient to support the weight of the vehicles and protect tires from the underlying slash.

STREAM CROSSINGS

Winter roads typically cross streams on ice bridges and snow fills. Both structures offer the potential for environmental disturbance, primarily through blocking streamflow and introducing debris into the stream.

Stream crossings should be located on gently sloping banks. The lower grade will minimize bank erosion resulting from disturbance by traffic, and enable vehicles to negotiate exits from the crossings more easily. Steep grades on the accesses and exits of ice bridges and snow fills can result in machinery losing power when trying to make the grades.

• **stream and lake crossings on winter roads should have gentle approaches**
• **note clean snow fill with no debris or timber**

CONSTRUCT ICE BRIDGES TO MAINTAIN STREAM FLOWS AND INCREASE CARRYING CAPACITIES ACROSS STREAMS

The construction of an ice bridge involves clearing the ice or snow to allow deeper freezing and, if necessary, flooding the surface. If flooding is carried out, the ice should be built up in shallow lifts as these will freeze harder than deeper ones.

DO NOT USE SOIL OR DEBRIS IN SNOW FILLS OR ICE BRIDGES

The terms of a Land Use Permit in Northwest Territories and Yukon prohibit the use of soil or debris in snow fills or ice bridges. Logs are also normally prohibited, although cleaned, limbed logs may be allowed under certain circumstances. Approval from the Land Use Inspector must be obtained prior to using logs and, if permission is granted, the logs must be removed prior to break-up. If soil and debris, from bank cuts approved in the Land Use Permit, are deposited on the ice, they must be pushed back onto stable portions of the bank prior to break-up,

Ice bridges must not obstruct the flow of water in streams. Full-depth freezing of a normally open stream will have a negative effect on overwintering fish and aquatic mammals. From a physical viewpoint, an ice bridge frozen to the bottom of a normally free-flowing stream, will cause icings upstream. These icings not only pose a traffic hazard as they spread beyond the stream banks, but the forces exerted by the ice can damage or destroy trees and bushes along the stream and create erosion hazards.

REMOVE SNOW FILLS AND ICE BRIDGES BEFORE BREAK-UP

Snow fills and ice bridges must be removed prior to break-up to allow free passage of water. Removal of these structures should occur progressively as the contractor finishes in one area and moves on.

Approval may be given for only partially removing snow fills and ice bridges. In same cases, a V-shaped notch at the middle of the stream to allow flow will result in the removal of the rest of the fill or bridge by the spring freshet.

• snow fills and ice bridges must be removed prior to break-up

• soil should not have been used in this snow fill

EROSION CONTROL

Erosion control on winter roads and trails is not normally required unless cuts and fills are needed, as in mountainous terrain. In this case, erosion control structures, as discussed in Chapter 7, may be necessary.

MAINTENANCE

Maintenance of winter roads is minimal, the objective being to keep the surface smooth and covered with snow. Grading and dragging are used for this purpose. Wooden drags, because they cause less surface scuffing, are preferable to metal ones.

As much snow as possible should be retained on the road to protect underlying soils and vegetaion, and the road surface should be kept white to reduce melting. Bare spots should be covered with snow. If grading is necessary, snow windrows along the road should have breaks to allow animals to cross the road, and to allow proper drainage in spring.

. retain as much snow as possible on the road

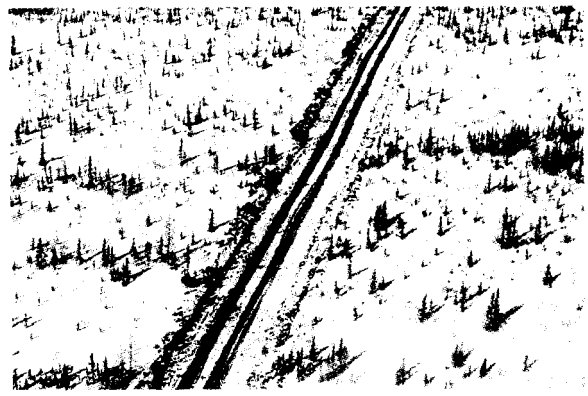
Where winter access crosses ice, maintenance consists of maintaining a snow-free surface, monitoring ice thickness, and checking the ice for cracks and the presence of pressure ridges. These latter features are upheavals in the ice sheet caused by changes in wind and temperature on large waterbodies. When cracks are noted, vehicle loads should be reduced or travel suspended.

•reduce or suspend travel when ice conditions deteriorate

WHEN TO SHUT DOWN

Winter roads should be closed when the surface is no longer frozen enough to support the weight of vehicles without rutting. Land Use Permits designate break-up as the time for closure, and assign a date to it. Since the specific date for any given year is dependent upon terrain conditions along the road, closure may be moved forward in an especially warm year or back in an unusually cold one.

indications that closure is imminent first appear on south-facing slopes and along road sections with dark surfaces. Stream approaches also begin to melt early as a result of wear and tear of vehicle movement. In the latter stages of the winter, snow conditions may not be suitable for travel during the day, although colder temperatures at night may allow limited travel and extend the final closure date.



• winter roads must be shut down before rutting occurs
•spring travel on this road has led to rutting

PUTTING THE ROAD TO BED

Winter roads that are no longer necessary should be abandoned in a manner similar to that discussed for multi-season roads in Chapter 7. The abandonment of winter roads, however, is usually easier because of the narrower clearing width and the smaller number of drainage and erosion control structures.

Chapter 9
Support Facilities For The Road

Some of the roads discussed in this manual will require support facilities in the form of borrow pits, construction camps, and fuel storage sites. Trails and winter trails will normally have little or no need for either borrow or camps, and only a minor need for fuel storage. Access roads, haul roads, winter access roads, and compacted snow roads may require all three support facilities. In this chapter, land use guidelines for these support facilities will be outlined.

BORROW PITS

OBTAIN A QUARRY PERMIT

The extraction of borrow for road base, fill, and rip rap during road construction will require a permit from the Land Use Office, and adherence to certain terms and conditions. Casual borrow pits are not allowed. Procedures for developing pits are addressed in the publication "Environmental Guidelines Pits and Quarries" available from your local INAC office. A few salient features of those guidelines will be included here, but you are encouraged to read the above-mentioned publication for a more thorough discussion on borrow extraction.

• obtain a permit before opening a borrow pit

PLAN YOUR BORROW PIT

As with road construction, planning is the most important step in borrow extraction. The quality and quantity of the borrow needed should be determined during the planning stages of the road.

- sand and gravel, quarried rock and clay till free of organics and ground ice will be required as general fill;
- well-graded, cobbles and boulders, resistant to chemical and mechanical weathering, will be required for rip rap; and

  well-graded, angular sandy gravel will be required for road base and sub-base construction and road surfacing.

Existing pits should be used where possible. If none are available, locations for new pits should be identified on maps and airphotos and examined in the field.

AVOID WATERBODIES, SENSITIVE TERRAIN AND CRITICAL WILDLIFE AREAS

In most cases, material cannot be removed from below the ordinary high water mark of any stream or lake. This restriction is intended to prevent sedimentation of spawning areas and interruption of fish migration. At the discretion of the Land Use Inspector, this restriction can be removed at some locations in early spring, late fall, or during winter,

Seasonal and terrain restrictions similar to those for road construction and operation may also apply to borrow pits. Soft, wet ground, sensitive slopes, and critical wildlife periods or habitat may affect the extraction of borrow.

ENSURE TOTAL DISPOSAL OF BRUSH

The pit boundary must be staked. In preparation for extraction, the site must be cleared of vegetation. Total disposal of brush is the normal practice.

ENSURE PROPER DRAINAGE AND EROSION CONTROL AND ABANDONMENT

Topsoil and overburden should be removed and stored separately for later use in pit reclamation.

Techniques for drainage and erosion control of pits are similar to those for multi-season roads as outlined in Chapter 7.

Pits must be restored when they are no longer needed, the type of restoration depending on the future use of the site. Regardless of the end use of the pit, the site must be cleaned-up prior to abandonment.

CAMPS

If they are needed at all, work camps for the construction of lower class roads will be small and portable.

DISPOSE OF ALL GARBAGE

The proper disposal of garbage, aside from health and aesthetic reasons, eliminates the potential for wildlife problems created by the attraction of wildlife to garbage. This situation that can be harmful to both humans and the animals themselves.

Garbage and debris must be disposed of by burning and burial, or removal to an approved disposal site.

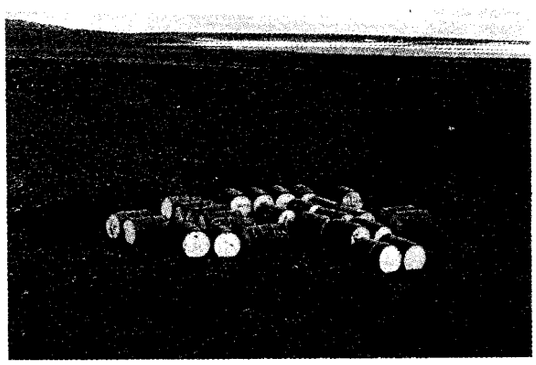
• ensure proper garbage disposal

FUEL STORAGE

Storage requirements for fuel used during construction of lower class roads will normally be small, and would probably consist of several 205-litre drums. Following the few simple procedures outlined below will ensure that environmental problems associated with fuel storage are minimal.

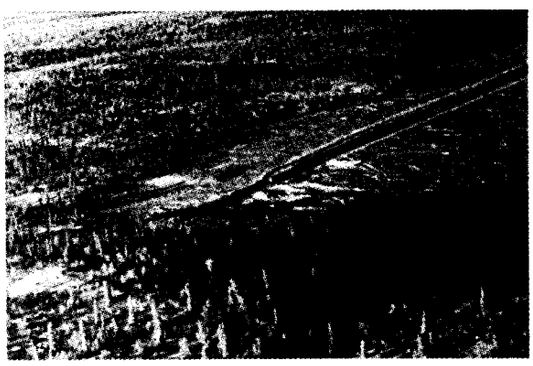
STORE FUEL AWAY FROM WATERBODIES

Fuel should be stored on flat, stable terrain well away from waterbodies. Slopes leading to waterbodies must not be used as storage sites. Regulations require that drums be at least 12 metres from the ordinary high water mark of any lake or stream. Fuel containment areas should be clearly marked to prevent damage to the drums by passing machinery.



.natural depressions, away from waterbodies, are ideal for storing fuel

Normally, mobile fuel facilities may not be parked on the ice cover of waterbodies; however, provisions can be made for storage for up to 12 hours, This number is arbitrarily chosen, but the intent is to minimize the Potential for fuel leaking into lakes. Stationary fuel facilities must not be located on ice cover under any circumstances.



- **fuel must not be stored on the frozen surface of waterbodies**

REPORT FUEL STORAGE LOCATIONS TO THE LAND USE INSPECTOR

The locations and contents of all fuel caches must be reported to the Land Use Inspector so that the sites can be included in the inspection program.

KEEP FUEL CONTAINERS SEALED

With the exception of a container in use, all fuel container outlets must be kept sealed to prevent fuel leaking. Fuel containers should be inspected regularly for leaks which, when noticed, should be repaired immediately.

DISPOSE OF WASTE PETROLEUM PRODUCTS

Waste petroleum products should be burned completely or stored at specific sites for later use in road maintenance such as dust control. The preferred method of disposal will be noted on the Land Use Permit. In any case, all containers must be removed by the expiry date of the permit.

Chapter 10
Contingency Planning

Regardless of the care taken in planning, constructing, and operating a road, the potential remains for unforeseen environmental problems, for which the contractor or operator is liable. Potentially, the most serious of these are fuel spills and fires. The effect these problems will have on the environment depends on how well prepared the contractor or operator is to solve them, In this chapter, some guidelines for addressing fuel spills and fires will be presented.

CONTAIN FUEL SPILLS IMMEDIATELY

Fuel spills may originate from fuel storage barrels or from tanker trucks using a road. The key in dealing with fuel spills is to ensure they are isolated and not allowed to spread to adjoining land or into streams or lakes. This may be accomplished by containing the spill and pumping it into empty barrels or, if conditions are favorable, burning the fuel.

•contain fuel spills immediately
•report spills to your Lend Use Officer

Spill clean-up in open waterbodies may be achieved with absorbant material. On land, earthen dikes can be used to hold the fuel until removal is possible. The dikes should be lined with plastic to prevent seepage. This principle also works for winter access trails and roads where snow dikes can be constructed. In permafrost areas dikes should be constructed of snow only, as the pushing of soil into a berm can cause more long term damage than a small amount of fuel.

All vehicles transporting fuel or toxic liquids should be equipped with a shovel and a large piece of PVC plastic for dike construction and lining. The plastic can be rolled into a small package and attached to the outside of the vehicle. A recommended size of plastic is 25 square metres.

REPORT FUEL SPILL LOCATIONS

The location of all fuel spills must be marked and reported to the Land Use Office.

When a significant amount of fuel is to be hauled, the submission of a written fuel spill contingency plan may be a condition attached to your Land Use Permit.

REPORT ALL FIRES

In the event of an uncontrolled fire, all personnel and equipment should be immediately deployed to fight the fire and the local Resource Management Officer must be notified.

•report fires immediately and deploy fire fighting equipment and personnel

Consideration should be given to having an emergency fire tool-box available during construction activities. Its contents should be discussed with the Resource Management Officer, but may include water pails, long handled shovels, pulaskis, axes and chainsaws, hoses and portable pumps.

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Saskatchewan Department of the Environment. 1981. Guidelines for Environmental Protection during Road Development. Available from Saskatchewan Environment, 1855 Victoria Avenue, Regina, Saskatchewan, S4P 3V5.

Appendix A
List of INAC Offices

NORTHWEST TERRITORIES

Regional Manager, Land Resources
INAC
P.O. Box 1500
Yellowknife, N.W.T.
XIA 2R3

District Superintendent
INAC
P.O.Box 2550
Yellowknife, N.W.T.
XIA 2P8

District Manager
INAC
P.O.Box 658
Fort Smith, N.W.T.
XOE OPO

District Manager
INAC
P.O. Box2100
Inuvik, N.W.T.
XOE OTO

District Manager
INAC
P.O. Box 150
Fort Simpson, N.W.T.
XOE ONO

District Manager
INAC
Rankin Inlet, N.W.T.
XOC OGO

Assistant District Manager
INAC
Baker Lake, N.W.T.
XOC OAO

District Manager
INAC
Frobisher Bay, N.W.T.
XOA OHO

Resource Management Officer
INAC
P.O. BOX 1420
Hay River, N.W.T.
XOE ORO

Resource Management Officer
INAC
PO. Box 126
Norman Wells, N.W.T.
XOE OVO

Resource Management Officer
INAC
Fort Liard, N.W.T.
XOG OAO

YUKON TERRITORY

Regional Manager, Land Resources
Attention: Land Use Section
INAC
200, Range Road
Whitehorse, Yukon
YIA 3V1

Resource Management Officer
INAC
Watson Lake, Yukon
YOA 1 CO

Resource Management Officer
INAC
Teslin, Yukon
YOA 1 BO

Resource Management Officer
INAC
200 Range Road
Whitehorse, Yukon
Y1A 3V1

Resource Management Officer
INAC
Haines Junction, Yukon
YOB 1 LO

Resource Management Officer
INAC
Beaver Creek, Yukon
YOB 1 AO

Resource Management Officer
INAC
Carmacks, Yukon
YOB 1 CO

Resource Management Officer
INAC
Ross River, Yukon
YOB 1 SO

Resource Management Officer
INAC
Mayo, Yukon
YOB 1 MO

Resource Management Officer
INAC
Dawson City, Yukon
YOB 1 GO

Appendix B
Land Use Checklist for Access Roads and Trails

This checklist presents, as questions, many of the points discussed in the handbook. It can be used as a quick reference to assess compliance with Land Use conditions and as a check for sound environmental planning during all phases of a road's life. Its structure is similar to that of the handbook and covers planning, clearing, multi-season access, winter access, and support facilities. The number after the question refers to the page in the handbook where more information on the topic is available. If the answer to any question is "no", the reader should give some thought to why that answer is "no".

