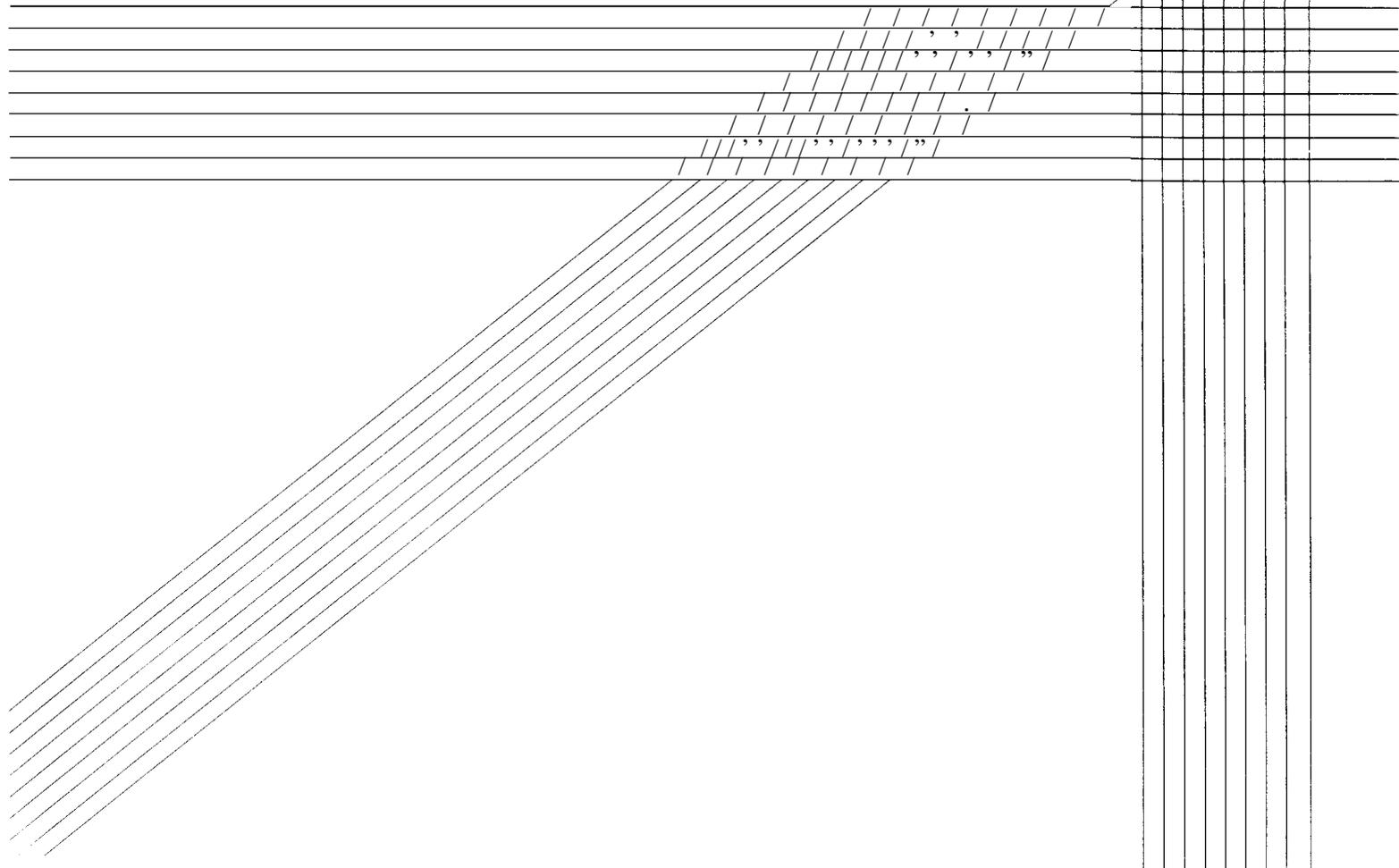


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NORTHWEST TERRITORIES
TRANSPORTATION STRATEGY

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Northwest
Territories Transportation
1990

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Part I -
OVERVIEW

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The per capita costs of delivering government programs in housing, health, education, social services and recreation are the highest in the country. Every government program includes high direct and indirect transportation components.

The high cost and relative lack of access to transportation in the North also has important social impacts. There is a sense of isolation. There is restricted access to goods and services. There are fewer employment opportunities. The effectiveness of public programs in education, health care, social services and employment is reduced. As a result, the standard of living and opportunity for many Northerners is low. Furthermore, there are marked inequalities within the North. The more remote communities combine the highest costs, lowest per capita incomes and lowest levels of service.

The settlement of aboriginal claims will turn huge land areas over to native groups. Improvements in access to these lands will enhance their value and accessibility for both traditional and market-based management.

The interdependence of transportation and political development should not be underestimated. It is often natural or man-made transportation systems which shape the evolution of political, administrative and economic regions. Transportation policy decisions can have major impacts on the development of a nation or region. For example, the building of a national railway was a major factor in Canadian Confederation.

Without good transportation systems, a viable, self-supporting northern economy will never develop. Without a strong economic base, self-determination and a fully responsible government seem unlikely. The Northwest Territories has enormous potential. Northerners and Canadians want to see that potential harnessed in a rational and responsible manner.

One cannot suggest that transportation improvements will solve all our problems. However, transportation will play a major role in the future economic, social and political development of the Northwest Territories. Modern transportation development in the North has been driven by successive economic, social, and political imperatives. It has also stagnated in their absence.

What is needed now is a long-term strategy and resulting action to develop a transportation system for the twenty-first century. This must be done in a rational and balanced manner which will respond to the long-term needs and aspirations of the citizens of the North and Canada.

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Most of the transportation infrastructure in the North was built between the 1940's and 1970's in response to successive military/strategic, social and economic imperatives. Over the last 10 years, very little progress has been made. Without a significant shift in northern transportation policy, the future is even less promising.

National transportation systems emerged from the post-war boom in a relatively mature state. The focus has shifted to rationalization of services, capacity improvements on high density routes and rehabilitation of existing facilities. This shift has come decades too soon for the North.

For example:

- The federal Arctic Air Facilities Policy expired in 1983. Its objectives have not been fully achieved.
- The federal Northern Roads Policy expired in 1984. Many of the highways proposed in the 1960's have not been built and are no longer in the plans.
- Federal expenditure restraints are cutting both federal and territorial transportation infrastructure and subsidy programs.
- Despite the fact that federal Indian and Northern Affairs, Transport (Air), Transport (Coast Guard), National Defence and Fisheries and Oceans all have northern transportation mandates, there has never been a comprehensive federal northern transportation strategy or plan.

The ongoing devolution of infrastructure maintenance and rehabilitation programs to the G. N.W.T. and the creation of the territorial Department of Transportation will result in a more rational, comprehensive and integrated approach to delivery of these programs. However, these transfers and the funding provided are not adequate to address the upgrading and system expansion which will be required.

A new partnership and commitment of considerable resources by both the territorial and federal governments will be required in the coming decades.

4. FOUR STRATEGIC OBJECTIVES

The goal of the Northwest Territories Transportation Strategy bears repeating:

To ensure the safe, accessible and reliable movement of people and goods to meet the economic, social and political needs and aspirations of the people of the Northwest Territories and Canada.

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2. FEDERAL GOVERNMENT'S ROLE -

The federal government's role is to ensure the safe, accessible and reliable movement of people and goods to meet the economic, social and political needs and aspirations of the people of the Northwest Territories and Canada.

Even if we discount the Arctic Islands, the Northwest Territories mainland covers about 2 million square kilometres. As a measure of remoteness, less than 340,000 square kilometres is within 100 kilometres of a highway.

Mineral and oil and gas exploration and development, renewable resource development and tourism all depend on transportation availability. The economics of these sectors are all adversely affected by 'remoteness'. All-weather highways providing low cost surface transport can make 'absolute' natural resources 'economic'. They can also greatly enhance the tourism potential of a region.

The economics of developing a rich mining property may allow for some construction of access roads. Depending on terrain, 100 kilometres of access road would cost 10 to 50 million dollars. It would appear unlikely that investment by a mining company in hundreds of kilometres of access road would be justified. Without roads, mine developers will have to rely on seasonal winter roads or seasonal marine access combined with a high degree of air support.

Other surface transportation alternatives (winter roads, marine routes and railways) do not provide a full measure of access or flexibility suitable for inter-community travel, goods transportation, resource development or tourism.

Five potential new roadway projects have been identified:

1. Extension of the Mackenzie Highway, Wrigley to Inuvik.
2. Extension of the Mackenzie Highway, Inuvik to Tuktoyaktuk.
3. Construction of an Arctic Highway, connecting the Central Arctic coast to Yellowknife.
4. Construction of a Keewatin Highway, connecting the Keewatin coast south to Manitoba and west to Yellowknife.
5. A road connection between Fort Smith, N.W.T. and Fort MacKay, Alberta.

These projects have a total estimated cost of \$3.2 billion of which \$2.7 billion is in the N.W.T. This appears to be a very large sum, but consider that it is less than the \$4 billion plus price tag of the proposed Mackenzie Valley gas pipeline.

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Road construction will provide substantial direct and indirect employment opportunities.

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Pushing Back the Economic Frontiers

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mately 180 ongoing operations and maintenance jobs will also be created for Northerners. The resulting resource development, tourism and other business activity will multiply these effects.

- Costs for delivering public programs will be reduced while their effectiveness is enhanced. The jobs and income created will significantly reduce social assistance and unemployment payments. Government revenues in the form of personal, business and consumer taxes and resource royalties will increase. In the long run, revenues may well outstrip expenditures.
- Increased G. N.W.T. revenues will reduce N.W.T dependence on federal financial assistance. With a strong economic base, the N.W.T. can proceed towards greater self-reliance and self-determination and assert itself as a full partner in Confederation.
- The economic occupation of our northern frontier will solidify Canadian arctic sovereignty far more effectively than military occupation.

In summary, this Transportation Strategy will be a catalyst for the economic, social and political development of the Northwest Territories into the twenty-first century. It will benefit current generations of Northerners and Canadians and establish a legacy for the future.

We can wait cautiously and react to whatever the future brings. Or we can have the vision, courage and commitment to shape the future to fit our aspirations.

6. COSTS

The following tables illustrate the capital and O & M funding which will be required over the next 20 years to implement the Transportation Strategy.

In the first five years, the major emphasis on capital is upgrading existing facilities. During this catch-up period, average annual expenditures are almost \$69 million, more than double the current capital base.

It is towards the end of the first 5 years that significant expenditures on major new road construction begin. Annual capital expenditures rise steadily to a level of \$167 million per year by the 10th year.

O & M expenditures on facilities are seen to rise gradually with traffic growth, expansion of inventory and increases in service availability. Estimated expenditures



The Strategy will provide enormous opportunities in virtually every sector of the economy.

Δεῖν ἔστιν ἡ ἀνάγκη ἵνα ἡμεῖς ἀποκαταστήσουμε τὴν ἰσότητα τοῦ ἀπὸ τὸν ἰσχυρὸν Καναδὰ ἕως ἄραυτος ἡμεῖς.

Ἡμεῖς ἄνθρωποι τῆς ἄρctic ὀροσειρῆς ἔχουμε τὴν ἐξουσία νὰ ἑκδηλώσουμε τὴν ἰσότητά μας.

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TRANSPORTATION STRATEGY LONG TERM CAPITAL (1.990 \$000's)

STRATEGIC OBJECTIVE	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97 2000/01	Total 2001/02 2010/11	20 year TOTAL
1 IMPROVING WHAT WE HAVE									
Airports	13260	16832	22812	23162	22572	21302	97410	172120	376210
Highways	16965	30460	32210	34430	34580	31930	92650	182500	455725
Local Roads	250	1250	1500	1500	2000	2000	10000	20000	38250
Marine Facilities	750	2800	4500	4500	4500	4500	22500	35000	78300
SUBTOTAL	31225	51342	61022	63592	63652	59732	222560	409620	948485
2 NEW ROADS	0	1000	2000	3000	12000	22000	525000	1250000	1815000
4 EXCELLENCE	0	0	500	1000	1000	1000	5000	10000	18500
TOTAL CAPITAL	31225	52342	63522	67592	76652	82732	752560	1669620	2781985

TRANSPORTATION STRATEGY LONG TERM O & M NEEDS (1990 \$000's)

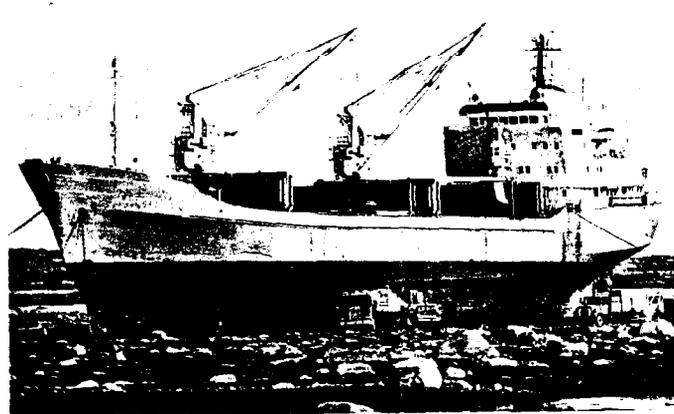
STRATEGIC OBJECTIVE	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97 2000/01	Average 2001/02 2010/11	20 year AVERAGE
1 IMPROVING WHAT WE HAVE									
Airports	25486	26686	27171	27736	28236	28786	29346	30681	29608
Highways	26018	30192	30392	29492	29592	29792	29392	29392	30818
Local Roads	60	90	135	165	230	270	390	670	477
Marine Facilities	0	200	250	300	350	400	550	925	675
SUBTOTAL	51564	57168	57948	57693	58408	59248	59678	61668	61578
2 NEW ROADS	0	200	200	300	500	800	4000	7700	4950
3 "TRANSPORTATION" SUBSIDIES	0	0	5000	10000	10000	10000	10000	10000	9250
4 EXCELLENCE	0	0	500	1000	1000	1000	1000	1000	925
TOTAL	51564	57368	63648	68993	69908	71048	74678	80368	76703

ΔΥΨΨΨΨΨΨ ΔΕΨΨΨΨΨΨΨΨ ΔΨΨΨΨΨΨ (1990 \$000)

ΛΕΨΨΨΨΨΨ	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	βΨΨΨΨΨΨ 1996/97 2000/01	βΨΨΨΨΨΨ 2001/02 2010/11	ΨΨΨΨΨΨ 20 βΨΨΨΨΨΨ
1. ΨΨΨΨΨΨΨΨ ΨΨ ΛΨΨΨΨΨΨ									
ΓΨΨΨΨ	13260	16832	22812	23162	22572	21302	97410	172120	376210
ΔΨΨΨΨΨΨ	16965	30460	32210	34430	34580	31930	92650	182500	455725
ΨΨΨΨΨ ΔΨΨΨΨ	250	1250	1500	1500	2000	2000	10000	20000	38250
ΔΨΨΨΨΨΨ A ΨΨΨΨ	750	2800	4500	4500	4500	4500	22500	35000	78300
βΨΨΨΨΨΨ ΔΨΨΨΨΨΨ	31225	51342	61022	63592	63652	59732	222560	409620	948485
2. ΨΨΨ ΔΨΨΨΨ	0	1000	2000	3000	12000	22000	525000	1250000	1815000
4. ΨΨΨΨΨΨΨΨΨΨΨΨΨΨ	0	0	500	1000	1000	1000	5000	10000	18500
C L A W βΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ	31225	52342	63522	67592	76652	82732	752560	1669620	2781985

ΔΥΨΨΨΨΨΨ ΔΕΨΨΨΨΨΨΨΨ ΔΨΨΨΨΨΨ ΨΨΨΨΨΨΨΨ (1990 \$000)

ΛΕΨΨΨΨΨΨ	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	ΨΨΨΨΨΨ ΨΨΨΨΨΨ 1996/97 2000/01	ΨΨΨΨΨΨ ΨΨΨΨΨΨ 2001/02 2010/11	20 ΨΨΨΨΨΨ ΨΨΨΨΨΨ
1. ΨΨΨΨΨΨΨΨ ΨΨ ΛΨΨΨΨΨΨ									
ΓΨΨΨΨ	25486	26686	27171	27736	28236	28786	29346	30681	29608
ΔΨΨΨΨΨΨ	26018	30192	30392	29492	29592	29792	29392	29392	30818
ΨΨΨΨΨ ΔΨΨΨΨ	60	90	135	165	230	270	390	670	477
ΔΨΨΨΨΨΨ ΛΨΨΨΨ	0	200	250	300	350	400	550	925	675
βΨΨΨΨΨΨ ΔΨΨΨΨΨΨ	51564	57168	57948	57693	58408	59248	59678	61668	61578
2. ΨΨΨ ΔΨΨΨΨ	0	200	200	300	500	800	4000	7700	4950
3. ΔΥΨΨΨΨΨΨΨΨΨΨΨΨΨΨ	0	0	5000	10000	10000	10000	10000	10000	9250
4. ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ	0	0	500	1000	1000	1000	1000	1000	925
C L Δ ΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨΨ	51564	57368	63648	68993	69908	71048	74678	80368	76703



Part II
FOUR STRATEGIC
OBJECTIVES

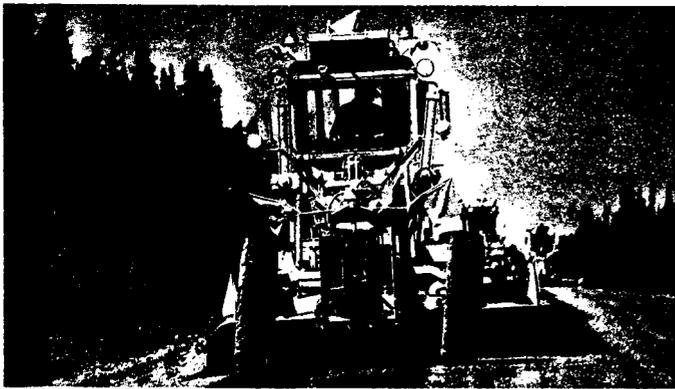
OBJECTIVE ONE - IMPROVING WHAT WE HAVE

1.1 INTRODUCTION

Improvement Defined

Existing public transportation infrastructure includes airport facilities, highways, community roads and marine facilities.