PLANNING

. **what** type of road is required? (p. 2)

_____

. can access be obtained along an existing right-of-way? if yes, describe. (p. 10) Yes____ No _

_____

_____

. can access be obtained without road construction? (p. 10) Yes _ No _

. have you discussed the road with someone at your local Land Use Office? (p. 45) Yes _ No____

name of contact: _____

. have topographic, geologic, and land use information maps of the proposed route been examined? (p. 13) Yes _ No____

. have aerial photographs of the proposed route been examined? (p. 13) Yes _ No____

. does the proposed route avoid poorly drained areas and sand hills? (p. 13) Yes _ No____

. for multi-season roads, does the proposed route avoid north-facing slopes in the discontinuous permafrost zone? (p. 13) Yes — No____

. does the route run upslope of snowbanks and avoid patterned ground? (p. 14) Yes _ No____

• are streams crossed at right-angles and along straight stretches of streams? (p. 14) Yes _ No____

. are stream crossings located downstream of spawning beds? (p. 14) Yes _ No____

. have game sanctuaries and archaeological sites been avoided in planning? (p. 15 and 16) Yes _ No____

. has important wildlife habitat been identified and avoided? (p. 15) Yes_ No_____

. have approaches to public roads and streams been doglegged? (p. 16) Yes — No____

. has approval from the Territorial Government Highways Department been obtained for approaches to public roads? (p. 16) Yes — No____

. has the entire route been planned? (p. 12) Yes _ No____

. has the potential route been checked by a fly-over or on the ground? (p. 13) Yes _ No____

- has a Land Use Permit been applied for? (p. 6) Yes_ No____
- have you allowed sufficient lead time for a review of your application? (P. 6) Yes_ No____
- are Water Authorizations required? (P. 6) Yes_ No_
- are Quarry Permits required? (p. 6) Yes_ No_
- are Timber Permits required? (P. 6) Yes_ No_
- are Burning Permits required? (P. 6) Yes_ No_
- who is your Land Use Inspector? Yes_ No_
  name: _____ telephone: _____
- has construction scheduling considered terrain conditions and critical wildlife periods? (p. 17) Yes— No_
- has the route been flagged? (p. 17) Yes_____ No___

CLEARING

- have buffers of uncleared land been left between your road and public highways and waterbodies? (P. 20) Yes_ No_
- have blade shoes been considered for use on bulldozers in areas of permafrost? (P. **20)** Yes_ No_
- have trees been felled onto the right-of-way and away from watercourses? (P. 21) Yes— No_..._
- have leaners been removed? (p. 22) Yes— No____
- are sensitive slopes and water crossings being hand cleared? (P. 22) Yes— No_.._.._
- have breaks been left in windrows? (p. 23) Yes— No_
- have burn piles been located in the centre of the right-of-way? (P. 24) Yes_ No____
- has brush disposal been carried out progressively with clearing? (P. 24) Yes— No_
- is fire-fighting equipment available to the road and construction crew? (p. 43) Yes_ No____

MULTI-SEASON ACCESS

- have cuts in ice-rich permafrost and loose materials been avoided? (P. 25) Yes— No____
- have cuts and fills on slopes been stabilized? (P. 25) Yes____ No_
- has in-stream activity been minimized or eliminated? (P. 26) Yes— No_
- has the deposition of debris, soil, and organic material in streams been prevented? (P. 26) Yes_ No._.._
- have the proper conditions been met for fording streams? (P. 26) Yes_ No____
- have culverts been set into the stream bed? (P. 27) Yes— No____

. have culverts the proper diameter, length, and lining to maintain natural stream velocities and prevent blockage? (p. 27) Yes — No _

. are bridges high enough to allow free passage of water and ice during periods of peak flow and break-up? (p. 27) Yes _ No____

. have flumes or coffer dams been considered for in-stream work? (P. 28) Yes_ No____

. has cross drainage been provided for the road? (P. 29) Yes_ No___

. do cross ditches direct runoff into well-vegetated areas? (P. 30) Yes _ No _

. have ditch blocks been used to control water velocities in ditches? (P. 31) Yes _ No____

. have culvert ends and bridge abutments been protected by rip rap? (P. 31) Yes _ No____

. in tundra environments, is the road being monitored for active layer seepage and appropriate measures being taken if seepage occurs? (p. 32) Yes — No _

. is the road being checked regularly to ensure drainage and erosion control structures are operating and the road surface is in satisfactory condition? (P. 33) Yes — No _

. have garbage, equipment, and culverts been removed as part of the abandonment plan? (p. 34) Yes — No _

. have erosion control structures been put in place prior to abandonment? (p. 34) Yes — No____

. have barriers to public access been erected where necessary? (P. 35) Yes— No._._

WINTER ACCESS

. is the surface adequately frozen before travel commences? (p. 36) Yes _ No____

. has care been taken to ensure that soil is not mixed with the snow on roads and snow fills and in ice bridges? (p. 37 and 38) Yes——_ No_

. has permission to use logs in ice bridges been obtained from your Land Use Inspector? (p. 38) Yes— No____

. have snow fills and ice bridges been removed prior to break-up? (P. 38) Yes— No____

. is the road monitored regularly and snow and ice conditions noted? (p. 38) Yes— No _____

. is the road being closed before rutting occurs? (p. 39) Yes_ No___

SUPPORT FACILITES

. have borrow sources been planned and staked? (p. 40) Yes _ No____

. are sewage and garbage disposed of as directed in your Land Use Permit? (p. 41) Yes _ No____

. is fuel stored on flat, stable terrain away from waterbodies? (p. 41) Yes _ No____

. have fuel storage sites been reported to the Land Use Inspector? (P. 42) Yes— No___

. has fuel storage on ice been avoided? (p. 41) Yes— No—._

. are fuel containers kept sealed and inspected regularly for leaks? (P. 42) Yes _ No _

. are vehicles transporting fuel or toxic liquids, equipped with a shovel and piece of PVC plastic to contain fuel spills? (p. 43) Yes _ No____

. have waste petroleum products been disposed of as directed in your Land Use Permit? (p. 42) Yes— No____

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Environmental Operating Guidelines: Access Roads and Trails

Prepared by

Hardy BBT Limited
Calgary, Alberta

for:
Land Resources, Northern Affairs Program

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Addendum

1. Readers are advised that the responsibility for the administration and management of the forest resources in the Northwest Territories has been transferred from the Minister of Indian Affairs and Northern Development to the Minister of Renewable Resources, Government of the Northwest Territories. To obtain detailed information concerning timber licences and permits to cut trees, please contact the Forest Management Division, Department of Renewable Resources, Government of the N. W. T., in Yellowknife.

2. Page 3, column one, 3rd paragraph - “suggest alternatives” should read “suggests alternatives”.

3. Page 11, 1st paragraph - “they may prove uneconomical . . . “ should read “that may prove uneconomical...”.

4. Page 38, column one, last paragraph - “In same cases...” should read “in some cases...”

5. Page 38, second column, 3rd paragraph - "vegetaion" should read “vegetation”.

6. Page 45, first column, 8th address - Frobisher Bay, N.W.T. has been renamed to Iqaluit, N.W.T.

7. Page 48, 10th question - “abandoment” should read “abandonment”.

8. The reader is advised that permits and licences required for operations which need access to or across Inuvialuit lands are available from the Inuvialuit Lands Administration. These lands are located in the northwest sector of the Northwest Territories. For detailed information on location of Inuvialuit lands and the regulations which apply to these lands contact the Inuvialuit Lands Administration, located in Inuvik, N.W.T.

Table of Contents

Preface

This handbook presents land use guidelines for the planning, development, operation, and abandonment of access roads and trails in Northwest Territories and Yukon. It explains the rationale behind many of the terms and conditions attached to Land Use Permits for roads, and demonstrates that procedures considerate of the environment can also be efficient for the operator. What has often been considered as the high cost of environmental protection is shown to be an investment requiring a relatively small outlay in the form of environmental planning that pays off in large savings on road construction and maintenance.

These guidelines are the third in a series designed to assist operators in assessing environmental impacts and mitigative measures associated with land use activity in Northwest Territories and Yukon. Certain aspects of the other two handbooks, "Land Use Guidelines Mineral Exploration" and "Environmental Guidelines Pits and Quarries", are included here, but the reader should refer to the original documents for a more complete discussion on the appropriate topics.

The information presented in this handbook was obtained through discussions with several administrators and operators in Northwest Territories and Yukon. We would like to thank personnel from the offices of Indian and Northern Affairs Canada in Yellowknife, Fort Simpson, Fort Liard and Whitehorse for their time and assistance. Personnel from Environment Canada, Fisheries and Oceans Canada, and Yukon Department of Renewable Resources also provided information and comments and we thank them for these. Thanks is also extended to the following operators and consultants who made time to discuss their experiences constructing and operating roads and trails in northern Canada: Clive Boyd, Mike Phillips, Dick Robinson, John Staples, J.J. Van Bibber and Steve Van Bibber.

The study team received valuable assistance and guidance from the Steering Committee composed of Chris Cuddy, Floyd Adlem, and Perry Savoie from Land Resources Northern Affairs Program, Indian and Northern Affairs Canada.

This handbook was prepared by the Environmental Division of Hardy Associates (1978) Ltd., Calgary, Alberta.

GUIDELINES PRESENTED HEREIN ARE SUBORDINATE TO ALL ACTS, ORDINANCES AND REGULATIONS.

Chapter 1
Introduction

PURPOSE OF THE BOOK

This handbook is written for contractors, operators, and inspectors of access roads and trails in Northwest Territories and Yukon. It is intended to provide an understanding of the impacts and mitigative measures associated with road and trail construction and operation, and to show that protection of the environment and cost-efficient road construction and maintenance are compatible, Engineering design information and the results of environmental impact studies of roads are not presented, and the reader is referred to the recommended references at the back of the book for direction in this regard.

CLASSIFICATION OF ROADS

Roads can be classified in several ways: by season of use, complexity of design, proposed purpose, materials composition, governmental administration, and others. This handbook uses a classification based on a combination of complexity of design and season of use, as shown in the table on page 2.

. a narrow trail

The classification of a road is not necessarily permanent. A road originally constructed to provide access for resource exploration may later be upgraded to serve as a haul road or even a secondary road. The potential for upgrading becomes an important factor in road planning, as is discussed below.

The roads and trails discussed in this book are those in Classes 6 to 4. Roads in these classes require limited engineering design, and generally provide access to resource exploration and development areas.

.a mining access road in mountainous terrain

As is evident from the table, some road classes have several common names. It is often the case, that a road name in one area may mean something quite different in another area. For the purposes of this book, the following common names will be used for Class 6 to 4 roads:

Multi-season access:	Class 6- Trail Class 5- Access Road Class 4- Haul Road
Winter access:	Class 6- Winter Trail Class 5- Winter Access Road Class 4- Compacted Snow Road

. an access road

ROAD AND TRAIL CLASSIFICATION AS USED IN THIS HANDBOOK

Multi-Season Access[1]		Winter Access[2]		
Common Names	Characteristics	Common Names	Characteristics	Road Class
TRAIL Off-road access, push trail.	– Provides access for a limited duration or to a site not serviced by a road. – Degree of clearing varies from merely pushing down vegetation to clearing a narrow right-of-way.	**WINTER TRAIL** Off-road access, push trail	– A trail established for winter use by a single pass of a tracked vehicle, using a blade, if necessary.	6
ACCESS ROAD Pioneer road, service road, tote road, fire road, skid road, spur road.	– Provides initial access to resource areas for exploration and delineation purposes. – Provides access to borrow pits, garbage dumps, water supply facilities, etc. – Minimum of design work carried out. – Designed to carry low traffic volumes at low running speeds. – Traffic volumes, running speeds and load weights are greater than for trails.	**WINTER ACCESS ROAD**	– An access road established for winter use by dragging and levelling the surface to allow smoother travel. – Depressions are filled with snow, but snow does not serve as the principal road surface.	5
HAUL ROAD Logging road, forest road, local road.	– Connects developed or producing resource areas to collector and arterial roads. – Designed to carry heavy trucks at speeds from 40 to 80 km/hr.	**COMPACTED SNOW ROAD**	– A winter use haul road built with snow as a cut and fill material. – The road surface is compacted snow.	4
COLLECTOR ROAD Secondary road.	– Connects local and arterial roads. – Carries light to medium traffic at speeds of 60 to 80 km/hr. – Access to lands and movement of vehicles are of equal importance.	NO EQUIVALENT		3
HIGHWAY Arterial road	– Joins major development areas and connects with local and collector roads. – Carries medium to heavy traffic at speeds of 65 to 80 km/hr. – Movement of vehicles is the mam function, access to lands is limited. – Intersecting roads are controlled at grade.	NO EQUIVALENT		2
FREEWAY	– Moves large volumes of traffic at high speeds. – Connects major population centres and expedites through traffic. – Does not provide access to lands. – Intersections are fully controlled by grade separations.	NO EQUIVALENT		1

1. Multi-season access refers to roads and trails that are in operation for more than one season or for only one season, but that season is not winter. Examples are haul roads and access roads that are open year-round and mountain trails that may be passable only during the summer. Class 6 and 5 multi-season roads are not normally associated with permafrost areas but may be constructed to provide access to garbage dumps or water supplies in those areas.

2 Winter access refers to roads and trails that are in operation only when the ground is frozen. In Northwest Territories and Yukon, winter access occurs from December until early April, for the most pad. Winter access does not occur above Class 4 with respect to complexity of design.

Roads and trails discussed in this handbook.

• a winter trail

• a winter access road

STRUCTURE OF THE BOOK

This handbook is laid out as follows:

- Chapter 2 presents the government administrative structure and the regulations that must be followed when constructing and operating a road. It also describes how a Land Use Permit application is reviewed.
- Chapter 3 discusses permafrost and how it results in road construction and operation activities in northern Canada differing from those in southern Canada.

  Chapter 4 poses the question “IS a road really necessary?” and suggest alternatives to the practice of constructing an overdesigned road when it is not required.
- Chapter 5 addresses the most important step in road construction - the planning stage.
- Chapter 6 is concerned with guidelines for clearing the right-of-way for a road.

  Chapter 7 describes construction, operation, and abandonment activities specific to multi-season access.

  Chapter 8 covers the same topics as Chapter 7, but addresses winter access.
- Chapter 9 deals with facilities ancillary to the road itself. These are borrow pits, camps, and fuel storage facilities.

  Chapter 10 discusses contingency planning - what to do in the case of fuel spills and wildfires.
- The book is completed by a list of recommended references which provide more detail on northern roads, a list of government contacts in Northwest Territories and Yukon, and a checklist for use when planning an access road or trail.

Chapter 2
Administration and Regulations

Throughout the life of a road, from planning to closure, contractors and operators must interact with government agencies. Regulations concerning the construction and operation of roads are established by the government, and the enforcement of these regulations is carried out by government inspectors representing several departments. A lack of understanding of government jurisdiction and the permitting process often makes the red tape involved in building a road seem more onerous than it really is. In this chapter, the structure of the government in the North and the Acts and Regulations applicable to road construction will be outlined, and the procedure to follow in obtaining permits will be explained.

GOVERNMENT IN THE NORTH

Most of Northwest Territories and Yukon is Federal Crown Land, called "Territorial Lands", administered for the Federal Government by Indian and Northern Affairs Canada (INAC). Around many of the communities, the land has been transferred from the Federal Government to the Territorial Government. These lands, known as Commissioner's Lands, were set up to allow territorial and community jurisdiction of matters affecting the community. Thus it is possible for part of a private road to fall under the jurisdiction of INAC and part under the Territorial Government, A public road, once completed, is under the jurisdiction of the Commissioner (Territorial Government).

For INAC administrative purposes, Northwest Territories and Yukon have been divided into resource management areas as shown on the map. The two regional offices are located in Yellowknife and Whitehorse.

Each resource management area has an office where Land Use Permit applications are reviewed and assessed, and where contractors and operators can seek advice on road planning and construction. The addresses of these offices are listed at the back of this handbook.

ACTS AND REGULATIONS

There are numerous pieces of government legislation (Acts, Ordinances and Regulations) which control land development in the North; however, only a few Acts and Regulations apply to road development. The following are brief summaries of these.