All of these facilities require some degree of ongoing maintenance. For example, a gravel road requires periodic grading to maintain the traffic surface. Annual O & M budgets are established for this purpose.



Transportation Facilities require on-going maintenance,

Most facilities require periodic capital restoration or replacement. Even with the best maintenance, the road embankment and drainage systems deteriorate over time and require capital refurbishment after 20 to 30 years of service.

These two activities represent the bare minimum in ongoing public investment. Maintenance and restoration (reconstruction, replacement) are required just to maintain the status quo, to prevent our facilities from deteriorating and to continue to provide the current level of service.

But the focus of this strategic objective, 'improving what we have', is upgrading existing facilities to higher

standards and levels of service. This upgrading may respond to increased traffic, safety concerns, high user or agency costs, or simply heightened public expectations of comfort and convenience. Upgrading could include paving a gravel road, lengthening a runway or rebuilding a wharf.



The focus of this objective is upgrading existing facilities.

In examining existing transportation infrastructure, we assume that ongoing maintenance will be performed and that necessary capital restoration will be given priority over upgrading or enhancement. It doesn't make sense to build an addition on a house without first repairing the leaky roof.

Establishing Priorities

During the course of research for the Transportation Infrastructure Study, extensive consultations were held with various user groups and community representatives. The consultation process also included the many government agencies responsible for planning, construction and maintenance of the various types of infrastructure.

Based on this input, it became clear that the need and the possibilities for upgrading existing public infrastructure are virtually unlimited. Hundreds of recommendations, large and small, were provided.

Furthermore, there was no general agreement on what the priorities should be. Each person spoke from his or her own viewpoint. Naturally, community representatives generally responded with local or regional concerns, while carriers were most concerned with facilities affecting only their operations. The mandate of public agencies generally covered only one mode of transportation (air, road or marine) and often only one of several administrative regions. (Transport Canada divides the north into Western, Central and Quebec regions and has separate administrations for airport facilities and air navigation services).

An objective approach is therefore required which can help to assess and rank very different types of projects and which will help draw the line between necessary and 'nice to have' improvements.

Several approaches to an objective evaluation process were considered. The one selected was a Benefit/Cost analysis in which the benefits include:

- Economic Benefits to users (increased revenues/reduced costs).
- Employment Benefits (where local employment is weighted higher in areas of high unemployment and northern employment is rated higher than southern employment).
- Mobility Benefits (value of improved availability or convenience of access - rated highest where existing opportunities are poorest).
- Safety Benefits (based on the degree of improvement and number of people exposed)

Costs include:

- Capital Costs (initial and recurring government costs).
- Maintenance Costs (marginal increase or decrease in ongoing maintenance costs).

The total estimated value of benefits over the life of a facility are compared to the total estimated costs. If the benefits are greater than the costs, then the Benefit/Cost ratio will exceed a value of 1.0 and the project is cost effective. The higher the Benefit/Cost ratio, the better the return on the investment.

The advantage of this approach is that it provides an indication of both the absolute and relative merits of very dissimilar improvement projects. It is also responsive to the overall goal and principles of the transportation strategy.

Programming

The balance of this section provides an assessment of the upgrading needs and priorities for various types of existing transportation infrastructure. In all cases, this assessment was initially made using the same Benefit/Cost approach. Benefit/Cost (B/C) ratios can therefore be compared directly and can provide an indication of which projects are viable (B/C ratio greater than 1.0) and which should have the highest priority (descending order of B/C ratio).

Theoretically, we should simply list all projects in descending order of Benefit/Cost ratio and start at the top of the list. Furthermore, all projects with a B/C ratio greater than 1.0 should be done immediately. This approach would neither be practical nor logical. Some rational judgement must be applied in developing an implementation plan.

Funds are not unlimited. Neither is contractor and labour pool capacity. We must therefore program the work over a reasonable period of time, in order to make it affordable and to ensure the most effective utilization of available resources.

It is also sensible to balance the program to provide a reasonably steady workload of various types of work in each region (avoiding a feast/famine situation).

We must also take a system approach in some cases. For example, all airports in an area may be part of a natural route structure. It would make little sense to upgrade only some of the airports in this system to accommodate a larger aircraft. In such cases we must evaluate upgrading the system rather than individual airports. Furthermore, we should schedule this upgrading as a program, since there will be no benefit until all airports in the system have been upgraded and the larger aircraft is in service.

Finally, we must remember that this evaluation is not static. Population, traffic, economic, social and technological changes may dictate re-evaluation and adjustment of priorities. For example, projects which now have a Benefit/Cost ratio below 1.0 may become economic with a small increase in benefits or a small decrease in costs.

Virtually every project recommended over the first 5 years in each of the program areas now has a current Benefit/Cost ratio exceeding 1.0.

Summary Costs

The following sections detail the needs for improving what we have in four program areas:

1. Airports
2. Highways
3. Local Community Roads
4. Marine Facilities

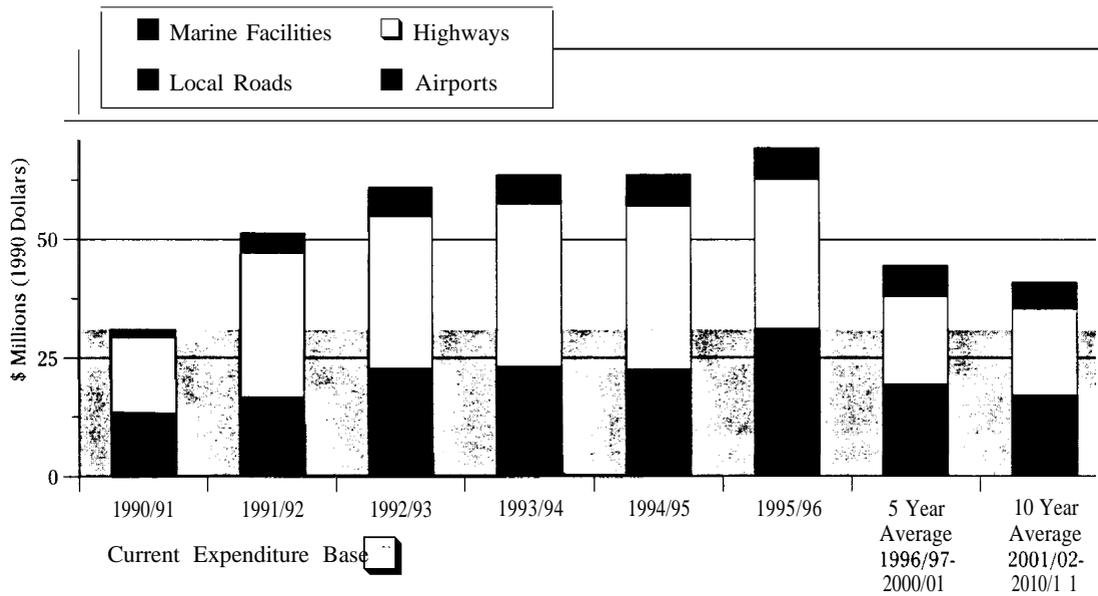
As shown in the following figures, highway and airport upgrading constitute the majority of the capital needs

over the next 20 years. In both areas, significant system deficiencies indicate a requirement for 'catch-up' capital investment over the first five years.

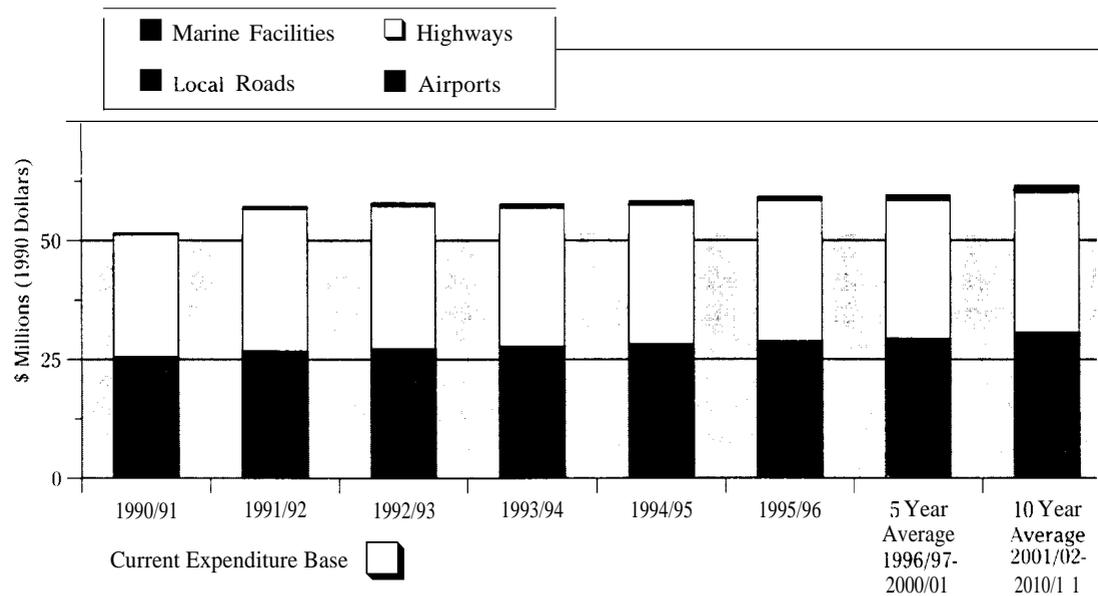
Highways and airports also contribute a majority of the ongoing O & M requirement. This will grow gradually over the planning period.

Marine facilities and Local Community Roads needs form a relatively small share of the capital and O & M needs.

IMPROVING WHAT WE HAVE - TOTAL CAPITAL



IMPROVING WHAT WE HAVE - TOTAL O & M



1.2 AIRPORTS

1.2.1 The Current Situation

Background

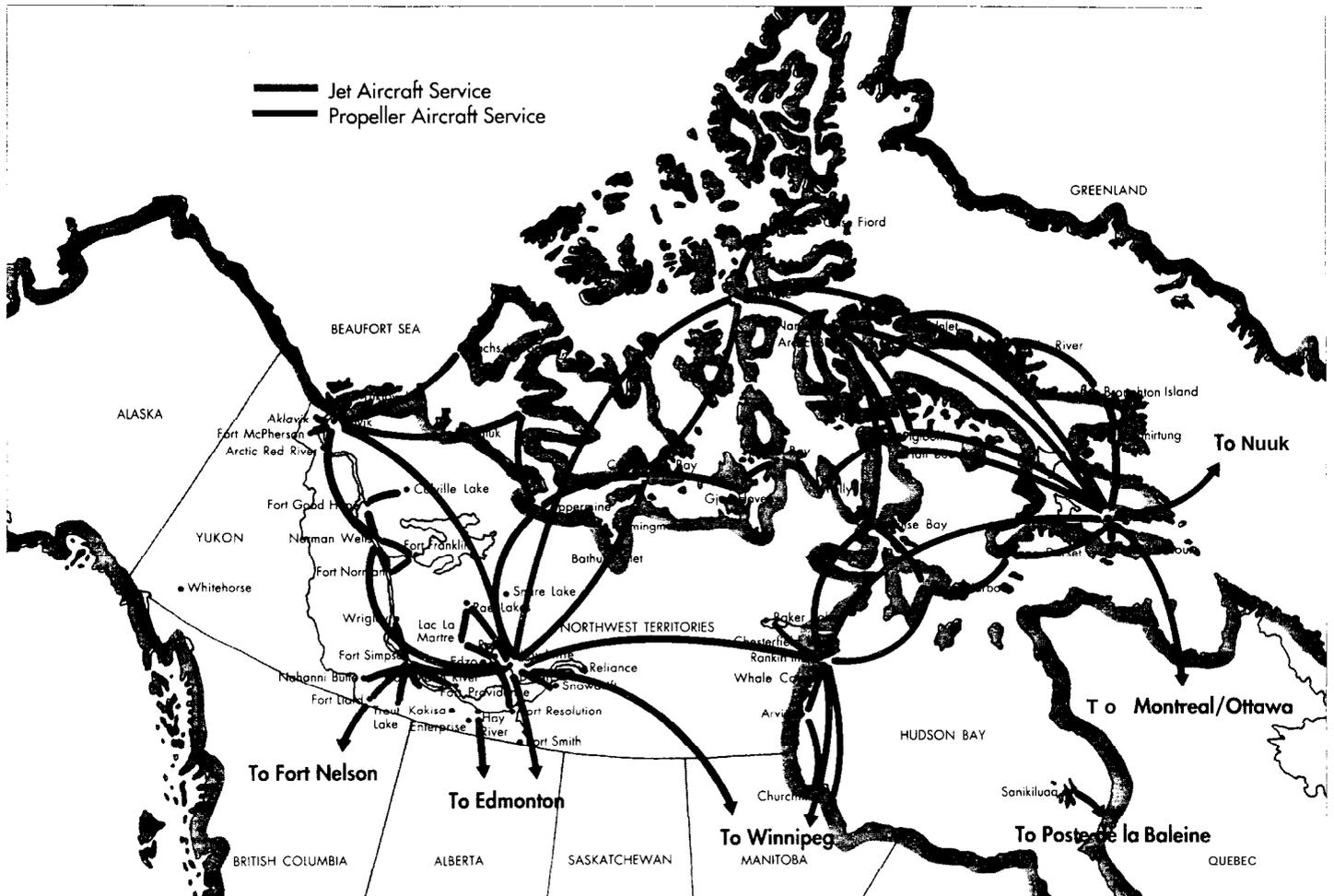
Up to the 1970's, airport development in the North was a hedge-podge affair. Airports had been constructed by the military (DEW line), Transport Canada, Indian Affairs and Northern Development and private interests, and also through local resources. Many of these landing strips were poorly located and oriented and some were unsuitable for further development. The ad hoc communications, meteorological and maintenance services at many airports were considered sub-standard and unreliable.