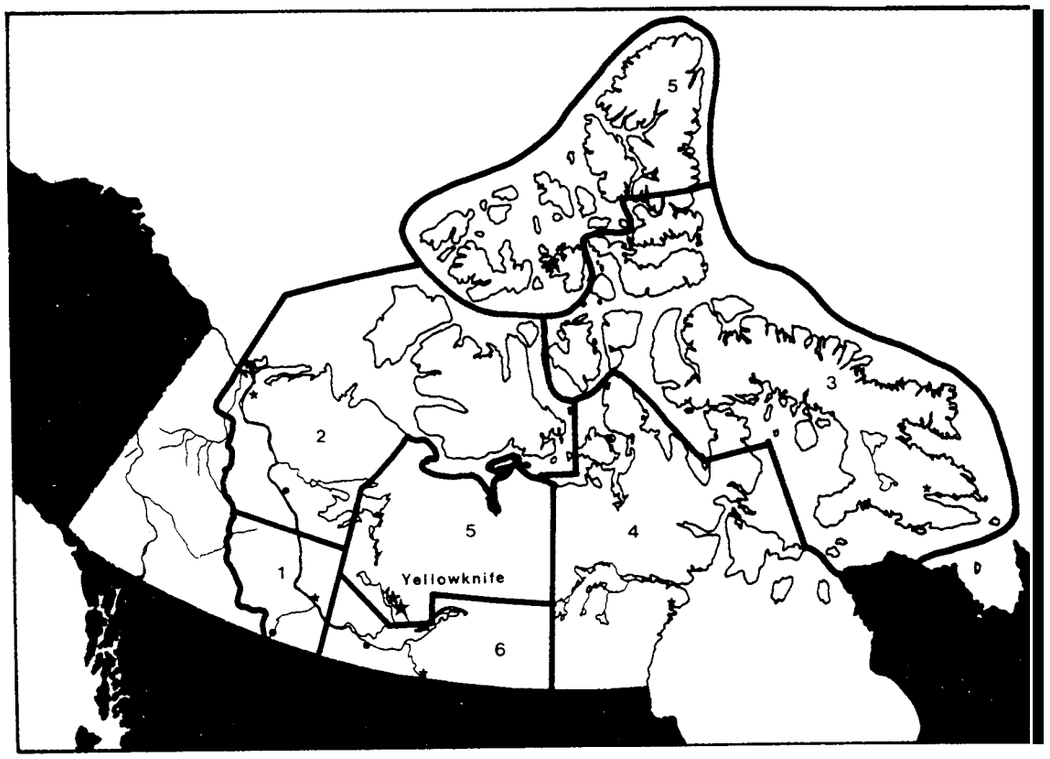
Territorial Lands Act - provides the authority for dealing with the administration and protection of Territorial (Federal Crown) Lands, which are under the direct control of the Minister of Indian and Northern Affairs.

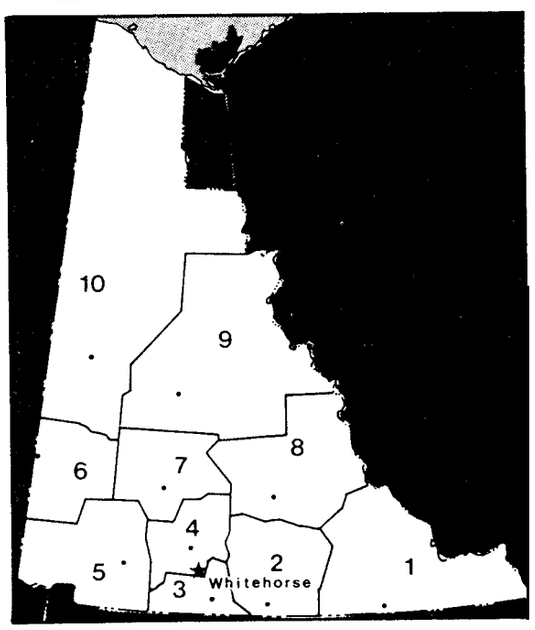
Territorial Land Use Regulations - provide regulatory control for maintaining sound environmental practice for any land use operation on lands under INAC control in theTerritories. These Regulations require that Land Use Permits be issued for, amongst other things, all work involving the use of heavy equipment, establishment of camps, use of explosives and clearing of lines, trails and rights-of-way. The Regulations are administered by INAC Land Use Engineers, who review land use applications and issue Land Use Permits, and Land Use Inspectors, who conduct field inspections to ensure compliance with the Regulations and Land Use Permits.

Territorial Quarrying Regulations - set out the fee schedule and the procedures for extracting Crown-owned limestone, granite, slate, marble, gypsum, loam, marl, gravel, sand, clay or stone in territorial lands. The regulations specify permits, applications, staking and dimensions of quarries.

Fisheries Act - provides for the protection of fish and fish habitat from any interference through pollution, or any structure that impedes or blocks fish movement.

Northern Inland Waters Act - provides for the licensing of water use, which serves as a means of controlling pollution by prohibiting waste deposition in any water body, and supporting the establishment of a comprehensive water management program.





INAC RESOURCE MANAGEMENT AREAS

Northwest Territories:

1. Ft. Simpson
2. Inuvik
3. Baffin
4. Keewatin
5. Yellowknife and Arctic Islands
6. Ft. Smith

INAC RESOURCE MANAGEMENT AREAS

Yukon

1. **Watson** Lake
2. Teslin
3. Tagish
4. Laberge
5. Haines Junction
6. Beaver Creek
7. Carjacks
8. Ross River
9. Mayo
10. Dawson

Most of the requirements relating to these Acts and Regulations will be included in the terms and conditions attached to the permits required for road construction and operation. Their inclusion does not mean, however, that the Acts and Regulations themselves can be ignored. The contractor and operator should become familiar with these pieces of legislation. The INAC publications "A Guide to Territorial Land Use Regulations" and "Northern Natural Resource Development: Requirements, Procedures and Legislation" are good starting points for this purpose.

• these INAC publications help explain some of the legislation you will have to follow

PERMITTING PROCEDURES

CONTACT YOUR LOCAL RESOURCE MANAGEMENT OFFICE (LAND USE OFFICE) TO FIND OUT WHAT PERMITS YOU WILL REQUIRE, TO OBTAIN APPLICATION FORMS, AND FOR INSTRUCTIONS ON COMPLETING THE FORMS

Before any clearing or construction activity commences, the contractor has to obtain certain permits. A Land Use Permit issued by INAC will be required, Others that may or may not be required include Water Authorizations, Timber Permits, Burning Permits and Quarrying Permits.

Once the application is submitted and accepted as being complete, it maybe passed on to members of the Land Use Advisory Committee and to potentially interested communities for review. Following this review, the recommendations go to the Land Use Engineer who does one of three things with the application. The Engineer may:

1) issue a Land Use Permit with appropriate conditions for environmental protection, or

2) refuse to issue a permit and provide the reasons therefore, or

3) place the application on hold while the project is studied in more detail.

in most cases a Land Use Permit is issued within 42 days of submission. If, however, further time is required for studies, especially field studies, the decision maybe delayed up to 12 months. If possible, it is a good idea to make your application in the spring or summer so that if field studies are required they can be carried out under optimum conditions.

READ YOUR LAND USE PERMIT

One final word on permits. Once you have received your permits, make sure you read them. The terms and conditions attached to the permits are intended as practical methods of protecting the environment and the permit holder is responsible for seeing they are adhered to. If,' for whatever reason, circumstances prevent you from complying with a term or condition, notify your Land Use Officer and your situation will be assessed. The Land Use Regulations provide a process for appealing any decision of a Land Use Inspector or Engineer.

• get to know your Land Use Inspector and keep him informed of any problems

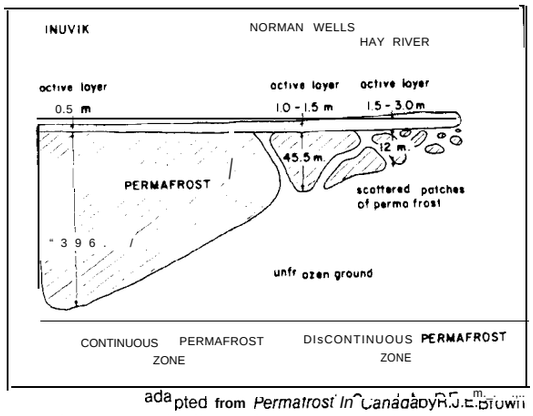
Chapter 3
Permafrost and Travel in the North

The presence of permafrost in northern Canada necessitates an approach to road construction and operation different from that followed in southern Canada. In this chapter, the characteristics of permafrost that have an effect on roads will be addressed.

DEFINITIONS

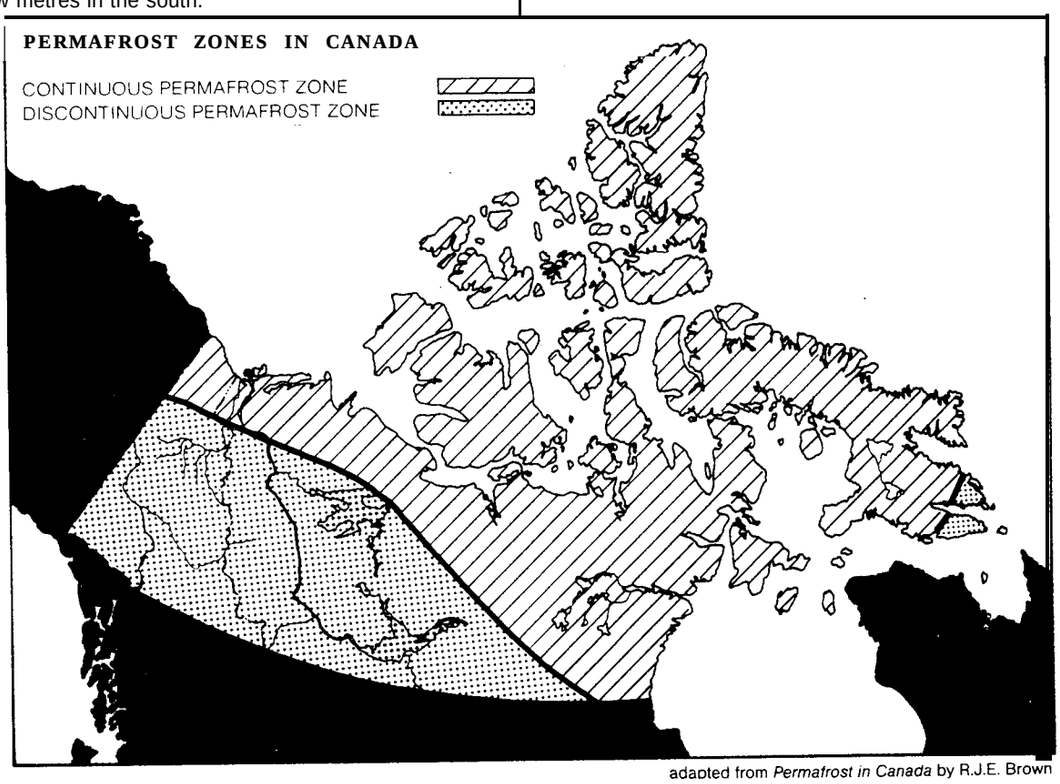
Permafrost is ground that remains frozen through at least two consecutive winters and the intervening summer. It can consist of mineral soil, organic soil, or rock, and can be either ice-free or ice-rich. Permafrost varies in thickness from a few centimetres near the southern limit of its range to several hundred metres in the north. The top of the permafrost layer is called the permafrost table.

A zone called the active layer overlies permafrost. It consists of soil or organic matter that freezes and thaws with the season. Active layer thicknesses vary from a few centimetres in the north of the permafrost zone to a few metres in the south.



adapted from *Permafrost in Canada* by R.J.E. Brown

- **continuous and discontinuous permafrost**
- **active layer**



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DISTRIBUTION

Permafrost is found across northern Canada, It is divided into the continuous zone and the discontinuous zone. In the continuous zone, permafrost is present under all land surfaces - active layers are thin and permafrost is thick. In the discontinuous zone, permafrost is found under certain conditions only. Its occurrence varies from the northern portions of the zone, where islands of non-frozen soil interrupt the permafrost, to the southern fringes where islands of permafrost interrupt the non-frozen ground. The typical locations of permafrost in the discontinuous zone are on north-facing slopes, within muskeg, and on shaded terrain with minimal snow cover.

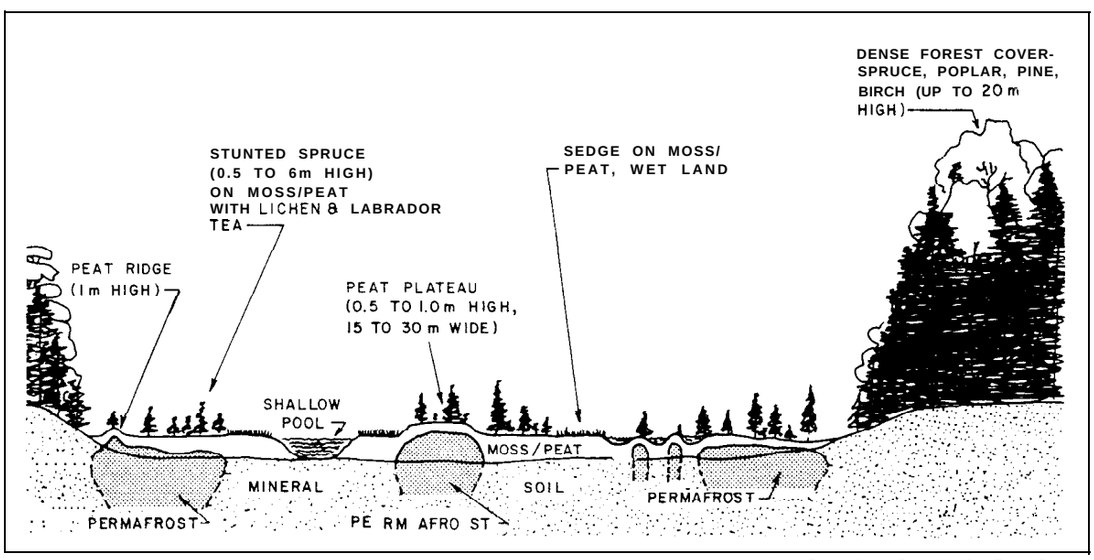
CHARACTERISTICS

Permafrost is sensitive to changes in ground and air temperature. It is protected from these changes by the organic mat which acts as insulation and by the shade provided to the surface by trees, shrubs and grasses. Snow is also an excellent insulator, However, the effect of snow on permafrost can be two-fold; in the early fall, snow can insulate the ground surface from the cold and retard the penetration of frost; in late spring, snow can delay frost leaving the ground.

The insulative characteristics of peat result in a close association between permafrost and muskeg in the North. During the summer, the surface layers of peat, when dry, are good insulators, and warming of the soil is impeded; in the fall, when there is more moisture in the surface layers, these layers become poorer insulators. By this time of year, the air is colder and the underlying soil is cooling. As a result, the ground temperature below the peat is colder than that of the adjacent areas without peat,

• **surface rutting on tundra causes distrubance to the organic mat**

When the insulative layer is disturbed, permafrost thaws, If the soil is ice-rich, slumping, sliding and other forms of erosion may occur. Ice-free soils show little physical change if permafrost thaws



adapted from *Permafrost in Canada* by R.J.t. Brown

• **permafrost distribution in peatlands in the southern**

Because it acts as a conductor of heat, water greatly influences the distribution of permafrost, and as a result the permafrost table is depressed under lakes and streams. Water is also an effective erosive agent of frozen soils. In winter, the blockage of subsurface drainage by frozen soils or roadbeds can force groundwater to come to the surface, resulting in a build-up of ice and the consequent formation of icings or “glaciers” as they are sometimes called.

PERMAFROST AND ROADS

PRESERVE THE PERMAFROST DURING ROAD CONSTRUCTION AND OPERATION

The interaction between permafrost and roads results in special problems, both in protecting the road from the effects of permafrost and in protecting the permafrost from the effects of the road. In most cases, efforts are made to preserve the permafrost. However, under special conditions, such as the presence of a small patch of permafrost in an otherwise permafrost-free area, removal of the permafrost may be more appropriate. The preservation of permafrost is accomplished by minimizing the disturbance to the insulative organic mat,

• placing fill on top of the organic mat will protect the permafrost

Opportunities to break or destroy the organic mat occur throughout the life of a road. Uprooting of trees during clearing, cutting into the surface during grading, snow ploughing off the road grade, and rutting of a soft surface by vehicle tracks area few examples. The following chapters will present suggested road construction, operation, maintenance, and abandonment procedures to minimize such disturbances.

Chapter 4
Is a Road Really Necessary?

CONSIDER THE ALTERNATIVES TO ROAD CONSTRUCTION

When access to an exploration or development site is needed, the initial reaction is usually to call for the construction of a new road. In many cases, however, a new road is not the only or the best option.