In 1974, the "Policy for Provision of Air Transportation Facilities and Services in the Yukon and Northwest Territories" was approved by the Federal Government. Its objective was to provide and maintain "air transportation facilities to the minimum standard required to enable the operation of reliable, regular air services to communities in the Yukon and the Northwest Territories". Responsibility for implementing this policy was assigned to Transport Canada.

At that time, the estimated capital cost for implementation totalled \$61 million, of which almost 90% was for Northwest Territories sites. The Department of Transport proposed a somewhat optimistic time frame of 5 years, commencing in 1975/76.

In 1978, Transport Canada, D. I. A. N. D., Fisheries and Environment, the N.W.T. and the Yukon agreed to a Memorandum of Understanding (M. O. U.) which established and clarified the programming, financial and

NWT SCHEDULED AIR SERVICES



operational responsibilities of each of the parties. The main points of the M.O. U. were that:

Transport Canada would:

- Provide all air transport facilities at all Arctic Airports.
- Operate and maintain Arctic A Airports.
- Provide inspection, training and technical advice.
- Fund the provision, maintenance and operation of all airport, air navigation, communications and meteorological equipment.

G. N.W.T. would:

- Operate and maintain N.W.T. Arctic B & C Airports, including communication and meteorological equipment, on behalf of Transport Canada.

By 1983, when the Policy lapsed, new or fully reconstructed airports had been completed in 22 N.W.T. communities. Major improvements had been undertaken in many others. Total program expenditures over the period when the Policy was in effect amounted to approximately \$60 million for airport construction. Annual expenditures for operations and maintenance were in the area of \$6.5 million. Improvements to the frequency, regularity, reliability, comfort and safety of air services to some 39 N.W.T. communities had been realized.

Unfortunately, the Policy expired before the Program had been fully implemented. Airport construction and improvement projects in 10 N.W.T. communities (Pelly Bay, Paulatuk, Rae Lakes, Lac La Martre, Fort Good Hope, Fort Franklin, Arctic Red River, Rae/Edzo, Fort Providence and Snowdrift) were not completed. Some of these communities have been left without regular and reliable air services, and where air services are available, safety standards are compromised - in some cases severely. Five of these 10 sites do not meet minimum standards for certification. Two others have no airport.

Program delivery was administered by Transport Canada from Montreal, Winnipeg and Edmonton for the East, Central and Western Arctic areas respectively. The splitting of the North into three regions was unfortunate from a Territorial perspective, since it meant dealing with three administrations and resulted in inconsistencies in the program delivery from east to west.

Another problem area was the exclusion of several smaller communities which did not meet the minimum criteria for inclusion in the policy. G. N.W.T. responded by establishing an Arctic 'D' classification for sites in-

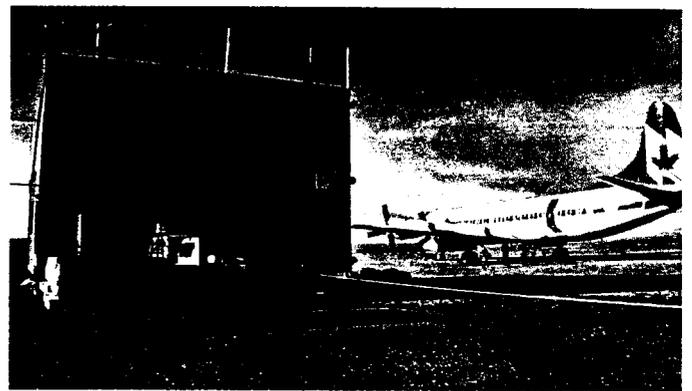
cluding Jean Marie River, Nahanni Butte, Trout Lake, Colville Lake and Snare Lakes. Some funding has been allocated by G. N.W.T. for construction, upgrading and operation of airports at these locations.

Since the inception of the Policy in 1974, the North has been growing and developing. Air service and traffic has increased dramatically. Aircraft types have changed. However, the Policy's original classifications and basic standards and criteria have not kept pace.

In 1990, the G. N.W.T. and Transport Canada agreed to devolution of responsibilities for Arctic B & C Airports.

G. N.W.T. is now fully responsible for rehabilitation, operation and maintenance of all Arctic B & C Airports. G. N.W.T. has also assumed responsibility for upgrading the 10 outstanding B & C sites to meet standards. In addition, the two governments have agreed to a 50-50 cost sharing split of the capital expenditures required over six years to upgrade 7 airports to minimum standards. This does not include terminal buildings or other equipment and facilities. No provision has been made for any future airport upgrading needs.

Transport Canada has retained full responsibility for Arctic 'A' airports and for provision of air navigation facilities and services at all Arctic airports. However, G. N.W.T. will continue to provide air navigation services for B & C Airports on behalf of Transport Canada under a new Memorandum of Understanding. Funding for these services is to be established annually.



G. N.W.T. is responsible for Arctic 'B', 'C' and 'D' Airports.

Classification

The classification system adopted in the 1974 Policy grouped airports into three categories based on somewhat subjective criteria. The policy sought flexibility "due to changing circumstances such as resource ex-

1974 ARCTIC AIRPORT CLASSIFICATIONS & STANDARDS

CLASSIFICATION	ARCTIC 'A'	ARCTIC 'B'	ARCTIC 'C'	ARCTIC 'f' (GNWT)
CRITERIA	regular scheduled service major distribution centre strategic location capital or regional centre extensive resource development role	population > 400 regular air service growing community area administrative centre active role in resource development	population > 100"	population < 100
TYPICAL AIRCRAFT	B737, B727, Electra	F27, HS748, F227, YS11 Hercules	Twin otter, Cessna 402	Twin otter, Islander Aztec, STOL Aztec
STANDARDS				
Runway	min. 6000 x 150ft (1830 x 46 m)	5000 x 150 ft (1524 x 46m) (may be shorter)	3000 x 100" ft (914 x 30 m) (may be shorter)	2500 x 75 ft min (762 x 23 m)
Lighting	high intensity runway & approach lighting VASIS lighted taxiways threshold identification lights beacon lighted wind sock	runway & approach lighting VASIS threshold identification beacon lighted wind sock	runway & approach lighting VASIS threshold identification beacon lighted wind sock	runway & threshold lighting beacon lighted wind sock
Approach Aids	ILS NDB	NDB	NDB	NDB
Navigation Aids	VOR/DME			
Facilities	terminal building access road apron & taxi fuel storage/dispensing maintenance equipment & facilities	passenger-cargo shelter access road apron fuel storage/dispensing maintenance equipment & facilities	passenger-cargo shelter access road apron fuel storage/dispensing maintenance equipment & facilities	passenger-cargo shelter access road apron fuel storage/dispensing maintenance equipment & facilities
Communications	Air to ground	Air to ground	Air to ground	site specific determination
Meteorological	routine observing program	observations on request	observations 1)11 request	site specific determination
AIRPORTS				
	Cambridge Bay Ft. Simpson Ft. Smith Hay River Inuvik Iqaluit Norman Wells Resolute Yellowknife	Baker Lake Coppermine Coral Harbour Hall Beach Nanisivik Rankin Inlet Tuktoyaktuk	Aklavik Arctic Red River Arviat Broughton Island Cape Dorset Chesterfield Inlet Clyde River Ft. Franklin Ft. Good Hope Ft. Liard Ft. McPherson Ft. Norman Ft. Providence Ft. Resolution Gjoa Haven Grise Fiord Holman	Igloolik Lac La Martre Lake Harbour Pangnirtung Paulatuk Pelly Bay Pond Inlet Rae-Edzo Rae Lakes Repulse Bay Sachs Harbour Sanikiluaq Snowdrift Spence Bay Whale Cove Wrigley
				Arctic Bay Bathurst Inlet Bay Chimo Colville Lake Jean Marie River Nahanni Butte Snare Lake Trout Lake

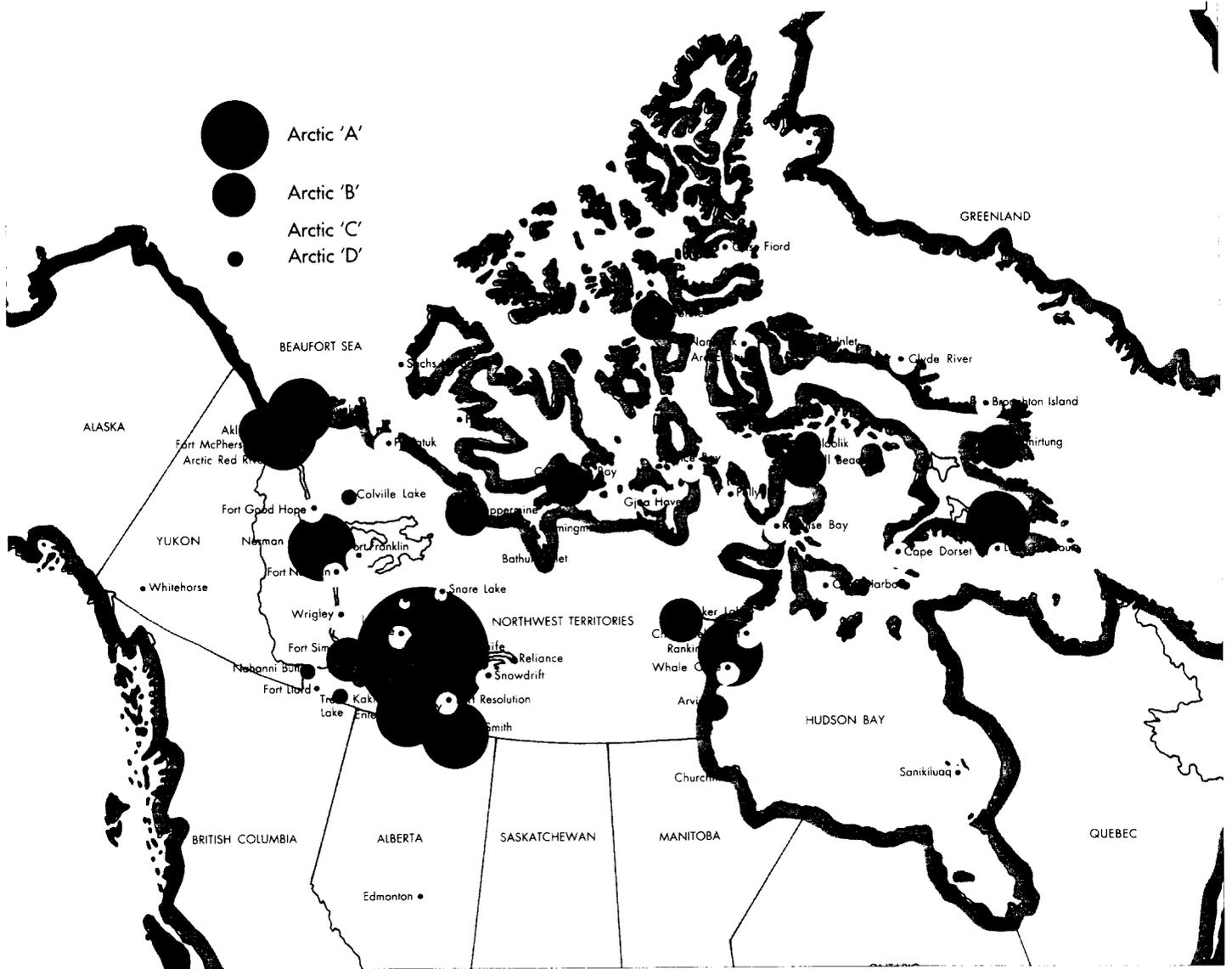


Transport Canada retains responsibility for the 9 Arctic 'A' Airports.

ploration and exploitation, air route service structure, types of aircraft being used and acceptability of other means of transportation". Besides the desire for flexibility, there was very little quantitative data to go on (except population).

Today, there is considerable detailed statistical data available for most N.W.T. airports. Statistics on numbers of enplaned and deplaned (E/D) revenue passengers provides an indication of the relative activity/importance with respect to passenger travel. Some locations may have aircraft activity which is disproportionate to population or passenger activity. This may be the case at hub airports, resource centres or mili-

REWSED NWT AIRPORT CLASSIFICATIONS



The resulting classification system provides an indication of the 'relative activity' at each airport. Other factors must be taken into account in rating the 'relative importance' of an airport or the facilities and services required. The remoteness, availability of alternative transportation modes, regional role or local economic activity may outweigh the importance of the traffic volume in establishing facility requirements.

It should also be noted that the current statistics underestimate aircraft movements, particularly at sites with limited aeradio hours of operation.

Traffic

It is not surprising, given the vast distances and lack of alternatives, that air routes are the lifeline of northern

transportation. In fact, we use airplanes more than four times" as often as the average Canadian. Scheduled air services are the buses of the north, while chartered aircraft are the taxicabs.

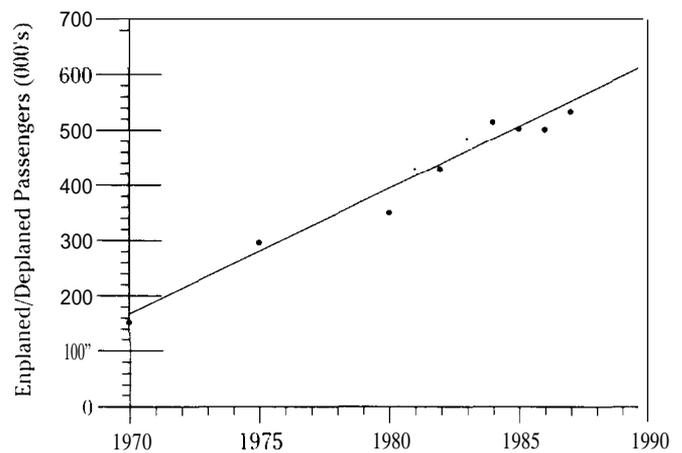
Total enplaned and deplaned revenue passengers have steadily increased from 152,000 in 1970 to 534,000 in 1987. This represents a compound annual growth rate of 8% per year. From 1987, a conservative extrapolation of growth would be 23,000 per year, representing a simple growth rate of 4.2% per year.

The reported 1988 revenues for Class II, III and IV carriers indicate that N. W. T.-domiciled carriers earned \$71 million revenue, ranking sixth of all provinces and territories (Air Canada, Canadian Airlines and Wardair were the only Canadian Class 1 carriers in 1988).

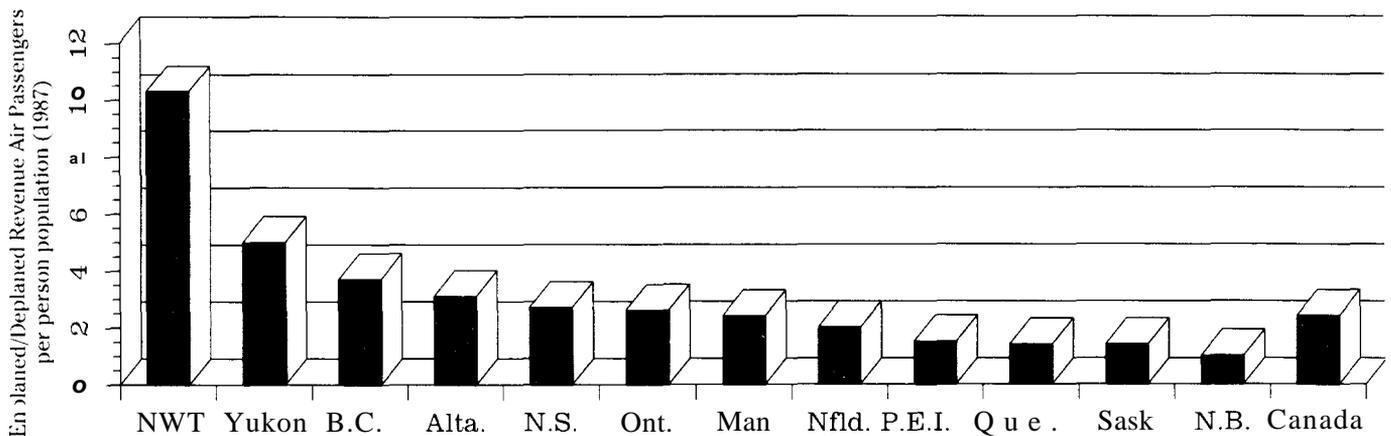


In the N. W. T., we use air services more than four times as often as the average Canadian.