A new road, especially an access road (Class 5) or haul road (Class 4), has severs{ environmental and economic ramifications, It creates what is, in most cases, a permanent disruption to the landscape, opens an area to increased hunting and fishing pressures, and represents a considerable outlay of money, When access to an area is required, the following options to a new road should be considered:

• a little forethought may have eliminated one of these roads

Can an Existing Road or Cleared Right-of-Way be Used?

ASK YOUR LAND USE OFFICER ABOUT THE LOCATION OF EXISTING ROADS AND RIGHTS-OF-WAY

There may already be a road that runs close to the site requiring access. If this road is designed to carry at least the same type and volume of traffic required for access to the new site and need only be extended, considerable savings, both environmental and economic, can be realized if the existing road is used. Even if upgrading is required to carry new traffic loads, it is still more advantageous to use an existing route than to construct a new one, where this is economically, socially and environmentally feasible.

• a communications line used as a right-of-way

In a similar vein, if a right-of-way for another linear facility, such as a transmission line, is present, consideration should be given to using that right-of-way as a road, providing permission from the Land Use Office can be obtained.

Can Access be Obtained Without Road Construction?

WALK IN A CAT; FLY IN SUPPLIES

• consider flying-in supplies rather than building a road

The option of avoiding road construction applies mainly to resource exploration access. Rather than building a road into an area they may prove uneconomical to develop, an operator can walk a cat in, clear an airstrip to bring in supplies, carry out the exploration activities, and, if the area is not to be developed, walk the cat out. This method minimizes unnecessary disturbance to the environment and may save money. It may take a considerable number of aircraft flights, whether fixed-wing or helicopter, to spend the amount of money required for road construction, maintenance, and restoration. An additional benefit of flying in men and equipment is that seasonal restrictions on road travel can be respected, while maintaining year-round access.

4

Chapter 5
Planning

Planning is the most important step in the construction of any road, regardless of its location. Unfortunately, it is also the step that is often treated the most lightly. In this chapter the procedures for planning a successful road are outlined.

•proper planning when locating a route would have avoided this drainage problem

RATIONALE - WHY PLAN AHEAD?

PLANNING PAYS FOR ITSELF IN THE LONG RUN

Proper planning saves both time and money and will minimize the chances of adverse environmental impacts. A well planned road will virtually eliminate false starts and the abandoned stretches of roads associated with them. In addition, a planned road will generally be useable for longer periods than one that isn't planned. This is especially true of winter access where good route planning may extend the life of a road into the spring. Whenever Federal funding (such as the Tote Trail Assistance Program) is provided for a road, INAC Roads Policy requires that the road be planned. Road planning assistance is available from your local Land Use Office.

Several commonly-used terms and conditions in Land Use Permits, such as "avoiding sensitive terrain", "constructing approaches to other roads and streams", and "marking the route" are addressed during the planning stage. It is more cost-effective and easier at this stage to have professional surficial geologists, engineers and biologists plan the route, than to encounter unforeseen problems (for example, losing a cat in a bog) or to have the operation shut down for non-compliance, putting crews and equipment on stand-by.

Ensure that the entire route is planned. Any benefits of partial planning will be eliminated if that one valley crossing that wasn't planned proves to have an impassable bog or non-negotiable grades.

• a lack of planning has resulted in a road through an ice lens and the beginning of a borrow pit on the ice lens

DETERMINE THE USE OF THE ROAD

PLAN FOR THE FULL LIFE OF THE ROAD

Once the need for a new road has been identified, decisions must be made as to the type of road wanted and the kind of design required. These decisions will depend on what the road will be used for, when it will be used, how much it will be used, and what its future use may be. The road classification table in Chapter 1 can give some guidance as to what type of road may be required.

During the planning stage the potential future use of a road is an important consideration. If a road initially used as a trail may later be upgraded to a haul road, additional time spent on finding a route with gentle grades, stable terrain, and a minimum of stream crossings may eliminate the need for constructing a new road at the later date,

COLLECT EXISTING DATA

To plan a road, information on climate, terrain, permafrost, and other environmental conditions along the tentative route, must first be acquired. With this information, a cost-efficient road requiring a minimum of maintenance can be planned.

Information concerning a potential route can be derived from a number of sources:

- topographic and geologic maps provide terrain and drainage information;
- INAC Land Use Information Series maps provide information on renewable resources and related human activities;
- an examination of existing roads in the area gives an indication of the kinds of problems to expect and the types of terrain to avoid;
- discussions with the local Land Use Officer can provide information on past problems with roads in the area, the location of special areas such as game sanctuaries and archaeological sites along the route, and recommendations as to other information sources and persons knowledgeable of the area;
- aerial photographs can be used to locate the route, provide information on potential areas of concern such as sensitive slopes and muskegs, and delineate possible sources of borrow;
- the best source of information is to personally examine the route, both by air and on the ground. It is only by conducting a field check that many small-scale terrain and drainage problems can be identified.

. examine the route by air and on the ground in order to recognize small scale, site-specific problems

PREFERRED TERRAIN

When planning a road, the goal is to locate it on as stable terrain as possible.

High, dry, flat-lying ground is the ideal location for most roads. Roads on high ground are blown clear of snow in the winter and are usually well drained in summer and fall.

Because of their better drainage and stability, coarse-grained deposits such as moraines and outwash are preferable to fine-grained deposits. Sand hills, however, are prone to erosion if disturbed and should be avoided. Active floodplains should be avoided for multi-season roads.

In valleys and on slopes, roads should be located in areas where there are adequate building materials, good cross drainage, and low gradients. Areas with seeps should be avoided, as these may undermine the road. Except for crossings, waterbodies should be avoided by at least 30 metres to reduce the possibility of erosion and deposition of material into the stream or lake. There may be cases, however, where waterbodies are too numerous for the 30 metre buffer to be established.

• do not locate your road too close to waterbodies
•note washed-out road and lack of a buffer between the road and waterbody

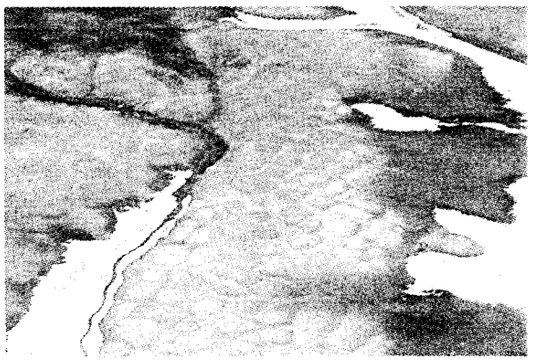
LOCATE ROADS ON SOUTH-FACING SLOPES WHEREVER POSSIBLE

In the discontinuous permafrost zone, permafrost should be avoided wherever possible. In valleys, this may be accomplished by locating the road on south-facing slopes which are likely to be both permafrost-free and drier than north-facing ones. For multi-season roads, areas of black spruce and muskeg should be avoided because they are wet and probably contain permafrost. Likewise, recently burned-out areas in permafrost are prone to erosion, although older, stabilized burns may be suitable.

• **this road, through poorly drained black spruce, will experience slumping and drainage problems throughout its life**

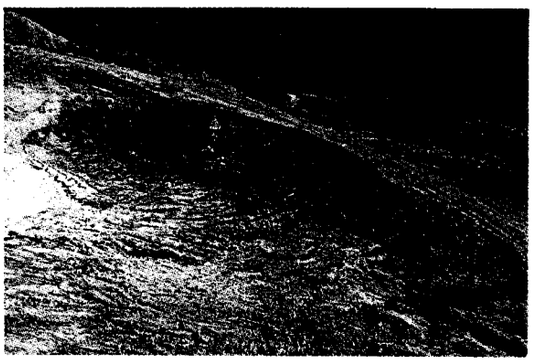
AVOID PATTERNED GROUND
AVOID ICE-RICH TERRAIN

When planning multi-season access roads and trails in the continuous permafrost zone, choose low-ice-content soils and avoid patterned ground, unstable slopes, and mud flows. If access is required across unstable permafrost terrain, detailed studies of the subsurface materials may be required.



•**avoid patterned ground in route selection**

Winter roads should make use of ice surfaces wherever possible. In some areas, lakes may constitute the greatest portion of the route,



•**avoid unstable slopes and mud flows**

MINIMIZE GRADES
FOLLOW CONTOURS

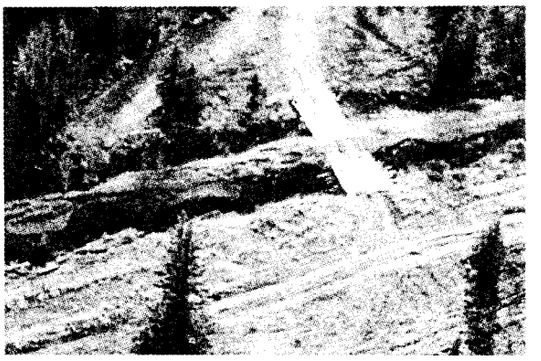
The most efficient, maintenance-free road is one with minimal grades. Don't be afraid to make the route longer in order to maintain a gentler grade, as the savings in maintenance costs will usually outweigh the expense of constructing a longer road.

STREAM CROSSINGS

MINIMIZE M OSSINGS

When planning a route, the fewer the stream crossings, the better. The best crossings are those that approach the stream at right angles and cross where the channel is straight, unobstructed, and well-defined. This approach minimizes contact with the stream and its banks, and decreases the likelihood of erosion. Selecting level stream approaches also helps to reduce erosion.

Fisheries habitat must be considered when planning a stream crossing. To avoid disturbance and possible sedimentation of spawning beds, the route should cross downstream of such areas.

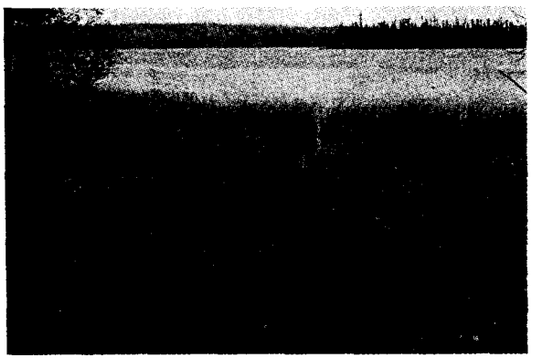


• **streams should be approached at right angles**
•**minimize the number of stream crossings**

DO NOT USE STREAMBEDS AS ROADWAYS

Stream beds cannot be used as rights-of-way for multi-season roads. The presence of vehicles in the stream, together with the increased potential for toxic spills and sedimentation, can cause serious impacts to fish. In addition, the water quality of the stream, or of a larger stream which receives its flow, may be affected. Ultimately, community water supplies may be impaired.

Some winter access roads and trails do follow streambeds or cross lakes. Once again, level approaches to the waterbodies are preferred in order to avoid erosion and allow easy passage of vehicles. On lakes, crossing narrows should be avoided because of the presence of faster water there which results in poor ice conditions.



•choose gentle approaches to lakes and streams when routing winter access roads and trails

SPECIAL AREAS AND CONCERNS

If a road crosses especially sensitive or unique areas, there will be certain terms and conditions in the Land Use Permit addressing these. Permafrost, lakes, and streams can be sensitive, and these have been discussed above. Other potentially sensitive areas that should be considered at the planning stage are:

. critical wildlife habitat;
• unique geographical features;
• archaeological sites and monuments;
. recreational areas; and
• commercial forests.

Critical Wildlife Habitat

AVOID IMPORTANT WILDLIFE HABITAT

Roads should be planned to avoid important wildlife habitat. Critical areas include nesting, rearing and staging areas for waterfowl and other birds, migrating and calving areas for moose and caribou, denning areas for bears, and rearing areas for some animals. The local Land Use Office can direct you to the appropriate government departments to obtain more information on the locations and restrictions of these areas. Access through game and bird sanctuaries may be restricted. These restrictions are necessary to avoid disturbing wildlife during activities such as egg incubation and rearing of young.

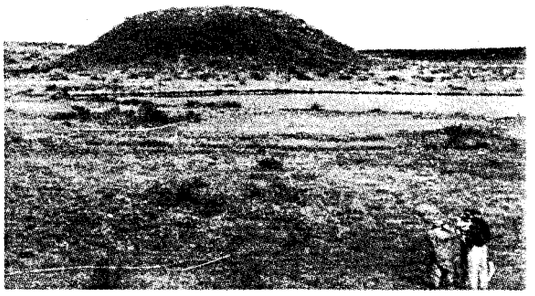
•minimize disturbance to economically important fur-bearing species

Special measures may be required to minimize disturbance to economically important fur-bearing species such as beaver and muskrat.

Unique Geographical Features

AVOID PINGOS

One of the unique permafrost landforms is a pingo - a round, ice-cored hill formed as a result of water and ice pressures in permafrost terrain. Pingos are few in number. They are most common on the Mackenzie Delta, but the chances of a potential road being near one are remote. Nevertheless, machinery, vehicles and equipment are prohibited within 150 metres of these landforms. This restriction is necessary because of the sensitivity of the ice-cored features to surface disturbance.



. machinery, vehicles and equipment are not allowed within 150 metres of pingos

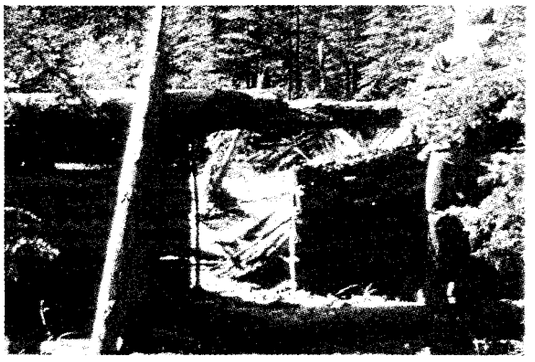
Archaeological Sites and Monuments

AVOID ARCHAEOLOGICAL SITES

Because evidence of past cultures helps us to understand our heritage, land use operations in proximity of known or suspected archaeological sites and burial grounds are prohibited. Known sites are registered, and routing assistance to avoid them can be obtained through the local Land Use Office.

REPORT ARCHAEOLOGICAL FINDS

Many archaeological and historical sites have yet to be discovered. If artifacts, such as arrowheads and pottery, old encampments, or buildings, are encountered during road construction, operations must be stopped and the Land Use Inspector notified,



• avoid archaeological sites
. inform your Land Use Inspector of any heritage resources encountered along the route

DO NOT TOUCH BOUNDARY MONUMENTS

A boundary monument is a fixed point which is used to of ficially mark the boundary ofanysurveyed lands, or is established for any surveying purpose. Monuments are labelled and can be a post, stake, peg, mound, pit, trench or any object. Monuments must never be moved, knocked over, damaged, or destroyed, but if by accident they are, the incident must be reported at once to the Surveyor-General at the office of Energy Mines and Resources Canada in Yellowknife or Whitehorse. The Surveyor-General will require payment for the investigation and restoration of the monument.

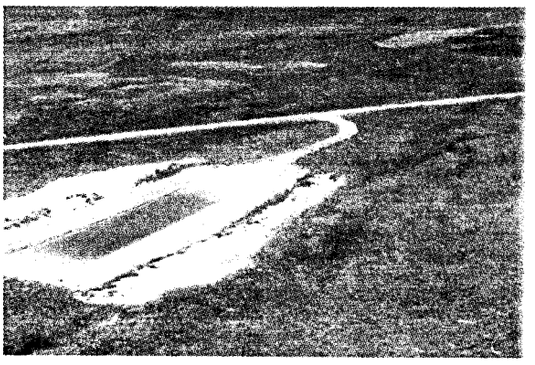
Recreational Areas

AVOID RECREATIONAL AREAS

Because unspoiled scenery and the natural landscape are important resources for the tourist industry, present and proposed recreational sites should be avoided when routing a road. The local INAC office can provide information on the location of such areas. If possible, areas used by outfitters should be avoided because the presence of a road detracts from the wilderness experience they promote.

DOGLEG APPROACHES TO STREAMS AND PUBLIC ROADS

The presence of a new road can detract from the aesthetic appeal of the scenery along a stream or public road and contractors are required to dogleg approaches to these. Public road approaches also have to be approved in writing by the Territorial Government Highways Department. This requirement ensures that approaches are located a safe distance from corners and curves, and that the proper size of culvert is installed for drainage purposes at the approach



• dogleg approaches to public roads

Commercial Forests

AVOID COMMERCIAL FORESTS

Routes should be planned to avoid cutting through commercial forests and woodlots because the right-of-way would take part of these areas out of production. If routing through such an area is necessary, arrangements will have to be made for the salvage of merchantable timber.

FLAG THE ROUTE

ELIMINATE FALSE STARTS

Once the route planning is complete and the Land Use Permit has been obtained, the route must be flagged. This procedure, which will require walking the route, will serve asa check on the appropriateness of the selected route and offer the opportunity to examine drainage conditions.

Flagging the route has economic as well as environmental benefits. Flagging should eliminate false starts and therefore minimize the impact of the road on the environment. Since even an experienced cat skinner can see terrain conditions only a short distance ahead of his machine, flagging is necessary when constructing any road. Obstructions such as a bog or steep slope may not be apparent far enough in advance to avoid having to backtrack and clear an additional length of right-of-way.

• **the false start on the left could have been avoided with proper planning**

Flagging is required above tree-line and in non-wooded areas as well as in forests.

SCHEDULING

IN PERMAFROST TERRAIN, CONSTRUCT AND OPERATE ROADS AND TRAILS ONLY WHEN THE ACTIVE LAYER IS FROZEN

Scheduling road construction and operation has to take into consideration the condition of the ground surface. In general, the surface must be strong enough to support the activity without allowing excessive rutting or tracking to occur.

Because of the sensitivity of permafrost terrain to disturbance, and because a large proportion of Northwest Territories and Yukon is covered by permafrost, most overland movement, except on multi-season roads, is restricted to times when the ground is frozen. As a result, most road construction must take place between the months of December and April. In these areas, off-road travel in the summer is prohibited unless special permission has been obtained from the Land Use Office, Exceptions to these regulations do exist, and in areas of stable surficial materials and ice-free permafrost, off-road travel may be allowed in the summer months. The local Land Use Office will be able to assess specific cases.

AVOID DISTURBANCE TO WILDLIFE DURING CRITICAL PERIODS

•**do not disturb wildlife during critical periods**
• **avoid habitats of endangered species**

Wildlife must not be disturbed during critical periods. Critical times in wildlife cycles are:

- nesting (waterfowl, birds);
- migrating (caribou);
- calving (moose, caribou);
- rearing (all animals);
- denning (bears); and
- staging[1] (waterfowl).

These periods occur during the spring, summer and fall. in most cases, winter access roads and trails will not be in operation at these times. However, because the construction and operation of multi-season access may occur at any time of the year, the contractor or operator must be aware of these critical times.

1 **Staging occurs during spring and fall migration periods and refers to waterfowl stopping to rest in an area during their flight.**

Chapter 6
Clearing

Once planning has been completed, the Land Use Permit and any other required approvals obtained, and the route flagged, the first step in construction will normally be clearing. The importance of this phase will depend upon the type of road being constructed and the nature of the existing vegetation, If an existing right-of-way is being used, clearing may be minimal or not required at all. Some winter-use roads where lakes are used extensively for the right-of-way may require little clearing. Since clearing is not required beyond the tree-line or on untreed terrain, the first step following planning in these areas is surface preparation.

• trails need only a narrow clearing width

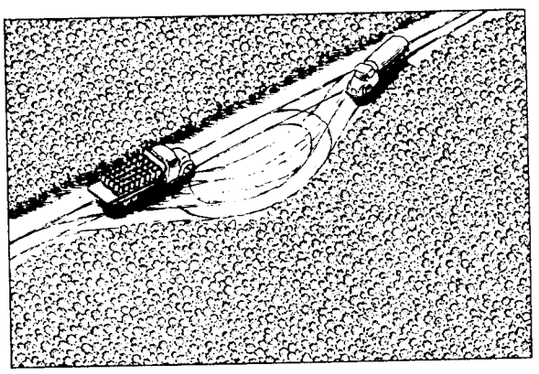
. do not clear more than is necessary; the area on the left should not have been cleared

, a cleared right-of-way for a haul road

WHERE TO CLEAR

RESTRICT AREA CLEARED TO THE APPROVED WIDTH

Clearing should be carried out only along the approved right-of-way. The width of the right-of-way will depend upon the type of road being constructed and the sensitivity of the terrain. Trails need only be cleared the width of the vehicles travelling the road. Haul roads, on the other hand, may require a single lane supplemented by turn-outs, or a right-of-way wide enough to handle traffic in two directions.



. clear turn-outs on single-lane roads

On haul and access roads, cleared widths should be sufficient to allow road surfaces to dry quickly. If the right-of-way is too narrow, the road surface will be shaded, and the slow rate of drying can result in poor drainage and unsatisfactory road conditions.

Clearing of trees may be prohibited in certain areas. There are two potential reasons for this restriction:

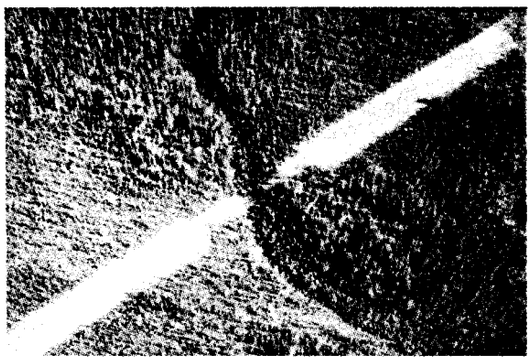
. the trees may provide shade to an area of permafrost which would thaw if the shade were removed; and

• the trees may act as a buffer, screening a road from a public highway.

• trees are left standing to serve as a buffer between an access road and a public road

For similar reasons, restrictions may be put on the size of the area cleared. This would apply in areas of unstable or high ice content soils where removal of vegetation may result in subsidence and erosion, in areas of merchantable timber, and in areas visible to the public.

Buffers of uncleared land must also be left along waterbodies, both for erosion protection and for aesthetic reasons. The width of the buffer zone will depend on soil characteristics, the steepness of the slope leading to the stream, and the type of road being constructed. On navigable streams and lakes, a 100 metre buffer is often required as a condition of the Land Use Permit.



.maintain narrow clearing widths on sensitive slopes

HOW TO CLEAR

MINIMIZE SURFACE DISTURBANCE AND EROSION

Clearing should be carried out in a manner that will minimize surface disturbance and prevent erosion. As discussed in Chapter 3, permafrost is sensitive to any disruption of its insulative surface layer. Even in non-permafrost areas, disruption of the surface by improper clearing practices can result in erosion.

DO NOT BREAK THE ORGANIC MAT IN PERMAFROST AREAS

When clearing in areas of permafrost, care should be taken not to break the organic mat which acts as insulation for the frozen ground. This insulative property also holds true for hummocks, and they should not be cut during clearing activities. In some cases, disturbance to the organic mat may be minimized by placing shoes on the blade of the bulldozer to raise it off the surface; however, this practice is not always successful, nor can it take the place of an experienced operator.

. blade shoes are designed to raise the cutting edge to protect the organic mat

PRESERVE GROUND VEGETATION

Ground vegetation loss should be kept to a minimum, and low shrubs should be preserved along the right-of-way. This vegetation preserves soil stability and acts as a sediment filter near waterways.

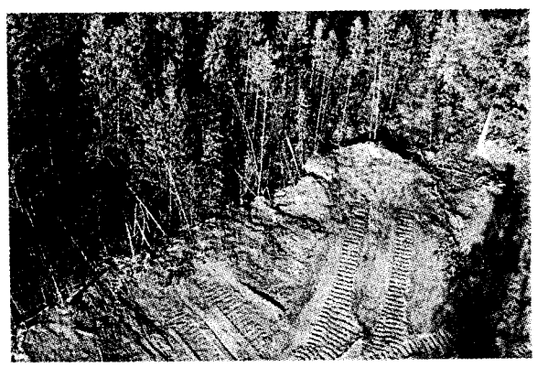
The simplest form of clearing in sparse forest cover is to walk down the vegetation. This consists of pushing down trees and shrubs by traveling the route with the bulldozer blade at a fixed height and allowing the weight of the machine to compress the felled vegetation. This method of clearing is common for trails where conventional wheeled vehicles will not be used.

Spray cutting is also used for clearing trails. Trees are pushed down into the adjoining forest with an angle blade, keeping the alignment width to a minimum. Use of the angle blade allows vehicles to travel back along the route without being speared.

• a right-of-way cleared by walking down the vegetation during winter

DO NOT USE U-BLADES

The use of U-blades for clearing access roads and trails is prohibited because of the high number of pushouts that result. Fires in the brush and debris covered by the pushouts are difficult to extinguish.



. U-blades result in numerous push-outs; fires in brush covered by push-outs are difficult to extinguish

Except when the technique of spray cutting is used, trees should be felled onto the right-of-way to minimize disturbance to the adjoining forest. in all cases, trees should be felled away from water courses.

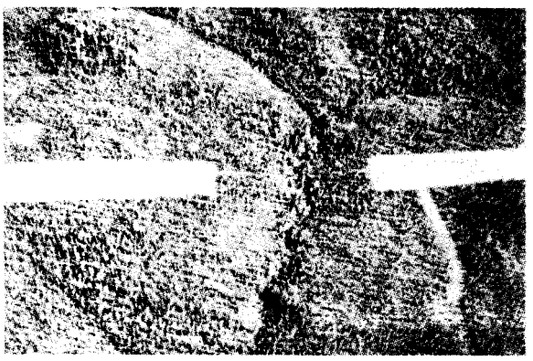
• **trees should be felled onto the right-of-way**

REMOVE LEANERS

When clearing, care should be taken to ensure that leaners are not left along the right-of-way. Leaners are trees that have been partially knocked over during clearing, but which are left leaning over the right-of-way or hanging in the surrounding forest. The weight of the leaning tree may cause the organic layer to rip, removing insulation for the underlying permafrost. These trees can also act as a safety and fire hazard.

• **these leaners should be removed to prevent ripping of the organic mat**

Sensitive slopes, unstable soils, and water crossings require special clearing procedures to prevent surface disturbance and reduce erosion. In these cases, machine clearing may be prohibited and hand clearing required.



. in sensitive permafrost terrain, leave water crossings to be cleared by hand

BRUSH DISPOSAL

FOLLOW THE DISPOSAL METHOD INDICATED IN YOUR LAND USE PERMIT

'There are several ways to dispose of the brush from clearing operations, and your Land Use Permit will specify which method is applicable to your road. Typical methods used on access roads and trails in northern Canada are:

- using brush for erosion control and insulation;
- lopping and scattering;
- windrowing; and
- complete disposal by burning.

Use Brush for Erosion Control and Insulation

On unstable soils and slopes, brush from clearing operations spread on the downhill side of the right-of-way can act as a sediment trap and prevent sedimentation in streams.

If fill is going to be used in road construction across muskegs with permafrost, brush may be spread on the right-of-way before the fill is dumped. This brush will act as added insulation to the underlying surface and help preserve the permafrost,

•brush may be used as added insulation under fill
•note end-dumping technique to protect the permafrost

Another disposal method used in permafrost regions is the spreading of brush on the right-o f-way following the abandonment of the road. This technique also protects sensitive slopes. Care must be taken to ensure that machinery does not leave the alignment or breakthrough the organic mat, because thawing of the permafrost and the creation of a mire could result.

Lop and Scatter Cleared Trees

When spray cutting has been used as a clearing technique and the trees do not fall flat on the ground, branches must be removed and the stems cut into lengths, so that all parts of the tree lie on the ground. This contact with the ground will speed up decay of the brush and debris.

• limb and buck trees to ensure they lie flat on the ground

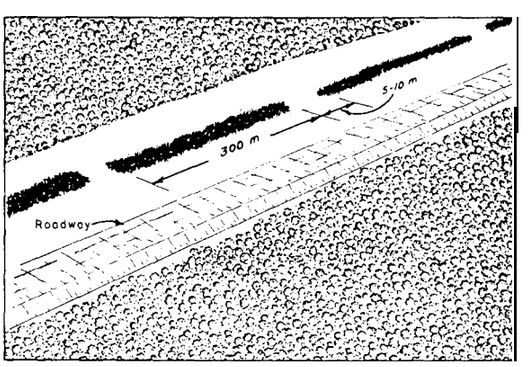
Windrow Brush

Where windrowing is the disposal method, the brush is piled at the side of the right-of-way and heavy machinery used to compact the windrow to promote quicker decay.

•ensure that windrows are not pushed against standing timber

The placement of windrows may alternate from side to side of the right-of-way. If placed on the downhill side, however, the windrow has the advantage of acting as a sediment trap.

To reduce the fire hazard, windrows should not be pushed against standing timber and breaks of from 5 to 10 metres should be made at intervals of about 300 metres. Fires have been known to spread by traveling along an unbroken windrow.



•ensure breaks in windrows to reduce fire hazards

Burn Debris for Complete Disposal

Complete disposal of brush, debris, and timber is often a requirement where a new road will come close to a public road or a waterway. Usually, only the first 100 metres or so need to be disposed of in this way. Where burning is carried out, the burning must be monitored, and the piles should be located in the centre of the right-of-way to prevent damage to the surrounding vegetation. Burning may not be allowed on sensitive slopes or in high-ice-content permafrost soils; it is not allowed during periods of high fire risk. Check with your local INAC Forestry Office for advice on burning.

• **locate burn piles in the centre of the right-of-way to avoid burning standing vegetation**

• **complete disposal is usually required at approaches to public roads**

DO NOT DISPOSE OF BRUSH IN WATERBODIES
DISPOSE PROGRESSIVELY

In no case is disposal of brush in waterbodies allowed. Disposal should be carried out progressively with clearing. Proper disposal along the whole route must be completed prior to the expiration of the Land Use Permit.

• **debris and brush must not be disposed of on the edge of lakes or streams**

Chapter 7
Multi-Season Access

Differences between multi-season and winter access roads and trails with respect to construction, operation and abandonment procedures necessitate discussing the two separately. In this chapter, multi-season access will be addressed; winter access will be covered in Chapter 8.

Multi-season access will be discussed in terms of:

- surface preparation;
- stream crossings;
- erosion control;
- maintenance; and
- putting the road to bed.

As has been stated earlier, the level of effort required to construct a road depends on its use. For example, surface preparation for an access road will be much simpler than surface preparation for a haul road. Where practices outlined below are peculairto certain types of roads, they will be indicated

SURFACE PREPARATION

Surface preparation includes all activities between clearing the right-of-way and opening the road. For trails, surface preparation may not be necessary; however, access and haul roads usually require some type of surface preparation. The establishment of road grade, and the use of cuts and fills are both examples of surface preparation.

Road Grade

MINIMIZE ROAD GRADES

Minimizing road grades can have advantages with respect to both environmental concerns and road operation. Low grades lessen the opportunity for water to erode the road surface and, at the same time, make vehicle travel easier. Nevertheless, because the establishment of low grades may increase the number of fills required, each one offering the potential for shoulder erosion, both the advantages and disadvantages of low grades must be considered.

In general, grades should be below 10 percent on long stretches, but may be as high as 15 percent for short distances.

.large fills offer the potential for shoulder erosion

Cuts and Fills

AVOID CUTS IN PERMAFROST TERRAIN

Cuts should not be made on slopes in ice-rich permafrost nor in loose materials, In the former case, the permafrost will quickly melt and the slope may slump. In the latter, the materials are naturally unstable and may fail if cut. A fill on the downhill side should be used instead.

USE DRY, ICE-FREE FILLS

Fills on slopes may utilize cut material from upslope or borrow from an approved borrow pit (see Chapter 9).

Fills are also used in constructing roads across muskegs and ice-rich permafrost. To avoid disturbance of the sensitive terrain, the fill should be end-dumped from the already-established road bed.

Cuts and fills on slopes should be stabilized to reduce the risk of erosion, Except in solid rock, the side slope of the cut or fill should be at least 2 horizontal to 1 vertical. Cuts may be stabilized by constructing benches or breaks in slope to act as surfaces for revegetation. Compaction of fills further increases their stability.

•cuts may be stabilized by constructing benches or breaks in slope

STREAM CROSSINGS

An important aspect of road construction is the interaction of the road with stream crossings and drainage lines. When crossing a stream, there are two environmental goals:

- the prevention of bank erosion and sedimentation into the stream; and
- the protection of fisheries and wildlife habitat in and along the stream,

Several Land Use Permit and Water Authorization conditions are directed toward these goals. The general content of these, together with other suggestions, are presented below, These conditions and suggestions refer to streams with flowing water for at least part of the year.