NWT ANNUAL ENPLANED/DEPLANED REVENUE AIR PASSENGERS



AIR TRAVEL ACTIVITY BY PROVINCE/TERRITORY



Critical Aircraft

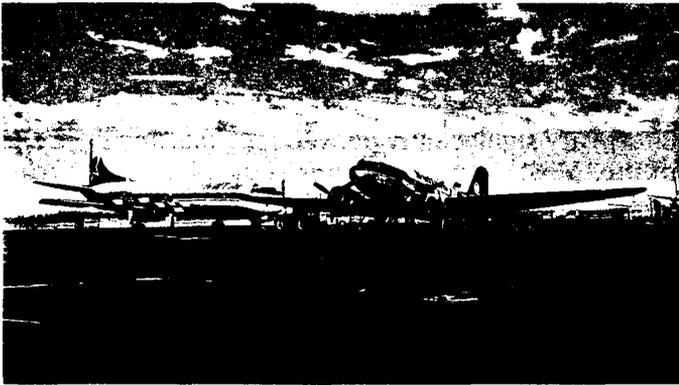
It is the critical aircraft which defines most of the physical characteristics and zoning requirements for an airport (eg. runway dimensions, obstacle limitations).

In developing the Arctic Airports Program in the early 1970's, critical aircraft types were assumed and airport standards developed, based on the airport classification.

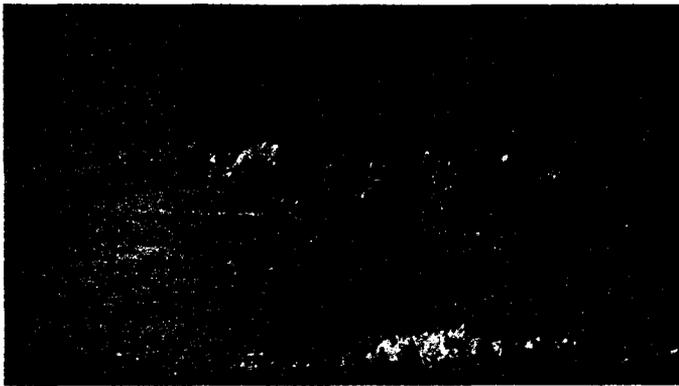
Today, airports are classified to indicate their role and relative importance. However, airport standards are based largely on characteristics of the critical aircraft.

The current critical aircraft for any existing airport is easily identified. The likely critical aircraft for proposed new airports may be selected with some confidence on the basis of carrier fleets.

What will be the critical aircraft in 5, 10 or 20 years from now? New generation aircraft are on the market. Many of the current models are no longer being manufactured. The DC-3, once the workhorse of the Arctic, has



Lockheed Electra and Douglas DC-3



Hawker Siddeley HS 748

been out of production for 40 years. The Twin Otter, HS748 and Lockheed Electra are all out of production.

Future choices by our air carriers will depend on several factors:

- Demand – The absolute and relative market demand will influence the optimum size and type of aircraft. A mix of passengers and freight will encourage use of combi-types, efficiently carrying both. An aircraft which is too large for the market would result in low load factors (unacceptable to carrier) or infrequent services (unacceptable to customers). The customer is also demanding comfort and speed.
- Economics – Older aircraft are generally less expensive to purchase but are more expensive to operate. Newer aircraft tend to be the opposite. Carriers cannot afford to have multimillion dollar investments sitting on the ground. Where the market, route structures and facilities allow high utilization, new aircraft are economic.
- Regulation – Air carrier regulation can often increase costs or restrict options. For example, current proposals regarding mixed passenger-cargo flights may cause severe disruptions in the current air service patterns.
- Facilities – Airport facilities may effectively restrict options for service. Obviously, when runways are too short, larger aircraft cannot operate or will operate under severe load restrictions. The type and quality of runway surface may also restrict aircraft. The quality of navigation and approach aids, meteorological and communications services, and terminal facilities will affect and possibly restrict air carrier choices.

Given all these factors, one can project the traffic patterns and carrier economics, and forecast the 'ideal' critical aircraft for a given market. It is then up to government to assess the economics and public interest of providing the necessary facilities.

For purposes of long-term planning, it is assumed that:

- The B737/B727 or equivalent medium range jet combi will remain in service and replace the Electra on existing routes.
- The HS748 will eventually be replaced by the BAE 146, Dash 8 or similar jet or turboprop combi.
- The Twin Otter will eventually be replaced by the Dash 8 or similar turboprop suitable for cargo-passenger mix.



De Havilland Twin Otter



Boeing B737 Cargo-Passenger Combi

These proposed critical aircraft are only typical of a variety of aircraft available. However, the facility re-

quirements are similar for most aircraft of a similar range and capacity. It will also be advisable to allow runway lengths for Hercules cargo charters at some locations.

Current Expenditures

The G. N.W.T. Department of Transportation 1990/91 gross expenditures on Arctic B, C, & D airports are estimated at \$18.3 million for maintenance, operation and upgrading of Arctic B, C, & D Airports, including base funding transferred.

Revenues from Transport Canada include \$2.4 million for operation of Arctic B & C Community Aerodrome Radio Stations (CARS), and a \$0.4 million capital contribution to upgrade 7 airports.

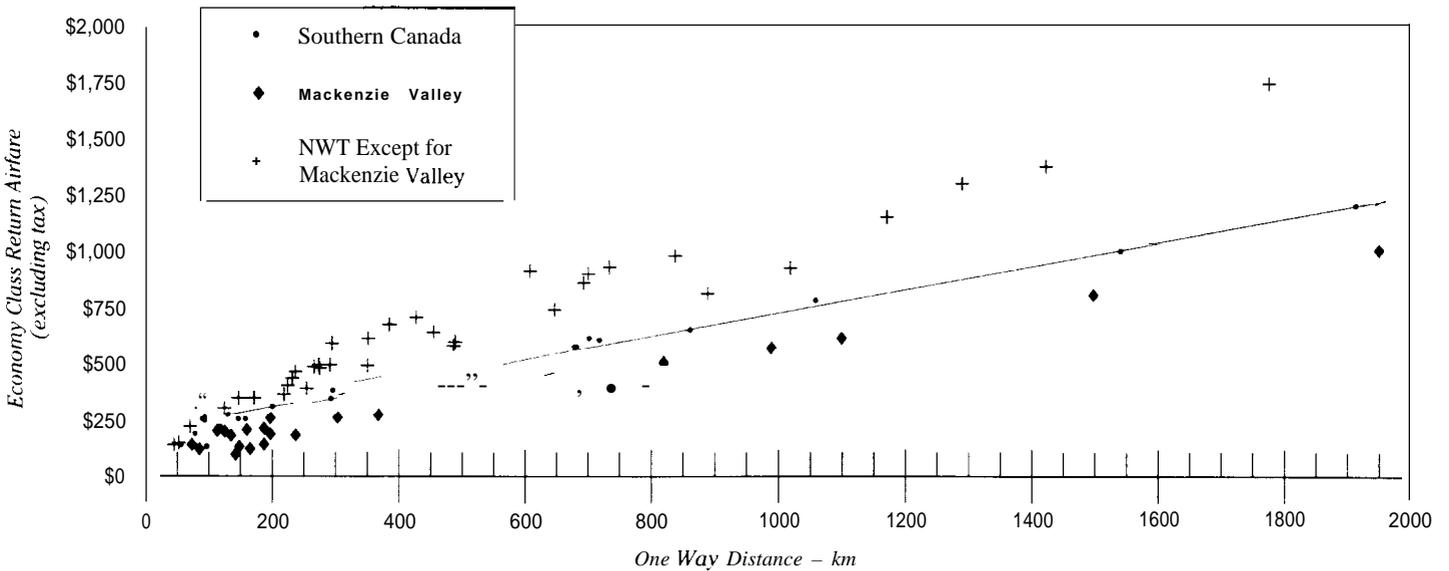
Transport Canada 1990/91 estimates show O & M expenditures of \$14.5 million and capital expenditures of \$6 million for the 9 airports operated by Transport.

User Costs

Analysis of N.W.T. airfares shows a significant premium on a cost per seat kilometre basis for northern air travel compared to the 'southern baseline' (the southern baseline is based on high density, competitive routes of similar distances).

Rates vary significantly between regions and from site to site. Most short haul routes in the Mackenzie Valley

COMPARISON OF NWT AIR TRAVEL RATES TO SOUTHERN CANADA BASELINE



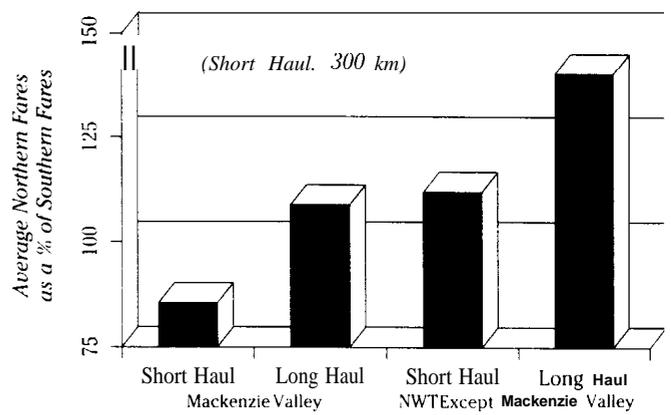
are actually cheaper than the southern baseline, while long haul routes are about 10% more expensive. Eastern and Arctic Coast longer haul rates show an average 40(X premium, while short haul rates average about 12% higher than the south.

This rate premium is compounded by the longer distances and heavy reliance on air travel, resulting in very high expenditures on northern air travel in the east.

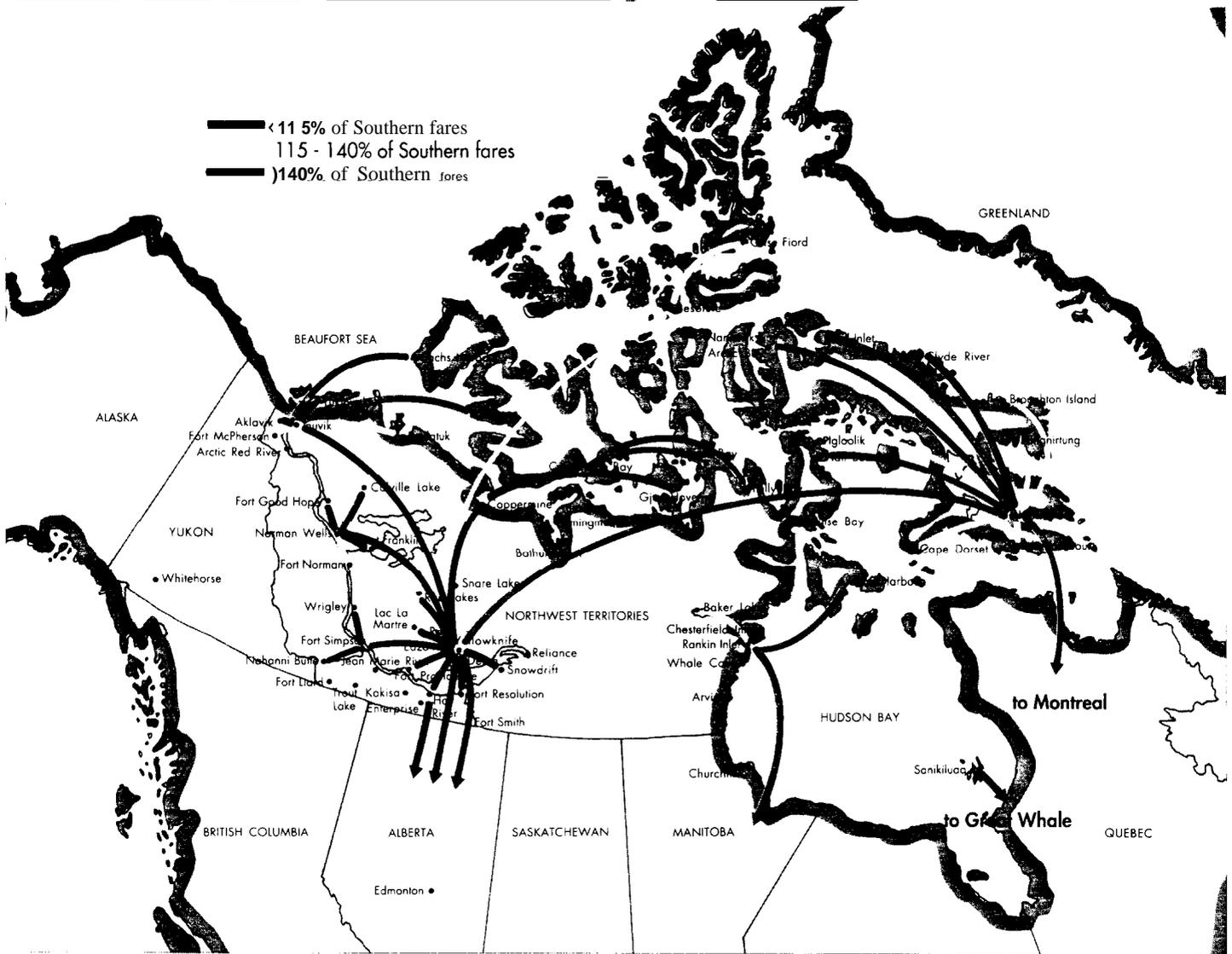
The higher rates are attributed by carriers to higher operating costs, higher fuel costs, lower route densities and poorer facilities and services.

Comparisons are based on regular fares. Promotional seat sales are available on some northern routes, but generally to a lesser extent.

COMPARISON OF NWT AIR TRAVEL RATES TO SOUTHERN CANADA BASELINE



NWT AIR TRAVEL RATE COMPARISON



Air freight rates follow a similar pattern to passenger rates. However, larger customers may negotiate rates or charter aircraft at costs well below the published air carrier tariffs. Reductions of 40 to 60% have been reported in the Baffin.

This is just as well, since the published rates for such perishables as milk would result in a shipping cost as high as \$4-\$8 per kilogram in the Baffin. The actual price premium is in the range of \$2-\$3 per kilogram. These premiums apply to the per kilogram cost of all perishables, including fresh and frozen foods.

1.2.2 Problems

Commercial air carriers, the Northern Air Transportation Association, the Canadian Aviation Safety Board, the Canadian Transport Commission's Air Transport Committee, and the Parliamentary Standing Committee on Transportation have all made representations to the Federal Minister of Transport recommending immediate improvements to N.W.T. airport and aviation facilities and services. However, since the expiry of the Arctic Air Facilities Policy in 1983, little has been done.

Major public and air carrier concerns are related to the safety, availability, reliability and cost of air travel.

Ten existing airports do not meet requirements for certification:

Broughton Island	Nahanni Butte
Colville Lake	Paulatuk
Ft. Good Hope	Pelly Bay
Lac La Martre	Rae Lakes
Lake Harbour	Snowdrift



Some airports do not meet minimum requirements for certification. (Lake Harbour)

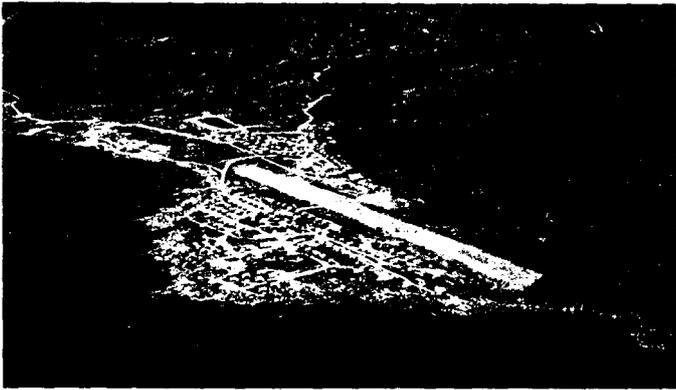
Ten airports have restrictions to improvement due to location or are in conflict with community land use and are restricting the orderly planning and expansion of growing communities:

Ft. Franklin	Lake Harbour
Paulatuk	Pangnirtung
Rae Lakes	Ft. Good Hope
Nahanni Butte	Lac La Martre
Tuktoyaktuk	Repulse Bay

There are no airports at Snare Lakes, Rae-Edzo or Arctic Red River. At Snare Lakes there is no alternative

GLOSSARY OF SELECTED AIR FACILITY TERMS

- VASIS** VFSUALAPPROACH SLOPE INDICATOR SYSTEM - Special lights on the sides of runways located near the threshold that show a pilot if he is too high or too low on his landing approach.
- ILS** INSTRUMENT LANDING SYSTEM - A precision approach system which provides aircraft on final approach with a precise horizontal and vertical guidance to the runway.
- MIS** MICROWAVE LANDING SYSTEM - A precision approach instrument similar to the features of ILS except that it also offers precise slant range information. It is planned to replace ILS at international airports by 1998.
- NDB** NON-DIRECTIONAL BEACON - A non-precision approach low frequency radio beacon which provides a non-directional radiation pattern to aid aircraft navigation.
- VOR** VHF OMNI-DIRECTIONAL RADIO - A non-precision approach radio navigation instrument radiating signals 360 degrees. An aircraft can use these radials to navigate inbound or out bound from the source with accuracy.
- DME** DISTANCE MEASURING EQUIPMENT - VHF radio transmitting equipment usually used in conjunction with VOR which provides horizontal distance of aircraft in relation to source.
- CARS** COMMUNITY AIRPORT RADIO STATION - A manned radio station operated by the Territorial/Provincial Governments in support of aviation activity.
- FSS** FLIGHT SERVICE STATION - A radio communications station operated and staffed by Transport Canada.
- ATB** AIR TERMINAL BUILDING - A building designed to accommodate aviation services i.e. CARS, FSS, air carrier operations and the traveling public.
- AWOS** AUTOMATED WEATHER OBSERVING SYSTEM - An unmanned automated weather observing device capable of observing and transmitting such information as wind speed and direction, visibility, precipitation, temperature and ceiling. Several models are available incorporating some or all of these features.
- RCO** REMOTE COMMUNICATIONS OUTLET - Remote VHF transmitters/receivers established where difficult communications exist or where extended communications capability is necessary. An RCO facility provides many of the services normally provided by FSS.
- INSTRUMENT APPROACH PROCEDURES** - Established IFR (Instrument Flight Rules) procedures that enable an aircraft to approach an airport through cloud or IFR conditions.



Some airports are in conflict with community land use.
(Pangnirtung)

year round access (except helicopter). Rae-Edzo is an area administrative and cultural hub, and a forestry centre. The need for an airport is demonstrated by the level of seasonal floatplane, ski plane and helicopter activity. Arctic Red River is cut off from the Dempster Highway during freezeup and breakup of the Mackenzie River.

Community Aerodrome Radio Stations (CARS) hours are restricted at many locations to a regular 40 hour week. There is no backup staff or provision for staff resignations, sick leave or holidays. Nor is there provision for coverage after hours or on weekends. This is a longstanding air carrier complaint. The Northern Air Transport Association contends that 'The level of service at CARS is inadequate in that it does not reflect the total needs of the users and flight safety is being compromised'. Carriers have requested CARS operations 12 hours per day, seven days a week. A review of air carrier schedules shows that operations are not feasible on a 9 to 5 weekdays-only basis.

Although licensed and publicly certified, many of the airports are substandard for current operations. In some cases, runways are too short for efficient carrier operations, passenger shelters are non-existent or inadequate, or other facilities do not address operational needs.

At many of the Arctic B, C & D sites, the navigation and landing aids are not compatible with modern aviation needs. Air carriers have invested in fleets of larger, higher performance aircraft to meet the growing demand for quantity, quality and reliability of air services in the North. The instrumentation in these aircraft can enhance both safety and reliability, but many rely on ground based equipment. Carriers have requested, as a minimum, that every site have a certified Non Directional Beacon (NDB) and Distance Measuring Equip-

ment (DME) which will allow for Instrument Approach Procedures.

There are exciting developments in technology taking place. Advanced Automated Weather Observation and Reporting Systems (AWOS) may eventually reduce dependence on manned observation stations by providing automatic 24 hour coverage. Proposed satellite positioning systems may eventually render many of the existing navigational aids obsolete and unnecessary (Including NDB's, DME's and possibly even instrument landing systems). These technological advances must be monitored in ongoing planning for nav aids and air navigation services. In the meantime, existing proven technology is assumed.

Carriers have also noted that the availability of aviation fuels can have a significant impact on route structures and load factors. In many cases, a single product suitable for heating, diesel power generation, and heavy equipment operation would need only filtration to make it suitable for aviation use,

In the longer term, our airports may well become less and less adequate. Traffic is steadily growing and may be expected to continue to do so. New generation aircraft can provide efficient services, but only if the facilities are compatible. This means adequate facilities to accommodate the optimum aircraft, and adequate navigation and landing aids and communications services to ensure that efficient carrier operations are possible.

Public demand for safe, reliable services at a reasonable cost is increasing. In a highly competitive market, air carriers will do their best to satisfy this demand (or lose their customers). Government must provide the necessary public facilities and services.

1.2.3 Program Objectives

Airports program objectives fall into 3 areas: continuing, short term (1-5 yrs) and medium to long-term (5-15 yrs).

Continuing Program Objectives

1. Maintaining What We Have

The first priority must be ongoing operation, maintenance and capital restoration/replacement necessary to maintain the current levels of service. This includes operation of communications equipment, routine

maintenance of airfields, passenger terminals and other facilities & equipment. It also includes capital restoration and replacement of gravel surfaces, buildings and equipment. For Arctic B & C Airports, the 1990 base transfer is adequate to meet only those ongoing maintenance, restoration and replacement needs.

2. User Cost Reductions

Measures must be pursued to reduce the extremely high costs for air travel and airfreight. Co-operation and meaningful dialogue between G. N. W. T., Transport Canada, the National Transportation Agency and air carriers must be directed at measures to reduce cost. Public facility and service improvements and increasing volumes may help narrow the gap between northern and southern costs and rates. Efforts may also need to be directed at regulatory changes and/or taxation regimes. The primary objective must be to reduce air transportation costs, while maintaining safety and service to all residents.

Short Term Program Objectives

3. Upgrade Airports for Certification

This involves upgrading 9 existing airports to standards for certification, including relocation of 5 sites and construction of new airports at 2 (possibly 1) locations:

- Paulatuk – relocate
- Rae Lakes – relocate
- Snowdrift - upgrade
- Lac La Martre – relocate
- Fort Good Hope – relocate
- Snare Lakes – new
- Arctic Red River – new ‘
- Nahanni Butte – relocate
- Colville Lake - upgrade

‘ pending feasibility study of airport vs bridge construction.

4. improve CARS Service

Immediate improvement must be made to Community Aerodrome Radio Station service at the busier Arctic ‘C’ sites. A minimum of 70 hours scheduled service at sites will allow for 2 full time operators. Backups should also be provided at those sites where coverage remains at 40 hours. Technology advances in Automated Weather Observation & Reporting Systems (AWOS) and Remote Communications Outlets (RCO) should be pursued. Such equipment can permit pilots to obtain



The first priority must be ongoing maintenance of existing facilities.

information on weather and turn runway lights on when airports are unmanned.

Minimum short term improvements are to provide 70 hours CARS operation at any site with a traffic index greater than 100 or any site with a traffic index greater than 50 and regular scheduled service using HS748 or equivalent aircraft types. Basic 40 hour CARS service is to be provided for sites with a traffic index greater than 30. Using this criteria, 3 new CARS installations will be required, while 10 stations will be upgraded to 70 hours per week.



improvements must be made to CARS service.

5. Upgrade to Standards for Current Critical Aircraft

Many airports, although certified, do not meet the standards for efficient operation and service of current critical aircraft. Runways which are too short restrict the efficient use of current aircraft. Inadequate lighting, approach and navigation aids must be upgraded. Some passenger shelters are substandard for current traffic. A program of improvements is needed to bring these facilities up to standard.

Specific short term improvements include:

- All airports to have runway lighting and a certified NDB. Five new NDB's are required. New or upgraded lights are required at 9 existing sites and 2 new sites.
- Airports with a traffic index greater than 50 or with scheduled service by HS748 or equivalent to have DME suitable for instrument approach. 24 new installations are required.
- All Arctic 'A' airports to have Microwave Landing Systems (MLS). New MLS will be required at Norman Wells, Tuktoyaktuk, Fort Smith and Rankin Inlet.
- Runways to be lengthened, where feasible, to allow for efficient critical aircraft operations. This applies to Pelly Bay and Chesterfield Inlet.
- Adequate passenger shelters to be provided for all airports with a traffic index of 30 or more. Upgrades are required at Norman Wells, Tuktoyaktuk and Rankin Inlet, while new facilities are required at Snowdrift, Lac La Martre and Paulatuk.

Medium to Long Term Objective

6. Upgrade to Standards for Future Critical Aircraft.

As traffic increases and air carriers update their fleets, new demands will be imposed on our airports. Runways may require lengthening, and in some cases, relocation, to accommodate these new aircraft. Nav aids and communications facilities and services may require upgrading. Aprons, terminal and groundside facilities will require expansion. Improvements to airfield surfaces may be required.

To some extent, this can be a chicken and egg situation. Air carrier economics may not permit upgrading to optimum aircraft fleets where facilities are not adequate. If government takes the approach that facilities should not be upgraded until the aircraft are in use, the improvements may never be made. Government must therefore be prepared to take the lead, in close consultation with air carriers.

The recommended medium-to long-term program of upgrading for future critical aircraft is based on current knowledge and projections of air traffic, aircraft types and characteristics and aviation regulation. This proposed program should be reviewed and updated on an ongoing basis. Traffic patterns may change. New aircraft may come on the market. New regulations may be imposed. Any of these factors can reduce or increase the future upgrading requirements.

Currently projected upgrading requirements include:

- Resolve conflicts/upgrade of Tuktoyaktuk, Pangnirtung, Fort Franklin, Lake Harbour and Repulse Bay airports.
- Lengthening of runways at an additional 20 sites, to be accompanied by necessary widening and apron expansion.
- Construction of new airport at Rae-Edzo.
- Arctic 'A' airports should be paved. With DND upgrading and paving of the Rankin Forward Operating Location, only Tuktoyaktuk remains.
- With changes in critical aircraft and increased traffic, CARS service should be upgraded to 70 hours per week at an additional 17 sites.
- All Arctic 'C' sites with a traffic index greater than 10 should have DME. This includes an additional 7 sites.

1.2.4 Program Schedule and Costs

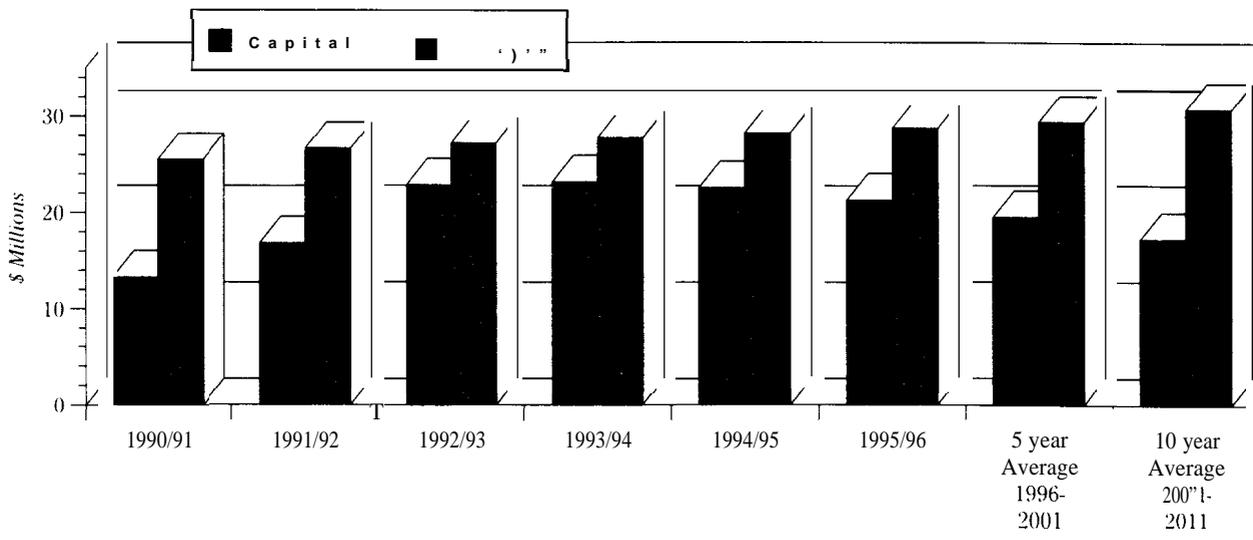
The following tables show the estimated capital and maintenance cost by task over the next 20 years for accomplishing each of the stated program objectives. Each task may represent a single major project or a series of smaller projects.

In programming airport improvements, a systems approach must be used. For example, the Baffin Island communities of Pangnirtung, Broughton Island, Clyde River and Pond Inlet form a natural route structure. It makes little sense to assume a different critical aircraft for any of these sites.

In terms of capital, expenditures required for the first 5 years average \$21.3 million per year, or an increase of \$8.1 million over 1990 expenditure levels. The average requirement over the period 5-20 years is \$18.0 million per year.

Operations and Maintenance expenditures average \$27.7 million over the first five years, increasing to an average of \$30.7 million per year, in the 10th to 20th years. This increase is due to addition of new facilities, nav aids and communications services.

AIRPORT PROGRAM COSTS



AIRPORTS PROGRAM CAPITAL (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97 2000/01*	Total 2001/02 2010/11	20year TOTAL
1 Maintaining									
GNWT	6470	6070	6070	6070	6070	6070	30350	60700	121400
Transport Can	6012	6012	6012	6012	6012	6012	30060	60120	120240
3 Upgrade to certification									
Paulatuk reloc.	536	1100	1000	870					2970
Rae Lakes reloc.	212	1890	220						2110
Snowdrift upgrade	30	960	970						2400
Lac La Martre reloc.			770	1630					1930
Ft Good Hope reloc.				230	1790	720			2740
Snare Lake new				500	500	500			1500
Arctic Red R. new					300	500			800
Nahanni Butte reloc			500	900	900				2300
Colville L. upgrade		300							300
4 CARS Upgrade			500	1000					1500
5 Upgrade to Standards									
Pelly Bay			570	1830					2400
Ft Franklin			500	320					820
Chesterfield inlet			200						200
5 NDBs			1000	1000					2000
11 Lights			2000	1300					3300
24 DME			2000	2500	5000	2500			12000
4 MLS					2000	2000	1000		8000
GNWT Pax Shelters						3000			3000
6 Upgrade to Future Standards									
Tuktoyaktuk							6000	20000	26000
Pangnirtung							15000		15000
Ft Franklin								3000	3000
Lake Harbour								14000	14000
Repulse Bay								2000	2000
Lengthen 21 Runways							10000	10000	18800
Rae-Edzo new							2000		2000
7 DME								3500	3500
TOTAL CAPITAL	13260	16832	22812	23162	22572	21302	97410	172120	376210

AIRPORTS PROGRAM OPERATIONS & MAINTENANCE (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97 2000/01	Average 2001/02 2010/11	20year AVERAGE
1 Maintaining									
GNWT	11030	11030	11030	11030	11030	11030	11030	11030	11030
Transport Can	14456	14456	14456	14456	14456	14456	14456	14456	14456
2 Consultation		100	100	100	100	100	100	100	100
3 New airports (O&M)			235	550	550	800	800	800	707
1 CARS upgrade		1100	1100	1100	1100	1100	1100	1100	1100
5 Upgrade to standards			250	500	1000	1300	1300	1300	1128
6 Upgrading to Future standards									
Mtc cost increase							50	430	235
upgrade CARS						480	1190	715	2400
DME costs								275	138
TOTAL O & M	25486	26686	27171	27736	28236	28786	29346	30681	29608

1.3 HIGHWAYS

1.3.1. The Current Situation

Inventory

The Northwest Territories primary highway network consists of 2200 kilometres of all-weather roads and 1800 kilometres of winter roads. Most of this system was constructed between 1960 and 1983. The current estimated replacement value of this system exceeds \$800 million.