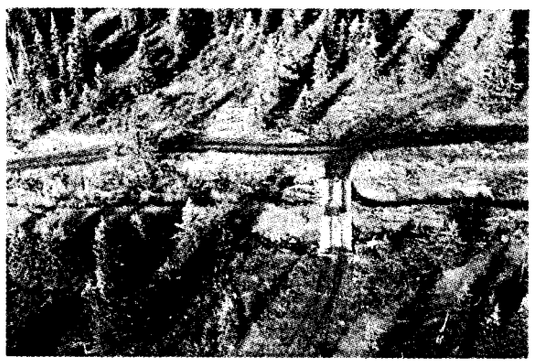
Some problems with stream crossings can be solved at the planning stage and these have been discussed in Chapter 5.

MINIMIZE STREAM IMPACTS BY GENTLE APPROACHES, BANK PROTECTION AND RESTRICTED IN-STREAM ACTIVITY

To minimize environmental impacts at stream crossings:

- select gentle approaches, whether naturally-occurring or' constructed. If construction of approaches is necessary, coarse-grained material should be used;
- avoid cutting stream banks as this results in sedimentation of the stream;
- minimize or eliminate in-stream activities as these can stir up sediment, restrict stream-flow, injure or kill fish, beaver, and muskrat, and divert the course of a stream; and
- prevent the deposition of debris, soil and organic material in the stream. Do not fill an intermittent stream channel or gully with soil to serve as a crossing.

Streams can be crossed by creating a ford, by installing a culvert or by constructing a bridge.



• select gentle approaches to stream crossings

Fords

Fords across streams may be acceptable for trails providing the following conditions are met:

- fish populations in the stream are low;
- traffic volumes on the trail are low;
- the approach to the stream is gentle; and
- the stream bed is composed of coarse-grained material.

. fording streams is acceptable under certain conditions

Fording may be allowed on streams with fish, butrestrictions during certain periods may be imposed. These include spawning and migration periods which usually occur in early spring (May 1 - June 30) and prior to freeze-up (August 1- November 1). Specific times will be noted on the Land Use Permit. No material should be deposited in a stream while fording. If material is inadvertantly deposited, it should be removed immediately.

Culverts

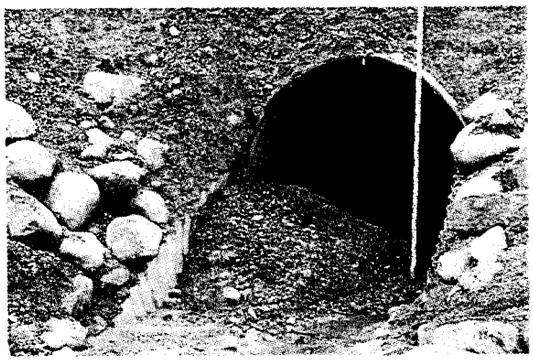
On lower class roads, culverts are the most common method of crossing a stream. They must be installed in such a manner that disruption to the stream bed and streamflow is minimized and fish passage is not obstructed.

To maintain the gradient of the steam, culverts should be installed at or below the natural level of the stream bed. The best method is to set the entire length of the culvert 15 to 30 centimetres into the stream bed. Setting the culvert in the stream bed will also help to reduce the formation of icings in the winter by promoting a continual flow of water,

•set culverts into the stream bad to maintain natural stream gradient

The original velocity and direction of streamflow should be maintained by the culvert. These conditions are controlled by culvert size, interior lining, and alignment, Guidelines on culvert design and size can be found in the publications “Design of Culverts for Fish Passage” by C. Katopodis and “fisheries Habitat Protection Guidelines” by Alberta Energy and Natural Resources.

Culverts should be of sufficient length to extend a short distance beyond the toe of the fill material to prevent blockage of the culvert ends by erosion.

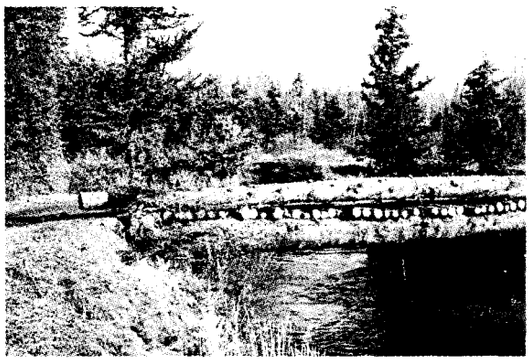


• culverts should extend beyond the toe of the fill to prevent blockage of the culvert ends by erosion

Bridges

Larger, faster-flowing streams may require the construction of a bridge in order to cross them, Portable bridges, such as native timber bridges, are the most appropriate types for lower class roads. They are the simplest to construct and cause a minimum of disturbance to the stream. These bridges offer the additional advantage of being able to be removed and re-used when a road is abandoned. Bailey bridges are also portable and suitable for lower class roads, but the metal may become brittle with the cold temperatures experienced in the North, and the bridge may have to be replaced.

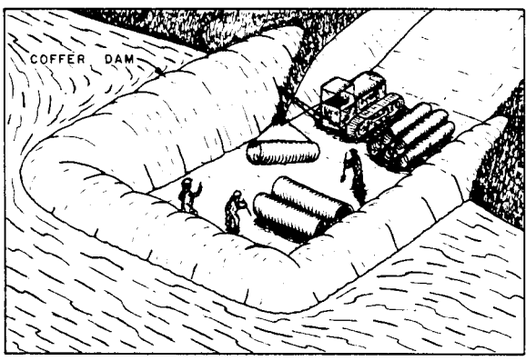
Bridges should be high enough to permit free passage of water and ice during periods of peak flow and break-up.



• native timber bridges are recommended for lower class roads
. note that the stream bank has not been disturbed

LOCATE BRIDGES AND CULVERTS ON STABLE SOILS AT NARROW SECTIONS OF STREAMS

Bridges and culverts should be located on stable soils at narrow, straight sections of streams. When work on stream crossings is in progress, flumes or coffer dams may be required to separate work areas from the stream. These structures should not block more than one-third of the stream width at any one time, and should be removed upon completion of the bridge or culvert.



• use coffer dams when working in streams

PROGRESSIVELY INSTALL CULVERTS AND BRIDGES

Culverts and bridges should be installed as construction progresses to limit the need for fording the stream and to minimize the time spent in the water by machinery.

EROSION CONTROL

Erosion control is required in some form on all classes of roads. An investment in erosion control in the early stages of a road will pay for itself with savings on maintenance and repairs.

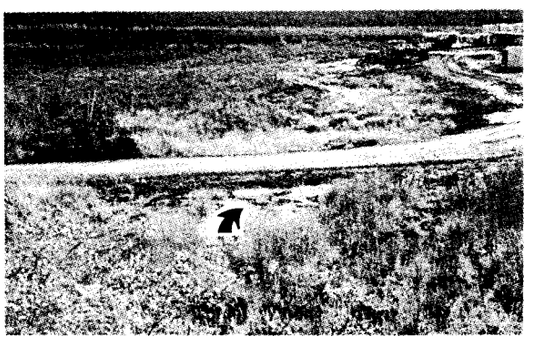
Erosion control activities should concentrate on providing adequate drainage for the road and the area it crosses, The extent of erosion and drainage problems depends on the class of road, topography of the area, vegetation present and amount of precipitation. Erosion control will be discussed in terms of general guidelines which are applicable to most roads in the North, followed by variations to these guidelines for roads in tundra environments.

•a lack of drainage control can result in your road becoming a drainage channel

General

MAINTAIN NATURAL DRAINAGE

Erosion control begins at the planning stage, at which time roads and trails should be routed so that they do not block natural drainage channels. However, in some areas, natural drainage patterns may not be noticeable until after the road has been constructed and pending occurs. In such cases, drainage structures will have to be installed after the road is operational.



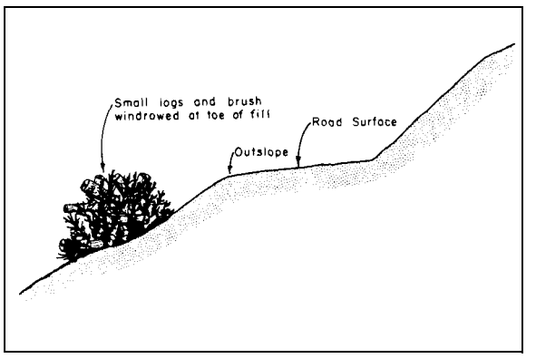
• roadside pending indicates a need for cross drainage structures

PROVIDE CROSS DRAINAGE

Roads running across the natural slope can act as dams and block drainage. This situation is most obvious in mountainous terrain, but can also occur in relatively flat areas, To prevent erosion problems caused by the blocked water, drainage across the road must be provided.

CONSTRUCT OUTSLOPING GRADES

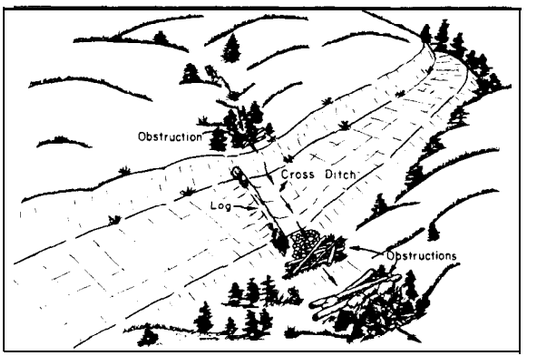
The provision of a gently outsloping road surface is the easiest way of ensuring good cross drainage. Outsloping should not be apparent to the eye, and should not be used in steep areas or where conditions are wet and slippery



- **outslope the road surface to ensure good cross drainage**

CROSS DITCH ON MOST ROADS

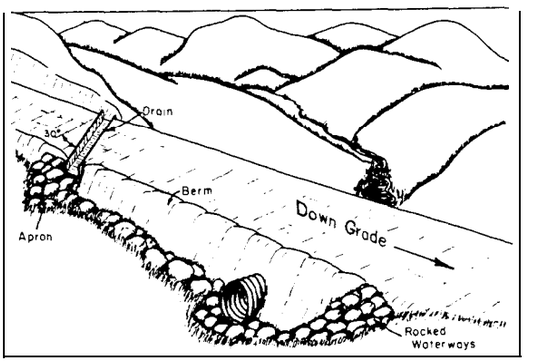
In areas where water collects on the uphill side of the road, cross ditching can be used to transport the flow to the downhill side. Cross ditches can also help collect and drain water off the road surface. A cross ditch is a shallow trench excavated by hand or cat blade across the road in the downslope direction. A log may be placed on the lower side of the ditch to protect it from vehicle traffic.



use cross ditches to carry water across the road

ISE CROSS DRAINS ON FILLS

Cross drains may be used in place of cross ditches on ome access or haul roads where fill is used and side itches are present. The cross drains are merely culerts placed in the road grade. In order to ensure water ill flow through them, culverts should be set below the evel of the side ditches and should be inclined about 2 ercent more than the road grade above. Culverts must ot be allowed to project on the downstream side as the waterfall" formed will result in erosion below the outlet. "he material in the road bed should be coarse and firm nough that water does not erode the fill around the ulvert or that the culvert does not bow from the weight of he fill. Small-diameter culverts should be avoided beause they clog easily and soon become useless.

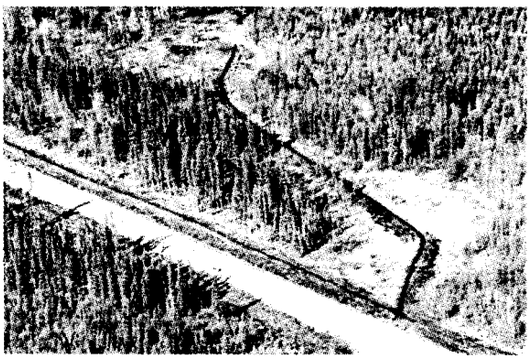


cross drains can be used to protect fills from erosion

• **ensure that culverts do not hang on the downstream side**

USE PARALLEL DITCHES ON ROADS WITH STEEP GRADES

Roads on steep cross slopes and those running upslope may require parallel ditches as well as cross ditches to keep the road surface free of water. Parallel ditches should be constructed at the same grade as the road and should be composed of coarse-grained material. On cross-slopes, ditches should be on the upslope side in order to catch the flow before it reaches the road.



• **use parallel and interceptor offshoot ditches to maintain proper drainage**

USE INTERCEPTOR OFFSHOOT DITCHES

Parallel ditches and cross ditches should not empty directly into streams, but should flow into vegetated areas located upslope of streams where any sediment is trapped prior to the water entering the stream. Interceptor offshoot ditches are used for this purpose. The location of interceptor offshoot ditches may have to be approved by the Land Use Office and their approval may be a condition of your Land Use Permit.

• **remember to follow proper clearing procedures when constructing interceptor offshoot ditches**
• **note leaners and poor disposal practice**

USE DITCH BLOCKS

Water flowing through parallel and interceptor offshoot ditches may reach velocities high enough to erode the ditches. Ditch blocks can help control water speeds and trap sediments. Ditch blocks can be constructed of logs, cleared vegetation, or rocks and coarse-grained materials. If materials are not available on site, sandbags can be used. The spacing of ditch blocks should bedefinedbythedesign engineerand will depend on the gradient and length of the ditch, and on the soil texture and amount of runoff within the ditch.

•use ditch blocks to control water velocities and prevent ditch erosion

• vegetated ditches help control erosion

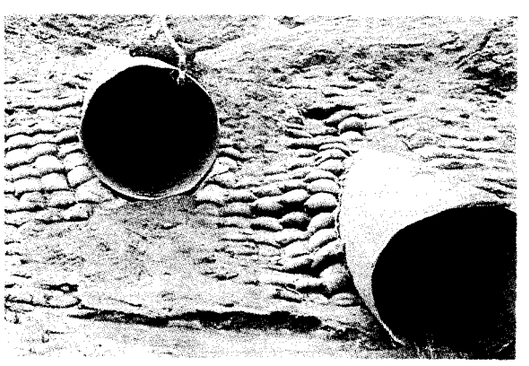
USE BERMS WHERE THE ROAD CROSSES LARGE FILLS

Berms may be required along the road shoulder to prevent runoff from eroding large fills. A berm acts as a dam, and should be periodically interrupted by cross drains to allow water to flow off the road,

. berms on both sides of the road can trap water and result in erosion of the road surface

PROTECT CULVERT ENDS AND BRIDGE ABUTMENTS

Scour around culverts and bridge abutments can be minimized by using riprap to hold the soil in place. Riprap may take the form of large rocks or sandbags placed at the culvert ends or around bridge abutments,



•sand bags prevent erosion around culvert ends

USE BRUSH FOR EROS/ON CONTROL ON SLOPES

In areas where vegetation has been cleared off the right-of-way, or where vegetation cover is sparse, slope erosion can be controlled by spreading brush, produced by clearing, on the slope.

INSTALL DRAINAGE AND EROSION CONTROL DEVICES AS CONSTRUCTION PROGRESSES

To minimize the time surfaces are exposed to erosion, drainage and erosion control procedures should be applied as construction progresses.

Erosion Control in Tundra Environments

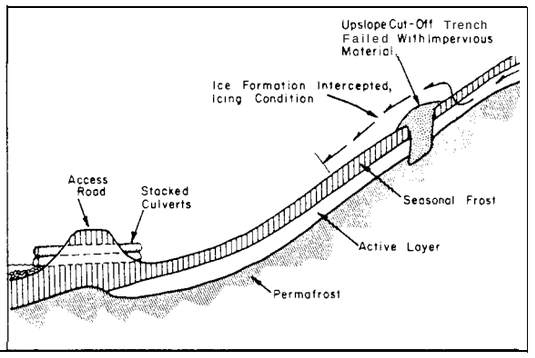
AVOID RUTTING

Multi-season access roads and trails in the arctic tundra are uncommon, but those that do exist have special erosion control problems. These roads are in the continuous permafrost zone, where erosion takes the form of permafrost thawing and sediments flowing. Permafrost thawing can be initiated by vehicles traveling when the active layer is unfrozen, causing the formation of ruts on the surface. These ruts act as drainage channels and promote the thawing of the underlying permafrost.

• traveling when the active layer is unfrozen can cause rutting

BE AWARE OF ACTIVE LAYER SEEPAGE

Drainage patterns in the tundra maybe difficult to determine because of the flatness of the terrain and low precipitation rates. In summer, thawing of the active layer often produces water that cannot penetrate the still-frozen permafrost. This water flows onto road surfaces where it can cause erosion problems. The road builder must be alert to the possibility of drainage from active layer seepage and be prepared to add drainage structures at a later date. In winter, active layer seepage can cause icings on the road. An upslope cut-off trench filled with impervious material can be used to intercept these icings and maintain a clear road.