This network provides all-weather access to 52% of the N.W.T. population and seasonal winter access to an additional 9%. In addition, off-highway residents of the Mackenzie Valley and the Western, Central and High Arctic areas benefit, since goods are trucked to Hay River, Yellowknife and Inuvik for transshipment by barge or air. Over 70% of the population therefore receives significant benefits from the highway system.

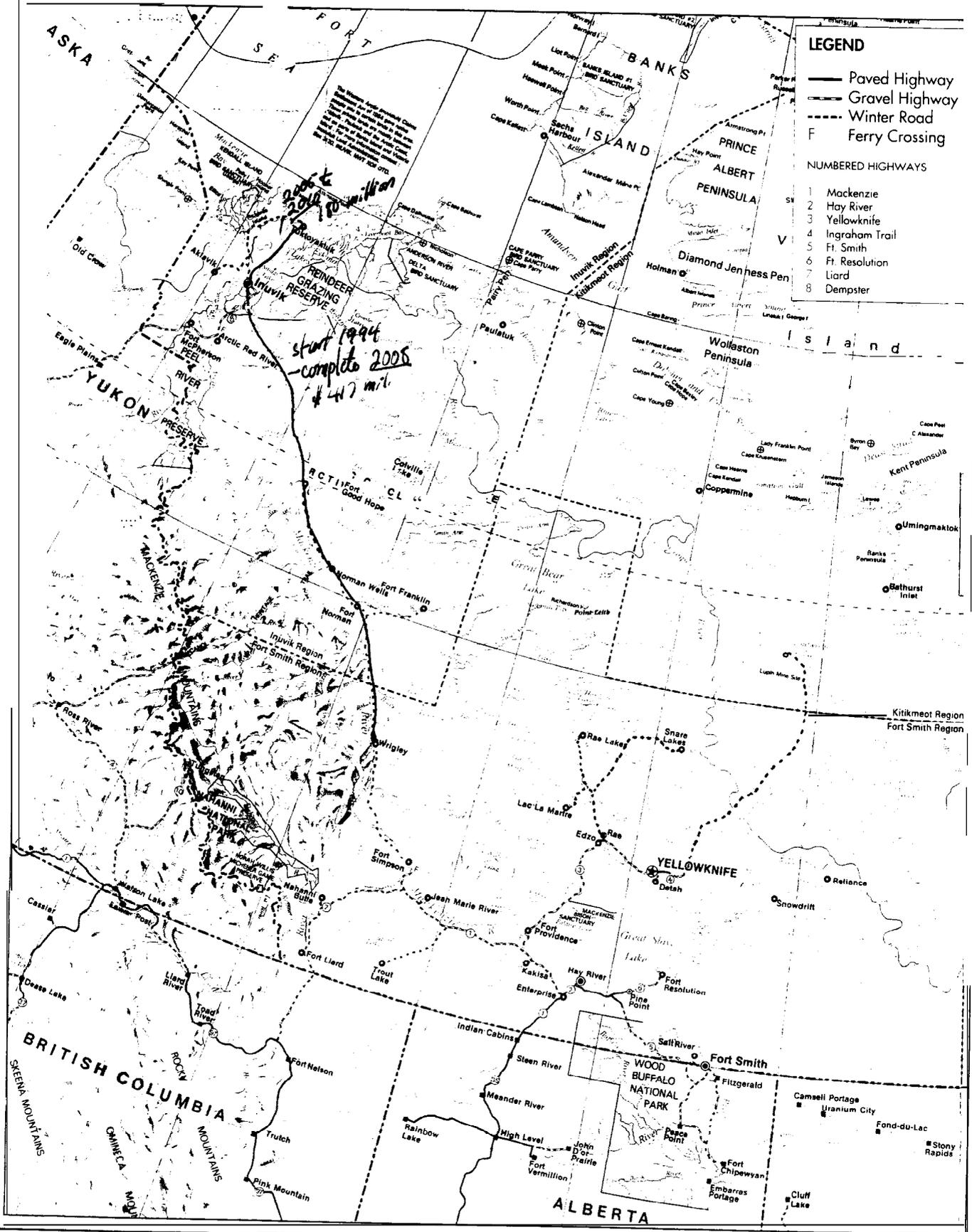
Ownership

Most of the highway system was funded through Indian and Northern Affairs Canada (I.N.A.C.) and constructed by Public Works Canada (P. W.C.). Highway responsibility has gradually been devolving to G. N.W.T.

NORTHWEST TERRITORIES PRIMARY HIGHWAYS



NORTHWEST TERRITORIES HIGHWAYS



Responsibility for highway and ferry operations and maintenance was transferred to the G. N.W.T. in 1981. Responsibility for capital rehabilitation of about half the existing highway system was transferred in 1984. A 1990 agreement has transferred responsibility for capital rehabilitation of all remaining highways, maintenance and marine infrastructure and community access roads. Under this agreement, the G. N.W.T. will also undertake completion of the Wrigley extension of the Mackenzie Highway.

The federal government retains responsibility for any new highway construction and for providing additional funding for O&M and rehabilitation required for these highways. At this time, I.N.A.C. has no plans for any new road construction in the N.W.T.

In negotiating the capital transfers, the basic territorial position was to request funding to meet ongoing rehabilitation needs and to allow upgrading of the highway network to current standards, including paving where it could be justified. In a climate of restraint, the federal position was to provide funding only for necessary rehabilitation and correction of the most severe deficiencies. Paving, if justified by agency or user savings, should be financed by those savings (user pay).

The resulting transfer agreements represent a compromise. Capital funds provided will be adequate to address ongoing rehabilitation, correction of severe deficiencies and a modest long-term program of upgrading and paving.

For example, it would take up to 20 years to complete the reconstruction and paving of the arterial route from the Alberta border to Hay River and Yellowknife (work started in 1984). This route has been identified as part of the National Highway System by the Canadian Council of Ministers of Transportation, and should be accorded a much higher priority.



The N.W.T. has 2200 kilometres of all weather highways

Classification

The Northwest Territories primary highway system includes the eight numbered highways as well as access roads to communities and recreation areas. It also includes a network of seasonal winter roads. It does not include municipal roads or streets or roads funded privately for resource exploration.

Highways are classified according to the nationally recognized system of the Roads and Transportation Association of Canada (R.T.A.C.). All N.W.T. primary highways are Rural Undivided and are categorized as Arterial, Collector or Local, depending on their function. Design speeds range from 50 to 100 kilometres per hour. A rural - collector -undivided highway with a design speed of 80 kilometres per hour is therefore designated RCU 80.

ALL- WEATHER HIGHWAY INVENTORY & CLASSIFICATIONS

CLASSIFICATION	LENGTH km
ARTERIAL 100	
Mackenzie Hwy.No.1 km 0-187	187.6
Hay River Hwy.No. 2 km 0-43.7	43.7
Yellowknife Hwy. No. 3	351.3
SUBTOTAL	582.6
COLLECTOR 90	
Mackenzie Hwy.No.1 km 187-693	504.9
Fort Smith Hwy.No.5	266.0
Fort Resolution Hwy.No.6	90.0
Liard Hwy. No. 7	254.1
Dempster Hwy. No. 8	267.1
SUBTOTAL	1382.1
COLLECTOR 80	
Ingraham Trail, Hwy. No. 4	69.2
Kakisa Lake Access	12.9
Ft. Simpson Access	3.4
Ft. Providence Access	5.5
Rae access	10.5
Detah Access	11.3
Hay R. Indian Village Access	14.2
Ft. Liard Access	5.3
SUBTOTAL	132.3
LOCAL 70	
Hay River Highway km 43.7-48.6	4.9
Yellowknife Access	1.7
Ft. McPherson Access	1.1
Inuvik Access	0.6
Inuvik Marine Bypass	3.9
Miscellaneous minor access	1.1
SUBTOTAL	16.6
LOCAL 50	
Miscellaneous minor access	36.8
LOCAL 50 (1 lane)	
Nanisivik-Arctic Bay Rd	37.9
Miscellaneous minor access	25.3
SUBTOTAL	63.2
TOTAL	2213.6



There are about 1800 kilometres of seasonal winter roads,

Standards

Design standards are also based on R. T.A.C. guidelines. The design road width and the alignment, sight distance and grade standards are based on the design speed and traffic volumes.

For all-weather roads, the selection of road surface type (gravel, treated gravel or pavement) is based on a detailed analysis of safety and economics for each road section.

Traffic

Traffic volumes vary widely throughout the system. There is an ongoing program of mechanical and visual counts and surveys to monitor changes in the number, type and size of vehicles on the system.

Currently the arterial routes between the Alberta border and Hay River and Yellowknife carry more than 50% of the estimated 120 million vehicle kilometres driven on the highways each year.

Overall traffic volumes have been growing by a steady 4% per year over the last 10 years.

Current Expenditures

As noted, although the federal government retains responsibility for new road funding, no activity is planned.

G. N.W.T. Department of Transportation estimated highway expenditures for 1990/91 total \$43.8 million. This includes highway maintenance, ferry operations, capital rehabilitation and upgrading, motor vehicles and management of these activities. It includes amounts negotiated in the most recent federal trans-

NORTHWEST TERRITORIES HIGHWAYS - GEOMETRIC DESIGN STANDARDS

DESIGN YEAR TRAFFIC		DESIGN SPEED km/h	USEABLE WIDTH m	MINIMUM PAVEMENT WIDTH m	MIN CURVE RADIUS m	STOPPING SIGHT DISTANCE: m	MIN SAG k	MIN CREST k	MAX GRADIENT %
PSADT	PSADTT								
3)0-10(0) or 100-200"	.15	100	10	8	390	200	50	70	6
		90	9	7.5	300	170	40	55	6
		80	8.5	7.5	230	140	30	35	x
100-20(1"	.15	70	8	7	170	110	25	22	8
		90	8.5	7.5	300	170	40	55	6
		80	8	7.5	230	140	30	35	8
		70	7.5	7	170	110	25	22	8
.100		50	7	6.5	80	65	11	7	10
		90	8	na	300	170	40	55	6
		80	7.5	na	230	140	30	35	8
		70	i	na	170	110	25	22	8
<30		50	6.5	na	80	65	11	7	10
		50 (1 lane)	4	na	80	130	11	18	10

NOTES:

Traffic PSADT, peak season (3 consecutive months) average daily traffic.
PSADTT, peak season average daily truck traffic.
For PSADT > 1000 refer to R. T.A.C. standards.

Width: For sideslopes steeper than 4: 1 add 0.5m rounding to each shoulder.
Allow 0.5m additional shoulder width if guardrail required.
Design width to allow for projected strengthening/resurfacing within design life.

fer, as well as amounts approved in the G. N.W.T. main estimates.

Not included are estimated Department of Finance revenues from highway gasoline tax and motive diesel tax totalling \$5.2 million.

User Costs

Definitive costs and rates are difficult to obtain. However, there is some statistical data indicating the magnitude of highway user costs.

A recent Transport Canada study suggests an average per-kilometre direct operating cost of \$1.14 for heavy trucks and \$0.35 for light trucks and cars. The report also suggests that these averages increase to \$1.26 and \$0.40, respectively, for operating on gravel roads.



Most N.W.T. primary highways are narrow, rough and dusty.

Based on the total volume and mix of vehicles on the highway system, this results in an estimated total direct user cost of \$57.6 million for the 115 million vehicle kilometres logged in 1989. It should be noted that direct costs include vehicle depreciation, fuel and maintenance only. The total operating expenses for commercial vehicles are at least double the figure noted.

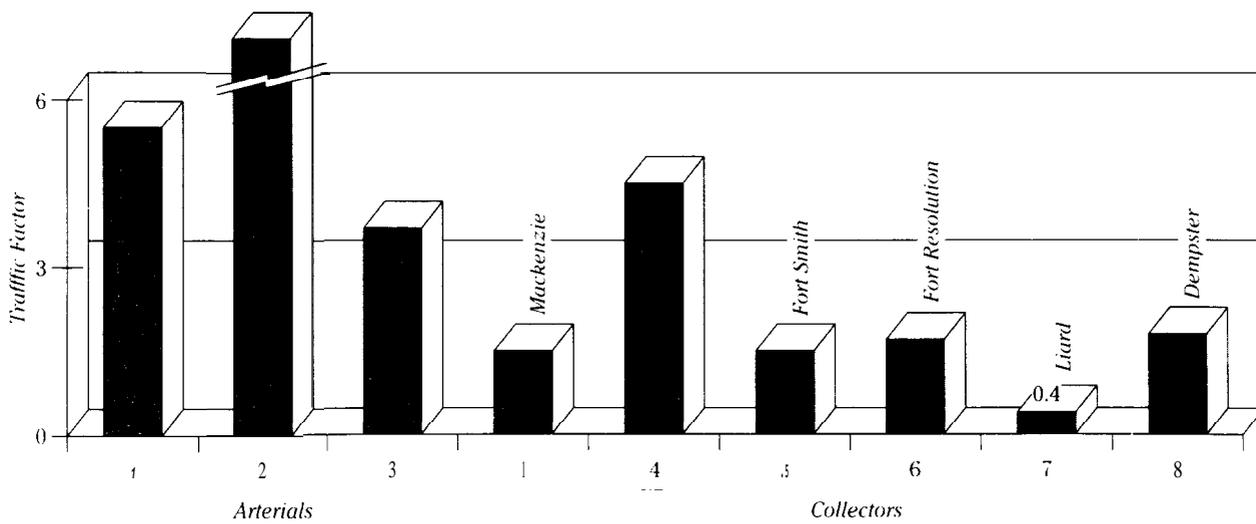
In 1986, class 1, II & [11 trucking companies (those with revenues exceeding \$100,000) reported N.W.T. operating revenues of \$37.7 million on shipments of 245,000 tonnes. This represented movements of 350 million tonne-kilometres at an average rate of \$0.11 per tonne-kilometre. These figures are for shipments which originated in, or were destined for, the N.W.T.

Published tariffs are available from commercial trucking companies for a variety of points served. These tariffs vary significantly depending upon the size of shipment and the commodity type. Furthermore, major customers can normally negotiate rates below the published tariffs.