•upslope cut-off trenches and stacked culverts can be used to control icing problems

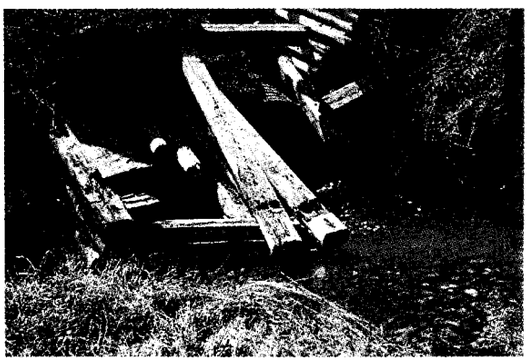
USE CULVERTS FOR DRAINAGE

Water flowing in permafrost areas thaws the frozen ground and rapidly erodes it. Cross-ditching should not be used in these areas. Water should be carried under the road in culverts, Consideration should be given to stacking culverts to maintain cross drainage in the event of the lower culvert freezing-up.

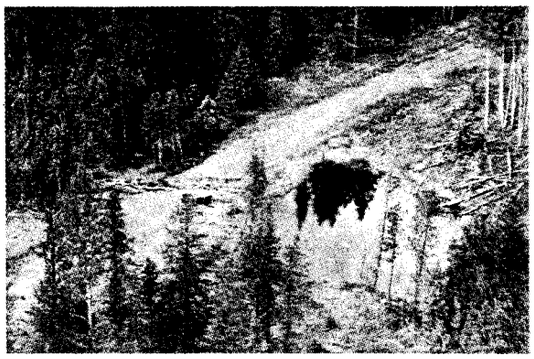
Proper route planning can avoid some of the erosion problems associated with tundra environments. This includes routing alignments upslope of snowbanks and avoiding wet sedge meadows and patterned ground.

MAINTENANCE

Maintenance of a multi-season road will vary with the class of road and season(s) of use. Trails will normally require little maintenance, although if they are used for more than one season, they may require grading or snow removal. Access roads and haul roads will require more extensive maintenance than trails.



•keep ditches and culverts free of debris

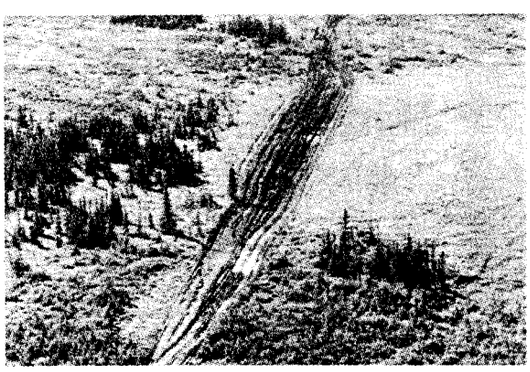


• if drainage is not maintained, road washouts can occur

• vegetation along the right-of-way can act as a means of erosion control

General maintenance activities should include the following:

- inspect drainage and erosion control structures regularly and repair when necessary;
- keep ditches and culverts clean and free of debris;
- clean sediment traps when necessary;
- ensure the road surface is free of ruts; grade if necessary to maintain good drainage;
- if the road surface becomes soft and rutting occurs, suspend traffic;
- minimize shading of roads to improve drying of the entire surface;
- carry out vegetation control along the right-of-way from the road surface; do not totally remove vegetation because it serves as erosion control; and
- keep traffic to a minimum during wet periods.



• if the road surface becomes soft and rutting occurs, suspend travel

If the road is used during the winter months and snow clearing is necessary, the following should be considered:

- do not damage drainage and erosion control structures (berms and culverts) when clearing snow;
- do not create continuous snow banks along the road. Make breaks at intervals to allow wildlife access to and from the road;
- remove snow berms prior to break-up to permit lateral drainage from the road and prevent the concentration of water on the surface; and
- check culverts and ditches for the occurrence of icings. If they are noted, keep small channels thawed to remove water and prevent it from freezing on the road surface.

• excessive snow ploughing has created snow banks along the road; these can disrupt natural drainage

PUTTING THE ROAD TO BED

When an access or haul road is no longer required, it should be restored in accordance with an approved abandonment plan. Abandonment plans are not usually required for trails; however, restoration requirements may be specified in the Land Use Permit.

REMOVE GARBAGE AND ABANDONED EQUIPMENT

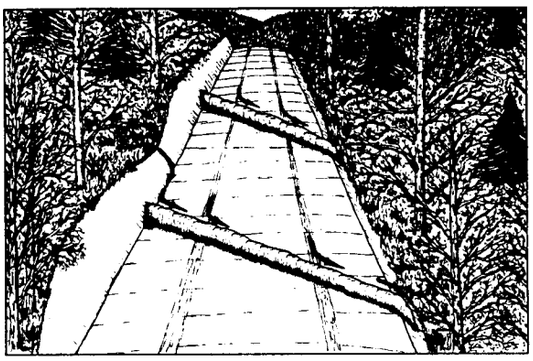
REMOVE CULVERTS

ENSURE THAT EROSION CONTROL DEVICES ARE IN PLACE

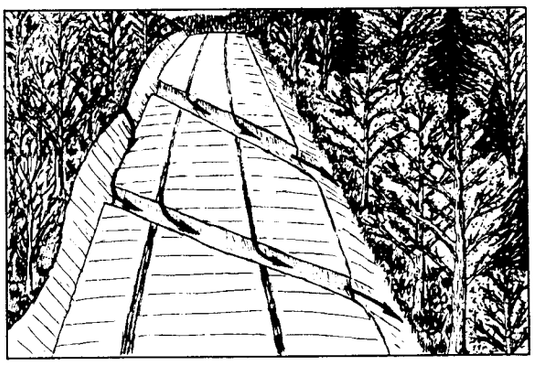
Culverts should be carefully removed from all streams and drainage channnels, and old stream channels should be re-established. Where culverts are removed from drainage channels, cross-ditches should be constructed to maintain adequate drainage along the route.

• provide adequate cross drainage on abandoned roads to minimize erosion and sedimentation

Erosion control devices (including revegetation) and slope stabilization procedures must all be in place prior to abandonment.



• erosion control devices, such as earth breakers on steep slopes, should be in place before abandonment

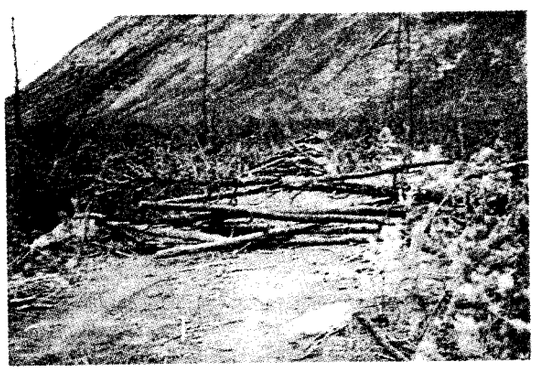


• cross ditching can also be used as an erosion control device on abandoned roads

The objectives of revegetation include both the control of erosion and subsidence while natural recovery is taking place, and the consideration of aesthetics. Disturbed land, especially unstable soils on slopes and stream-banks, and those areas visible to the public, should be revegetated. The percentage of vegetative ground cover required, and the time frame within which revegetation is to be carried out, may be specified by the Land Use Inspector.

•revegetation of the right-of-way should be carried out prior to abandonment

Public use of abandoned roads may lead to disruption of erosion control features and result in further erosion. Where it is desirable to prevent public use of abandoned roads, barriers may have to be constructed at intersections with public access. A more effective way of preventing use of an abandoned road is to spread slash and debris on the right-of-way.



•logs may be used as a barrier to close an abandoned road

Chapter 8
Winter Access

Roads and trails that are used only in the winter are common in the North. The sensitivity of much of the terrain restricts travel to when the ground is frozen and is protected by a layer of snow, Winter also offers the opportunity to utilize the frozen surfaces of numerous lakes and rivers for travel, thus avoiding the potential disturbance to the terrain that would be caused by a road on land.

In this chapter, construction, maintenance, and abandonment procedures peculiar to winter access will be discussed under the following headings:

- surface preparation;
- stream crossings;
- erosion control;
- maintenance;
- when to shut down; and
- putting the road to bed.

For a detailed discussion on winter roads, the INAC Arctic Land Use Research publication "Building and Operating Winter Roads in Canada and Alaska" by K.M. Adam should be consulted.

The roads discussed in this chapter are differentiated on their type of use and, more significantly, on how the frozen ground, snow, and ice is handled during construction and operation.

SURFACE PREPARATION

Surface preparation for winter access differs from that of multi-season access discussed in Chapter 7 in that the surface has to be "re-prepared" each year if the road is used for more than one winter.

The key factor in surface preparation for winter access is that the ground must be frozen before travel is allowed. If the surface is adequately frozen, rutting, channelling of runoff, and thawing of permafrost should not be problems.

The amount of surface preparation required for winter access depends on the class of road being constructed which, in turn, partially depends on the type of vehicle using the road. All-terrain vehicles and tracked vehicles can travel on winter trails, winter access roads, and compacted snow roads. Conventional-wheeled vehicles, on the other hand, will normally travel only on compacted snow roads.

Surface preparation may not be required for all trails in winter; however, overland travel should not be attempted until there is sufficient snow cover to protect grasses and shrubs from the tires or tracks of vehicles. Some winter trails may require blading over certain stretches of the route to smooth the surface.

Surface preparation of winter access roads is similar to that of winter trails, except that depressions on the road are filled with snow using blades or drags.

When roads and trails cross frozen lakes and rivers, surface preparation consists of clearing snow from the ice.

depressions on winter access roads can be filled by using drags

DO NOT CUT HUMMOCKS IN PERMAFROST AREAS

Whenever grading and packing of snow is required, there is a potential for breaking hummocks and disturbing permafrost soils. Care should be taken to ensure that the blades of bulldozers are high enough to prevent disturbance to the organic layer. Blade shoes may serve the purpose here on relatively flat terrain, but the difficulties in Preserving the organic layer in hummockyterrain remain.

• **grading on this winter access road has removed the snow and disturbed the organic mat**

DO NOT MIX SOIL WITH THE SNOW ON ROAD SURFACES

A second reason for not disturbing the organic layer is related to bringing soil to the surface. This can cause problems in permafrost areas because the dark-coloured soil on the snow road will absorb heat and speed the thawing of the underlying frozen surface, reducing the time the road can be used in the spring. Since the soil is often spread along the road by vehicles tires, thawing can become an even larger maintenance problem. Soils should not be mixed with snow for fills in permafrost areas.

• **the dark soil on the surface of this winter access road will encourage early melting**

In mountainous regions, surface preparation for winter access roads and trails may include cuts and fills at some locations along the alignment. If this is the case, the discussion on cuts and fills in Chapter 7, particularly with respect to erosion control procedures, would apply.

Sensitive permafrost terrain may be protected by placing slash from clearing on the alignment, and constructing the snow road on top. However, problems with the movement of conventional-wheeled vehicles may result from this practice if snow depths are insufficient to support the weight of the vehicles and protect tires from the underlying slash.

STREAM CROSSINGS

Winter roads typically cross streams on ice bridges and snow fills. Both structures offer the potential for environmental disturbance, primarily through blocking streamflow and introducing debris into the stream.

Stream crossings should be located on gently sloping banks. The lower grade will minimize bank erosion resulting from disturbance by traffic, and enable vehicles to negotiate exits from the crossings more easily. Steep grades on the accesses and exits of ice bridges and snow fills can result in machinery losing power when trying to make the grades.

• **stream and lake crossings on winter roads should have gentle approaches**
• **note clean snow fill with no debris or timber**

CONSTRUCT ICE BRIDGES TO MAINTAIN STREAM FLOWS AND INCREASE CARRYING CAPACITIES ACROSS STREAMS

The construction of an ice bridge involves clearing the ice or snow to allow deeper freezing and, if necessary, flooding the surface. If flooding is carried out, the ice should be built up in shallow lifts as these will freeze harder than deeper ones.

DO NOT USE SOIL OR DEBRIS IN SNOW FILLS OR ICE BRIDGES

The terms of a Land Use Permit in Northwest Territories and Yukon prohibit the use of soil or debris in snow fills or ice bridges. Logs are also normally prohibited, although cleaned, limbed logs may be allowed under certain circumstances. Approval from the Land Use Inspector must be obtained prior to using logs and, if permission is granted, the logs must be removed prior to break-up. If soil and debris, from bank cuts approved in the Land Use Permit, are deposited on the ice, they must be pushed back onto stable portions of the bank prior to break-up,

Ice bridges must not obstruct the flow of water in streams. Full-depth freezing of a normally open stream will have a negative effect on overwintering fish and aquatic mammals. From a physical viewpoint, an ice bridge frozen to the bottom of a normally free-flowing stream, will cause icings upstream. These icings not only pose a traffic hazard as they spread beyond the stream banks, but the forces exerted by the ice can damage or destroy trees and bushes along the stream and create erosion hazards.

REMOVE SNOW FILLS AND ICE BRIDGES BEFORE BREAK-UP

Snow fills and ice bridges must be removed prior to break-up to allow free passage of water. Removal of these structures should occur progressively as the contractor finishes in one area and moves on.

Approval may be given for only partially removing snow fills and ice bridges. In same cases, a V-shaped notch at the middle of the stream to allow flow will result in the removal of the rest of the fill or bridge by the spring freshet.

• snow fills and ice bridges must be removed prior to break-up

• soil should not have been used in this snow fill

EROSION CONTROL

Erosion control on winter roads and trails is not normally required unless cuts and fills are needed, as in mountainous terrain. In this case, erosion control structures, as discussed in Chapter 7, may be necessary.

MAINTENANCE

Maintenance of winter roads is minimal, the objective being to keep the surface smooth and covered with snow. Grading and dragging are used for this purpose. Wooden drags, because they cause less surface scuffing, are preferable to metal ones.

As much snow as possible should be retained on the road to protect underlying soils and vegetaion, and the road surface should be kept white to reduce melting. Bare spots should be covered with snow. If grading is necessary, snow windrows along the road should have breaks to allow animals to cross the road, and to allow proper drainage in spring.

. retain as much snow as possible on the road

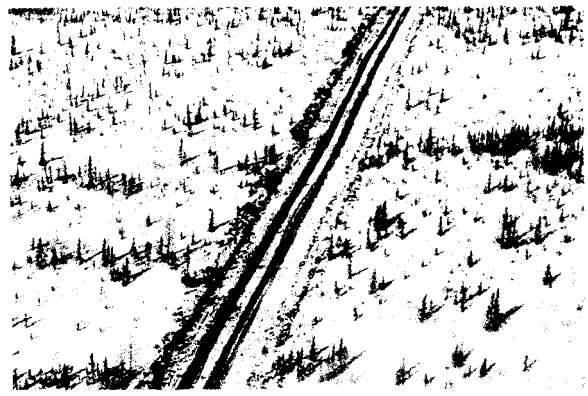
Where winter access crosses ice, maintenance consists of maintaining a snow-free surface, monitoring ice thickness, and checking the ice for cracks and the presence of pressure ridges. These latter features are upheavals in the ice sheet caused by changes in wind and temperature on large waterbodies. When cracks are noted, vehicle loads should be reduced or travel suspended.

•reduce or suspend travel when ice conditions deteriorate

WHEN TO SHUT DOWN

Winter roads should be closed when the surface is no longer frozen enough to support the weight of vehicles without rutting. Land Use Permits designate break-up as the time for closure, and assign a date to it. Since the specific date for any given year is dependent upon terrain conditions along the road, closure may be moved forward in an especially warm year or back in an unusually cold one.

indications that closure is imminent first appear on south-facing slopes and along road sections with dark surfaces. Stream approaches also begin to melt early as a result of wear and tear of vehicle movement. In the latter stages of the winter, snow conditions may not be suitable for travel during the day, although colder temperatures at night may allow limited travel and extend the final closure date.



• winter roads must be shut down before rutting occurs
•spring travel on this road has led to rutting

PUTTING THE ROAD TO BED

Winter roads that are no longer necessary should be abandoned in a manner similar to that discussed for multi-season roads in Chapter 7. The abandonment of winter roads, however, is usually easier because of the narrower clearing width and the smaller number of drainage and erosion control structures.