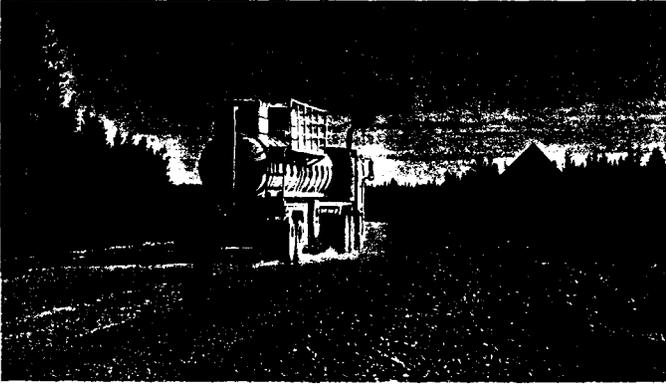
1.3.2 Problems

The major public and business concerns are the generally narrow, rough and dusty conditions of our highways and the effects these conditions have on vehicle operating costs, public safety and discouragement of tourism. These concerns are well founded. Sixty per cent of our primary highways fail to meet minimum standards for width. Only 14% are currently paved, with

TRAFFIC FACTORS - NWT NUMBERED HIGHWAYS

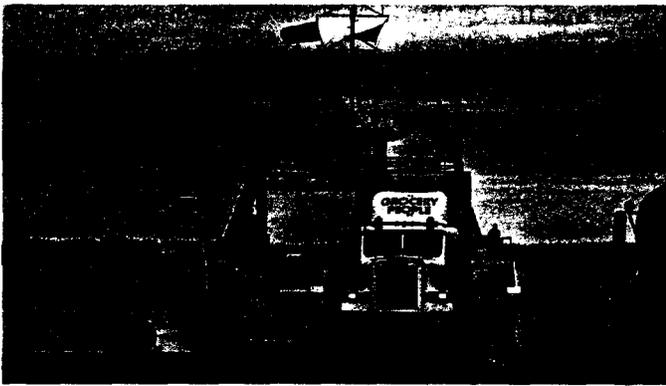


an additional 14% having calcium chloride dust control. Under these conditions, driving Northwest Territories highways is generally regarded as an ordeal for both driver and vehicle.

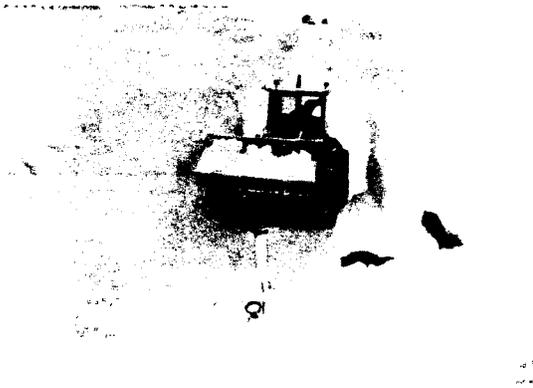


Many highways do not meet alignment standards,

There are also complaints about the twice yearly interruptions in service when neither ferries nor ice bridges are operational. The Liard River, Peel River and Arctic Red River crossings are closed for up to four weeks at freeze-up and two to four weeks at spring break-up,



Ferry service is disrupted at spring break-up and fall freeze-up.



Snowdrifting on the Dempster Highway.

while the Fort Providence crossing of the Mackenzie River suffers some disruption in the early winter and about four weeks closure in the spring.

More specific localized concerns include winter road conditions and completion of the Wrigley extension of the Mackenzie Highway for year round use.

In summary, there are six main user concerns stemming from current highway conditions:

1. Safety
2. Vehicle Operating Cost
3. Discouraged Tourism
4. Ferry/Ice Crossing Interruptions
5. Winter Road Conditions
6. Wrigley Extension Completion

The Department is also concerned with rising maintenance costs resulting from declining reserves of readily accessible gravel surfacing material. Economic reserves have been severely depleted on sections of the Mackenzie, Hay River, Yellowknife, Liard and Dempster Highways. This problem is aggravated where increasing traffic is accelerating the loss of surfacing material.

1.3.3 Program Objectives

Detailed analyses have been conducted on a variety of options for eliminating or mitigating the problems described above. This has resulted in 8 program objectives:

1. Maintaining What We Have

First and foremost, ongoing operation and maintenance functions must be performed just to maintain the current levels of service. This includes a variety of activities ranging from gravel surface blading, to operating ferries, to opening winter roads. Bridges, culverts, pavements, roadway embankments, ferries and maintenance equipment also require periodic capital refurbishment or replacement. The majority of current expenditures on the highway system are required simply to maintain and replace what we have.

2. Highway Upgrading

Road reconstruction is required on many road sections to correct width and alignment and to bring highways to an acceptable standard.



Paving arterial highways improves safety, reduces costs and helps attract tourists.

3. Highway Paving

Although costly, paving will improve safety, reduce vehicle operating costs and help attract tourists. It will also significantly reduce maintenance costs, especially where gravel reserves for road resurfacing are depleting.

4. Gravel Surface Improvements

Paving the entire highway system is not feasible. However, significant improvements to gravel highways can be made. It is proposed to provide higher quality (and more costly) gravel and use calcium chloride or other additives to stabilize the surface and control dust.

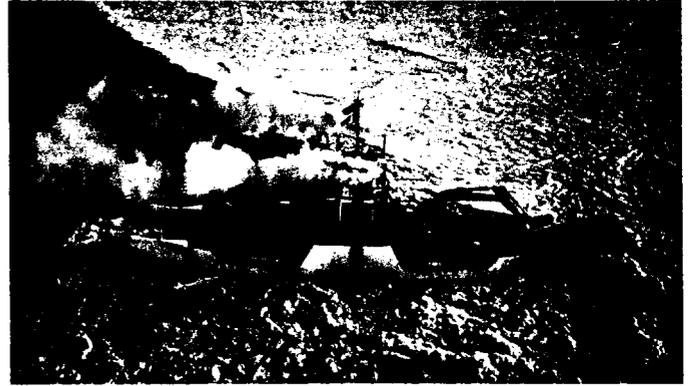
5. New Bridges

Bridges have been proposed or requested at virtually every location now served by ferry. In the short term, a bridge may be feasible connecting Arctic Red River to the Dempster Highway. Such a bridge would provide year-round road access for Arctic Red River residents to the airport at Fort McPherson, enhance the tourism potential of this community and obviate the need for ferry service. In the medium to long-term, bridge alternatives may be justified at the Fort Providence, Fort Simpson and Fort McPherson ferry crossings. Conventional bridge designs have proven too costly to consider. The feasibility of lower cost structures should be aggressively pursued. It is unlikely that bridge crossings of the Mackenzie River at Camsell Bend or Arctic Red River will be viable in the foreseeable future.

6. Ice Crossing Improvements

Unless and until bridges are constructed, river crossings at four (soon to be five) locations are interrupted

for 2 to 4 weeks during freeze up and break up, due to ice conditions and/or low water levels. Efforts should be pursued to minimize these service interruptions. For example, conditions at the Fort Providence crossing have allowed this ferry to operate intermittently well into January, when the ice bridge has formed. Research is also being conducted on methods of accelerating ice bridge formation. A shallower draft replacement vessel is proposed for the Liard River crossing, to better cope with low water levels in the fall. Such efforts should continue and should include examination of new technologies for vessel design and ice management.



The Fort Providence ferry operation has been extended through freeze-up,

7. Winter Road Improvements

Winter roads provide a relatively low cost seasonal access. Existing winter roads can be improved by providing temporary bridges where river and stream crossings delay openings or cause premature closings due to slow ice growth or overflows. Alignment improvements can also be made. For some communities, winter roads are provided only in some years. Roads to Snare Lakes, Colville Lake, Snowdrift and Fort Good Hope should be constructed annually. A winter road



Winter roads can be improved and extended at a relatively low cost.

connection linking Pelly Bay to sealift access should be investigated as an alternative to the current airlift of fuel and cargo.

8. Wrigley Extension Completion

An all-weather highway grade exists between Fort Simpson and Wrigley. Completion of this extension requires a ferry crossing at Camsell Bend, a bridge at the Willowlake River and gravel surfacing between Camsell and Willowlake.

1.3.4 Program Schedule and Costs

The following tables show the estimated capital and maintenance costs by task over the next 20 years for accomplishing each of the stated program objectives. Each task may represent a single major project or a series of smaller projects.

Under capital, the first three program objectives have been combined for practical reasons. By the time a facility has deteriorated to the point where rehabilitation or replacement is required, upgrading is usually warranted. For example, the Yellowknife Highway is overdue for reconstruction to restore the subgrade, drainage and cross section. The marginal cost of widening the highway to meet current standards will add about 10% to the cost. Strengthening and paving at the time of reconstruction will double the cost. These proportions would vary significantly for other projects. However, in all cases it is least costly to include upgrading when reconstruction or replacement is required.

Annual capital expenditures proposed over the first five years average \$32.7 million, but fall by nearly 50% in subsequent years as the backlog of overdue reconstruction and upgrading work is cleared.

Operation and Maintenance expenditures will experience forced growth in real terms due to increasing traffic and depletion of granular reserves. This will be offset by programmed paving. Proposed level of service improvements are noted, representing an overall increase of about 18% in the annual O & M expenditures.

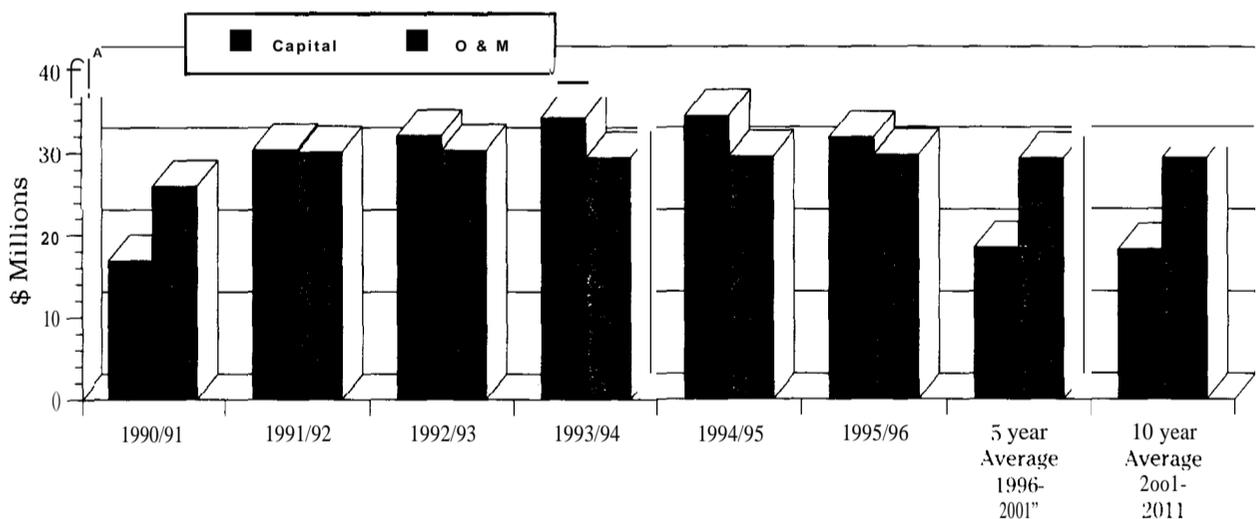
In addition to meeting necessary replacement and rehabilitation needs, this program will accomplish in the first 5 years:

- near completion of the reconstruction and paving of the arterial route to Yellowknife.
- completion of the reconstruction and paving of the Inuvik, Rae, Ft. Simpson, and Ft. McPherson access roads.
- commencement of reconstruction of the Dempster Highway.
- completion of the Wrigley extension of the Mackenzie Highway.
- a completely dust free highway system.
- construction of a bridge linking Arctic Red River to the Dempster Highway.
- significant improvements to winter roads and ice crossings.
- replacement of the Liard River ferry at Fort Simpson.

The second 5 years will feature:

- completion of the Dempster reconstruction.
- commencement of the reconstruction and paving of the Ft. Resolution and Ft. Smith Highways and the Ingraham Trail.

HIGHWAY PROGRAM COSTS



HIGHWAY PROGRAM CAPITAL (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97 2000/01	Total 2001/02 2010/11	20year TOTAL
1 Maintaining									
2 Highway Upgrading									
3 Highway Paving									
Pre-engineering	350	350	350	350	350	350	1650	3500	7250
Bridges & Culverts	580	580	580	580	580	580	5500	8000	16980
Pavement overlays	800	2200		2200	2950		3000	36000	47150
Mackenzie 0-187	6440	6500	6250						19190
Yellowknife 0-338	3005	9760	15500	20500	21500	21000	5000*		96265
Dempster 0-257	2545	1650	550	1500*	3000	6000	31000		46245
Ft Smith 60-266							11000	31000	42000
Ft Resolution 28-90							8000	5000	13000
Mackenzie 187-471								14000	14000
Liard 0-254	55							25000	25055
Ingraham 0-69							5000	15000	20000
Access Roads	220	3050	2270	1500	1500	1500	7500	15000*	32540
Maintenance Infrastructure	1610	1670	2260	1800	2200	2000	10000	20000	41540
Marine Infrastructure	540	3850	720	500	500	500	5000	10000	21610
5 New Bridges				2000	2000				4000
6 Ice Crossing		500	500	1000					2000
8 Wrigley	820	350	3230	2500					6900
TOTAL CAPITAL	16965	30460	32210	34430	34580	31930	92650	182500	455725

HIGHWAY PROGRAM ANNUAL OPERATIONS & MAINTENANCE (1990 \$000'S j

PROGRAM OBJECTIVE/TASK	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97 2000/01	Average 2001/02 2010/11	20year AVERAGE
1 Maintaining								
Highway operations & Mtc	18267	18267	18267	18267	18267	18267	18267	18267
Ferry operations & Mtc	4825	4825	4825	4825	4825	4825	4825	4825
Planning & Const. Mgmt	2727	3500	3500	3500	3500	3200	2800	2960
4 Gravel Surface Imp	149	2000	2000	1000	1000	500	500*	700
6 Ice Crossing			200	300	400	400	400*	365
7 Winter Roads	50	1600*	1600	1600*	1600	600	600	1600
8 Wrigley						2000	2000	2000
TOTAL	26018	30192	30392	29492	29592	29792	29392	29517

1.4 COMMUNITY LOCAL ACCESS ROADS

1.4.1 The Current Situation

Background

There has been considerable interest over the years for local access roads from communities to nearby attractions. These attractions may include recreational sites, camps, archeological sites, local resources, river portages and access to open water or to ice in support of fishing, hunting and tourism opportunities.

Such requests do not fall within existing G. N.W.T. municipal mandates such as water and sanitation or community granular programs. Although the federal D. I. A.N.D. Northern Roads Program allowed for such projects, there was little interest and even less funding made available. Only two such roads have been built under this program: the Ft. Resolution - Nagel Channel Road and the Arctic Bay - Victor Bay Road. In a few other cases, local initiative has led to 'informal' development of roads and trails.



Arctic Bay - Victor Bay road is an example of a community local access road.

In the 1990 transfer of highway reconstruction to the G. N. W. T., a small funding base was negotiated for such community access roads. This is now a G. N.W.T. program responsibility.

Classification and Standards

Depending on the intended purpose of these roads, they may be required on a seasonal basis (winter, summer, fair-weather) or for restricted vehicle use (four by four, all terrain vehicle, light traffic only). They may also



There is a desire for improved access to areas of local interest near communities.

be subjected to very low traffic volumes and/or very low operating speeds.

In summary, the road needs may range from a rudimentary seasonal ATV trail to an all-weather two lane rural local road. In some cases, it may also be acceptable to start with a very low standard and upgrade over a period of years. In fact, most of the requested roads follow some sort of existing route.

Under these conditions, it is not necessary or even advisable to establish a classification system or set of design standards as has been done for highways. Such a system may tend to result in overdesign and costs which put a proposed project out of reach.

This is not to say that a project should be developed without careful consideration of land use, environmental, safety or engineering factors. Rather, each trail or road should be examined on the basis of the intended vehicle types and season(s) of use, the expected traffic volume and local conditions, such as soil, drainage, permafrost, snowdrifting, environmental issues, etc.

Current Expenditures

As noted, this program was transferred to G. N.W.T. in 1990. The approved 1990/91 capital expenditures total \$250,000. Under existing funding, it is proposed to increase this expenditure base over the next few years to the range of \$1 million per year. This will not be adequate to address the need.

1.4.2 Problems

The major problem with this program is a lack of progress. Community consultations have highlighted

local access roads as a high priority. Forty-nine requests have been received from 36 communities for the construction or upgrading of a variety of roads and trails.