Chapter 9
Support Facilities For The Road

Some of the roads discussed in this manual will require support facilities in the form of borrow pits, construction camps, and fuel storage sites. Trails and winter trails will normally have little or no need for either borrow or camps, and only a minor need for fuel storage. Access roads, haul roads, winter access roads, and compacted snow roads may require all three support facilities. In this chapter, land use guidelines for these support facilities will be outlined.

BORROW PITS

OBTAIN A QUARRY PERMIT

The extraction of borrow for road base, fill, and rip rap during road construction will require a permit from the Land Use Office, and adherence to certain terms and conditions. Casual borrow pits are not allowed. Procedures for developing pits are addressed in the publication "Environmental Guidelines Pits and Quarries" available from your local INAC office. A few salient features of those guidelines will be included here, but you are encouraged to read the above-mentioned publication for a more thorough discussion on borrow extraction.

• obtain a permit before opening a borrow pit

PLAN YOUR BORROW PIT

As with road construction, planning is the most important step in borrow extraction. The quality and quantity of the borrow needed should be determined during the planning stages of the road.

- sand and gravel, quarried rock and clay till free of organics and ground ice will be required as general fill;
- well-graded, cobbles and boulders, resistant to chemical and mechanical weathering, will be required for rip rap; and

  well-graded, angular sandy gravel will be required for road base and sub-base construction and road surfacing.

Existing pits should be used where possible. If none are available, locations for new pits should be identified on maps and airphotos and examined in the field.

AVOID WATERBODIES, SENSITIVE TERRAIN AND CRITICAL WILDLIFE AREAS

In most cases, material cannot be removed from below the ordinary high water mark of any stream or lake. This restriction is intended to prevent sedimentation of spawning areas and interruption of fish migration. At the discretion of the Land Use Inspector, this restriction can be removed at some locations in early spring, late fall, or during winter,

Seasonal and terrain restrictions similar to those for road construction and operation may also apply to borrow pits. Soft, wet ground, sensitive slopes, and critical wildlife periods or habitat may affect the extraction of borrow.

ENSURE TOTAL DISPOSAL OF BRUSH

The pit boundary must be staked. In preparation for extraction, the site must be cleared of vegetation. Total disposal of brush is the normal practice.

ENSURE PROPER DRAINAGE AND EROSION CONTROL AND ABANDONMENT

Topsoil and overburden should be removed and stored separately for later use in pit reclamation.

Techniques for drainage and erosion control of pits are similar to those for multi-season roads as outlined in Chapter 7.

Pits must be restored when they are no longer needed, the type of restoration depending on the future use of the site. Regardless of the end use of the pit, the site must be cleaned-up prior to abandonment.

CAMPS

If they are needed at all, work camps for the construction of lower class roads will be small and portable.

DISPOSE OF ALL GARBAGE

The proper disposal of garbage, aside from health and aesthetic reasons, eliminates the potential for wildlife problems created by the attraction of wildlife to garbage. This situation that can be harmful to both humans and the animals themselves.

Garbage and debris must be disposed of by burning and burial, or removal to an approved disposal site.

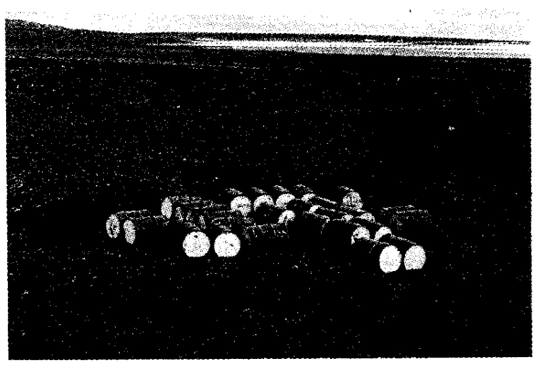
• ensure proper garbage disposal

FUEL STORAGE

Storage requirements for fuel used during construction of lower class roads will normally be small, and would probably consist of several 205-litre drums. Following the few simple procedures outlined below will ensure that environmental problems associated with fuel storage are minimal.

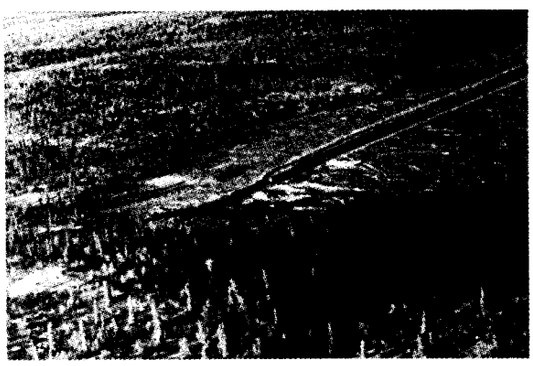
STORE FUEL AWAY FROM WATERBODIES

Fuel should be stored on flat, stable terrain well away from waterbodies. Slopes leading to waterbodies must not be used as storage sites. Regulations require that drums be at least 12 metres from the ordinary high water mark of any lake or stream. Fuel containment areas should be clearly marked to prevent damage to the drums by passing machinery.



.natural depressions, away from waterbodies, are ideal for storing fuel

Normally, mobile fuel facilities may not be parked on the ice cover of waterbodies; however, provisions can be made for storage for up to 12 hours, This number is arbitrarily chosen, but the intent is to minimize the Potential for fuel leaking into lakes. Stationary fuel facilities must not be located on ice cover under any circumstances.



- **fuel must not be stored on the frozen surface of waterbodies**

REPORT FUEL STORAGE LOCATIONS TO THE LAND USE INSPECTOR

The locations and contents of all fuel caches must be reported to the Land Use Inspector so that the sites can be included in the inspection program.

KEEP FUEL CONTAINERS SEALED

With the exception of a container in use, all fuel container outlets must be kept sealed to prevent fuel leaking. Fuel containers should be inspected regularly for leaks which, when noticed, should be repaired immediately.

DISPOSE OF WASTE PETROLEUM PRODUCTS

Waste petroleum products should be burned completely or stored at specific sites for later use in road maintenance such as dust control. The preferred method of disposal will be noted on the Land Use Permit. In any case, all containers must be removed by the expiry date of the permit.

Chapter 10
Contingency Planning

Regardless of the care taken in planning, constructing, and operating a road, the potential remains for unforeseen environmental problems, for which the contractor or operator is liable. Potentially, the most serious of these are fuel spills and fires. The effect these problems will have on the environment depends on how well prepared the contractor or operator is to solve them, In this chapter, some guidelines for addressing fuel spills and fires will be presented.

CONTAIN FUEL SPILLS IMMEDIATELY

Fuel spills may originate from fuel storage barrels or from tanker trucks using a road. The key in dealing with fuel spills is to ensure they are isolated and not allowed to spread to adjoining land or into streams or lakes. This may be accomplished by containing the spill and pumping it into empty barrels or, if conditions are favorable, burning the fuel.

•contain fuel spills immediately
•report spills to your Lend Use Officer

Spill clean-up in open waterbodies may be achieved with absorbant material. On land, earthen dikes can be used to hold the fuel until removal is possible. The dikes should be lined with plastic to prevent seepage. This principle also works for winter access trails and roads where snow dikes can be constructed. In permafrost areas dikes should be constructed of snow only, as the pushing of soil into a berm can cause more long term damage than a small amount of fuel.

All vehicles transporting fuel or toxic liquids should be equipped with a shovel and a large piece of PVC plastic for dike construction and lining. The plastic can be rolled into a small package and attached to the outside of the vehicle. A recommended size of plastic is 25 square metres.

REPORT FUEL SPILL LOCATIONS

The location of all fuel spills must be marked and reported to the Land Use Office.

When a significant amount of fuel is to be hauled, the submission of a written fuel spill contingency plan may be a condition attached to your Land Use Permit.

REPORT ALL FIRES

In the event of an uncontrolled fire, all personnel and equipment should be immediately deployed to fight the fire and the local Resource Management Officer must be notified.

•report fires immediately and deploy fire fighting equipment and personnel

Consideration should be given to having an emergency fire tool-box available during construction activities. Its contents should be discussed with the Resource Management Officer, but may include water pails, long handled shovels, pulaskis, axes and chainsaws, hoses and portable pumps.

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Appendix A
List of INAC Offices

NORTHWEST TERRITORIES

Regional Manager, Land Resources
INAC
P.O. Box 1500
Yellowknife, N.W.T.
XIA 2R3

District Superintendent
INAC
P.O.Box 2550
Yellowknife, N.W.T.
XIA 2P8

District Manager
INAC
P.O.Box 658
Fort Smith, N.W.T.
XOE OPO

District Manager
INAC
P.O. Box2100
Inuvik, N.W.T.
XOE OTO

District Manager
INAC
P.O. Box 150
Fort Simpson, N.W.T.
XOE ONO

District Manager
INAC
Rankin Inlet, N.W.T.
XOC OGO

Assistant District Manager
INAC
Baker Lake, N.W.T.
XOC OAO

District Manager
INAC
Frobisher Bay, N.W.T.
XOA OHO

Resource Management Officer
INAC
P.O. BOX 1420
Hay River, N.W.T.
XOE ORO

Resource Management Officer
INAC
PO. Box 126
Norman Wells, N.W.T.
XOE OVO

Resource Management Officer
INAC
Fort Liard, N.W.T.
XOG OAO

YUKON TERRITORY

Regional Manager, Land Resources
Attention: Land Use Section
INAC
200, Range Road
Whitehorse, Yukon
YIA 3V1

Resource Management Officer
INAC
Watson Lake, Yukon
YOA 1 CO

Resource Management Officer
INAC
Teslin, Yukon
YOA 1 BO

Resource Management Officer
INAC
200 Range Road
Whitehorse, Yukon
Y1A 3V1

Resource Management Officer
INAC
Haines Junction, Yukon
YOB 1 LO

Resource Management Officer
INAC
Beaver Creek, Yukon
YOB 1 AO

Resource Management Officer
INAC
Carmacks, Yukon
YOB 1 CO

Resource Management Officer
INAC
Ross River, Yukon
YOB 1 SO

Resource Management Officer
INAC
Mayo, Yukon
YOB 1 MO

Resource Management Officer
INAC
Dawson City, Yukon
YOB 1 GO

Appendix B
Land Use Checklist for Access Roads and Trails

This checklist presents, as questions, many of the points discussed in the handbook. It can be used as a quick reference to assess compliance with Land Use conditions and as a check for sound environmental planning during all phases of a road's life. Its structure is similar to that of the handbook and covers planning, clearing, multi-season access, winter access, and support facilities. The number after the question refers to the page in the handbook where more information on the topic is available. If the answer to any question is "no", the reader should give some thought to why that answer is "no".

PLANNING

. **what** type of road is required? (p. 2)

_____

. can access be obtained along an existing right-of-way? if yes, describe. (p. 10) Yes____ No _

_____

_____

. can access be obtained without road construction? (p. 10) Yes _ No _

. have you discussed the road with someone at your local Land Use Office? (p. 45) Yes _ No____

name of contact: _____

. have topographic, geologic, and land use information maps of the proposed route been examined? (p. 13) Yes _ No____

. have aerial photographs of the proposed route been examined? (p. 13) Yes _ No____

. does the proposed route avoid poorly drained areas and sand hills? (p. 13) Yes _ No____

. for multi-season roads, does the proposed route avoid north-facing slopes in the discontinuous permafrost zone? (p. 13) Yes — No____

. does the route run upslope of snowbanks and avoid patterned ground? (p. 14) Yes _ No____

• are streams crossed at right-angles and along straight stretches of streams? (p. 14) Yes _ No____

. are stream crossings located downstream of spawning beds? (p. 14) Yes _ No____

. have game sanctuaries and archaeological sites been avoided in planning? (p. 15 and 16) Yes _ No____

. has important wildlife habitat been identified and avoided? (p. 15) Yes_ No_____

. have approaches to public roads and streams been doglegged? (p. 16) Yes — No____

. has approval from the Territorial Government Highways Department been obtained for approaches to public roads? (p. 16) Yes — No____

. has the entire route been planned? (p. 12) Yes _ No____

. has the potential route been checked by a fly-over or on the ground? (p. 13) Yes _ No____

- has a Land Use Permit been applied for? (p. 6) Yes_ No____
- have you allowed sufficient lead time for a review of your application? (P. 6) Yes_ No____
- are Water Authorizations required? (P. 6) Yes_ No_
- are Quarry Permits required? (p. 6) Yes_ No_
- are Timber Permits required? (P. 6) Yes_ No_
- are Burning Permits required? (P. 6) Yes_ No_
- who is your Land Use Inspector? Yes_ No_
  name: _____ telephone: _____
- has construction scheduling considered terrain conditions and critical wildlife periods? (p. 17) Yes— No_
- has the route been flagged? (p. 17) Yes_____ No___

CLEARING

- have buffers of uncleared land been left between your road and public highways and waterbodies? (P. 20) Yes_ No_
- have blade shoes been considered for use on bulldozers in areas of permafrost? (P. **20)** Yes_ No_
- have trees been felled onto the right-of-way and away from watercourses? (P. 21) Yes— No_..._
- have leaners been removed? (p. 22) Yes— No____
- are sensitive slopes and water crossings being hand cleared? (P. 22) Yes— No_.._.._
- have breaks been left in windrows? (p. 23) Yes— No_
- have burn piles been located in the centre of the right-of-way? (P. 24) Yes_ No____
- has brush disposal been carried out progressively with clearing? (P. 24) Yes— No_
- is fire-fighting equipment available to the road and construction crew? (p. 43) Yes_ No____

MULTI-SEASON ACCESS

- have cuts in ice-rich permafrost and loose materials been avoided? (P. 25) Yes— No____
- have cuts and fills on slopes been stabilized? (P. 25) Yes____ No_
- has in-stream activity been minimized or eliminated? (P. 26) Yes— No_
- has the deposition of debris, soil, and organic material in streams been prevented? (P. 26) Yes_ No._.._
- have the proper conditions been met for fording streams? (P. 26) Yes_ No____
- have culverts been set into the stream bed? (P. 27) Yes— No____

. have culverts the proper diameter, length, and lining to maintain natural stream velocities and prevent blockage? (p. 27) Yes — No _

. are bridges high enough to allow free passage of water and ice during periods of peak flow and break-up? (p. 27) Yes _ No____

. have flumes or coffer dams been considered for in-stream work? (P. 28) Yes_ No____

. has cross drainage been provided for the road? (P. 29) Yes_ No___

. do cross ditches direct runoff into well-vegetated areas? (P. 30) Yes _ No _

. have ditch blocks been used to control water velocities in ditches? (P. 31) Yes _ No____

. have culvert ends and bridge abutments been protected by rip rap? (P. 31) Yes _ No____

. in tundra environments, is the road being monitored for active layer seepage and appropriate measures being taken if seepage occurs? (p. 32) Yes — No _

. is the road being checked regularly to ensure drainage and erosion control structures are operating and the road surface is in satisfactory condition? (P. 33) Yes — No _

. have garbage, equipment, and culverts been removed as part of the abandonment plan? (p. 34) Yes — No _

. have erosion control structures been put in place prior to abandonment? (p. 34) Yes — No____

. have barriers to public access been erected where necessary? (P. 35) Yes— No._._

WINTER ACCESS

. is the surface adequately frozen before travel commences? (p. 36) Yes _ No____

. has care been taken to ensure that soil is not mixed with the snow on roads and snow fills and in ice bridges? (p. 37 and 38) Yes——_ No_

. has permission to use logs in ice bridges been obtained from your Land Use Inspector? (p. 38) Yes— No____

. have snow fills and ice bridges been removed prior to break-up? (P. 38) Yes— No____

. is the road monitored regularly and snow and ice conditions noted? (p. 38) Yes— No _____

. is the road being closed before rutting occurs? (p. 39) Yes_ No___

SUPPORT FACILITES

. have borrow sources been planned and staked? (p. 40) Yes _ No____

. are sewage and garbage disposed of as directed in your Land Use Permit? (p. 41) Yes _ No____

. is fuel stored on flat, stable terrain away from waterbodies? (p. 41) Yes _ No____

. have fuel storage sites been reported to the Land Use Inspector? (P. 42) Yes— No___

. has fuel storage on ice been avoided? (p. 41) Yes— No—._

. are fuel containers kept sealed and inspected regularly for leaks? (P. 42) Yes _ No _

. are vehicles transporting fuel or toxic liquids, equipped with a shovel and piece of PVC plastic to contain fuel spills? (p. 43) Yes _ No____

. have waste petroleum products been disposed of as directed in your Land Use Permit? (p. 42) Yes— No____