Analysis of the estimated costs and benefits shows that many of these proposals are viable. This is particularly true where local construction costs and/or the scope of the project are relatively modest.

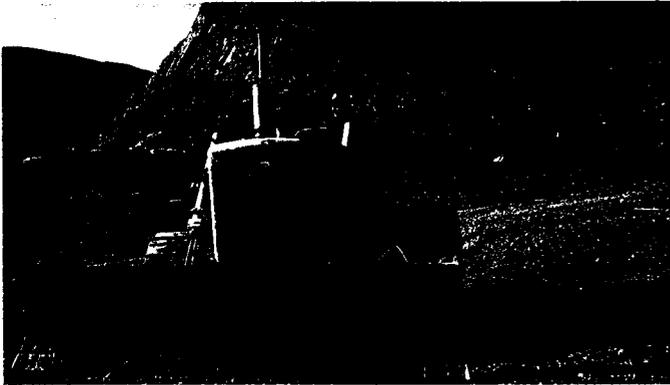
This being a new program, the government faces the challenge of developing mechanisms for prioritizing projects and ensuring effective and efficient program delivery. There is also a question of responsibility for ongoing maintenance of these roads.

1.4.3 Program Objectives

There are two program objectives:

1. Effective, Efficient Program Delivery

Adequate funds should be provided to respond to those requests where the estimated benefits are shown to exceed costs. Costs should be minimized by ensuring design and construction standards appropriate to the situation. The program should also be responsive to community initiative, with cost sharing and/or contribution arrangements encouraged. This approach should result in the benefits



Local access roads should be constructed with maximum community participation.

associated with local commitment to, and proprietary interest in, the project.

2. Establish Maintenance Plan

Once constructed, it will be logical to include local access roads on the inventory of municipal roads and streets. Maintenance grants and contributions should therefore be calculated and provided in the same way, through the Department of Municipal and Community Affairs. It will therefore be necessary to ensure that adequate maintenance funds are made available as the inventory expands.

1.4.4 Program Schedule and Costs

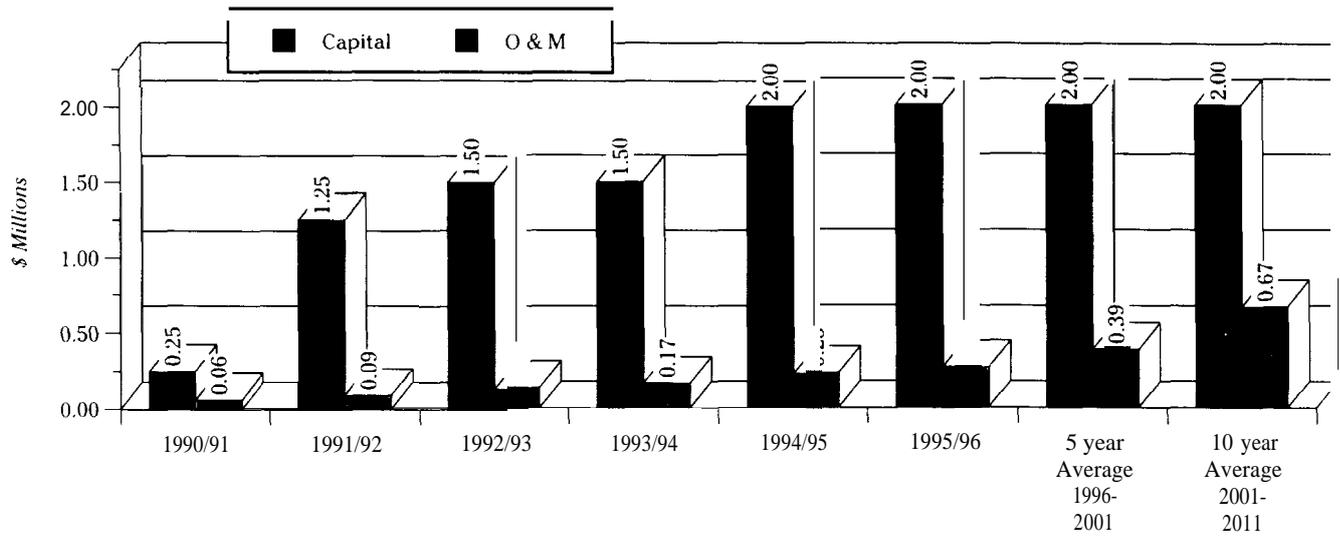
Preliminary economic analysis of all proposed projects indicates that 18 community local access roads are currently viable. The total estimated cost of these projects is \$10 million. Other projects will require only a small increase in identified benefits or a small decrease in project cost to be viable. It is also likely that as this new program gets under way, new projects for the construction or upgrading of local roads and trails will be identified.

Proposed capital and maintenance expenditures are shown on the following table. This level of capital expenditures will be adequate to complete all currently viable projects within six years. As noted, these funds can be stretched further and more can be accomplished where cost sharing or 'sweat equity' is provided at the community level.

Maintenance will be required, commencing in the year following completion of construction. An estimate of 2% of the capital cost is used for annual maintenance needs. Annual program maintenance is therefore 2(X of the cumulative capital cost.

A small cost component, amounting to 5% of the program capital, is allocated for planning and program administration.

COMMUNITY LOCAL ROADS PROGRAM COSTS



COMMUNITY LOCAL ROADS PROGRAM CAPITAL (1990 \$000'.S)

PROGRAM OBJECTIVE/TASK	Current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97 2000/01	Total 2001/02 2010/11	20year TOTAL
1 Program Delivery	250	1250	1500	1500	2000	2000	10000	20000	38250
TOTAL CAPITAL	250	1250	1500	1500	2000	2000	10000	20000	38250

COMMUNITY LOCAL ROADS PROGRAM OPERATIONS & MAINTENANCE (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	Current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97 2000/01	Average 2001/02 2010/11	20year AVERAGE
1 Program Delivery	60	60	75	75	100	100	100	100	96
2 Road Maintenance		30	60	90	130	170	290	570	382
TOTAL O & M	60	90	135	165	230	270	390	670	477

1.5 MARINE FACILITIES

1.5.1 The Current Situation

Inventory

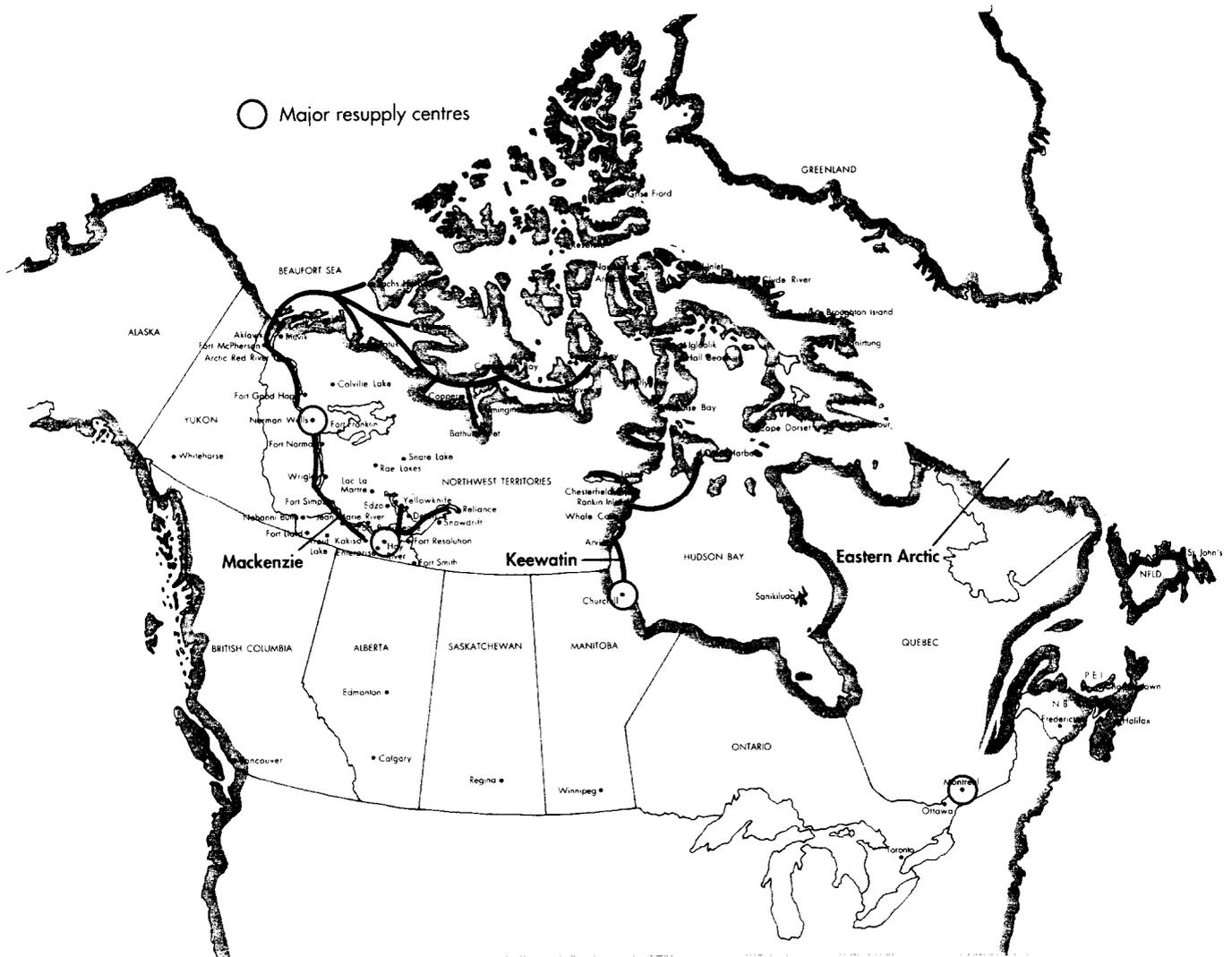
Marine facilities in the North have two main components - the waterways and terminal facilities. Our waterways are provided by nature and include the oceans, seas, rivers and lakes. It is often necessary to improve these waterways. Dredging may be required to improve channels and periodically remove deposited silt. Navi-

gation aids may be provided to assist in negotiating safe routes. In arctic conditions, ice breaking escorts may also be required to ensure safe passage.

Terminal facilities include wharves, breakwaters, landings, marshaling areas and other infrastructure required for the loading, unloading, protection and repair of vessels.

Sixty-one of the sixty-two N.W.T. communities have waterfront locations. Communities rely heavily on these water bodies for access to subsistence hunting and fishing. Forty-six N.W.T. communities also receive or ship significant quantities of fuel and/or dry cargo

MARINE RESUPPLY ROUTES



by water. Hay River, Norman Wells and Nanisivik are major shipping centres for outgoing cargo.

N.W.T. navigable waterways consist of three resupply systems. The Eastern Arctic is supplied by sealift from Montreal. The Keewatin, as far north as Coral Harbour, is supplied by barge out of Churchill. The Mackenzie Valley - Western Arctic is served from Hay River, Norman Wells (petroleum products) and to a lesser extent, Inuvik. Over the last two decades, marine resupply has been partially or completely displaced by roads at several locations.



Extensive terminal facilities exist at only a few locations (Hay River).

Terminal facilities at communities vary widely. Extensive facilities exist at Hay River, Inuvik and Tuktoyaktuk. Most communities have some modest, often rudimentary, or makeshift facilities. A few have little more than what nature has provided.

Ownership

Ownership and responsibility for marine facilities is poorly defined.



The Canadian Coast Guard provides ice breaking escorts in the short Arctic shipping season.

Transport Canada - Canadian Coast Guard has a mandate for providing navigation aids, dredging, ice escort and public terminal facilities in support of resupply activities. CCC also co-ordinates the Eastern Arctic sealift. The department administers its responsibility in the North through two regions.

Fisheries and Oceans Canada has a mandate for providing port and harbour facilities in support of commercial fishing and recreation.

In 1984, the G. N.W.T. established a community wharves program. This program was intended to provide facilities in support of small boats and floatplanes for local fishing, hunting and tourism. This program overlaps the Fisheries and Oceans program to some extent.

Several resource development and transportation companies have also constructed 'private' facilities (Hay River, Yellowknife, Norman Wells, Tuktoyaktuk, Nanisivik, Polaris).

A variety of small wharves have been constructed by tourism operators and through local initiative. The ownership of many such existing facilities is unclear.

Classification

Public marine activity in the north falls into two categories.

The **Marine Resupply Activity** involves the annual movement of bulk goods, including fuel and dry cargo. This is accomplished by relatively large craft, including barges and ocean-going ships. The activity is usually characterized by a short period of chaotic activity at each arrival. In most cases, this is one to three landings per season.



Ships must bring a full year's supply of dry cargo and fuel

Local Marine Activity involves relatively small craft utilized for commercial or subsistence harvest of local marine resources including fish, seals, whales, shellfish and other marine species. Local marine activity would also include access to land-based hunting activities, non-renewable resources (eg. soapstone), movement of supplies by small craft and local tourism and recreation. Facilities may also support float plane activity.

Recognizing the distinct nature of these two activities, a separate classification system for each has been developed. Resupply 'A', 'B' or 'C' classifications are established on the basis of the volume of goods handled. Local 'A', 'B' or 'C' classifications are established depending on population and the existence of commercial harvest.



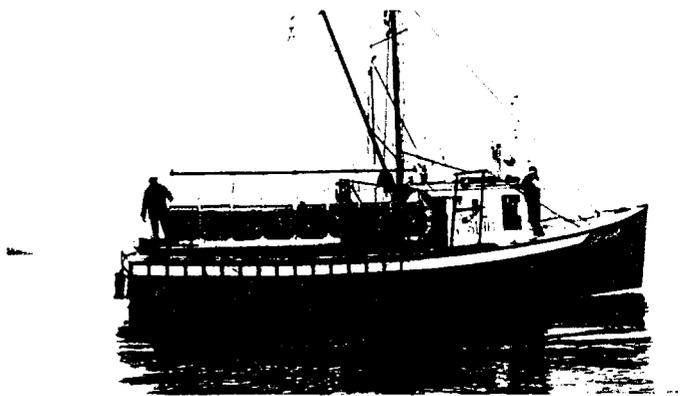
Small craft support subsistence harvest for most of the N.W.T. population,

Standards

Site to site variations in such natural features as water fluctuation, ice conditions, hydrology, wind, geology and topography require considerable flexibility in establishing optimum solutions. The objective of providing a prescribed level of service remains the same.

Standards are therefore based on level of service requirements, rather than standard solutions. In some cases, considerable investment in facilities will be required. In other cases, most or all of the level of service criteria are provided by nature. For example, a good natural harbour with favorable tidal conditions and a stable beach area may satisfy most of the requirements of a class B resupply facility and a class A local facility. In such a case, it may only be necessary to identify and protect land use areas for marshaling and an access easement and provide deadmen for anchorage.

At the other extreme, it may be necessary to provide dredging, navigation aids, breakwaters, ice protection,



The potential for commercial marine harvest is only beginning to be developed.

fixed or floating wharves, marshaling areas, moorage and/or access roads to satisfy the class standard.

In developing facilities for any site, all marine activities should be considered and all users consulted. It may be desirable to provide facilities serving multiple users or conversely, to ensure that facilities are separated to minimize potential conflict.

Traffic

The level of local marine activity has not been measured. However, several characteristics can be observed. Although the open water season is short, particularly in the arctic regions, marine activity is crucial to the population in supplying marine mammals and fish. This is particularly true in the more traditional native communities, where virtually every household may be expected to participate in marine harvest. In larger centres, recreation and tourism may represent a larger proportion of activity. Float plane activity is generally more prevalent in the Mackenzie Valley, where distances are shorter.

Resupply volumes have been estimated for purposes of classification. The relative volumes moved through each of the three systems show that the Mackenzie River system accounts for 61%, of the total volume with the Eastern Arctic at 27(X) and the Keewatin at a mere 12%. Total N.W.T. marine resupply exceeded 250,000 tonnes in 1988.

The greatest potential for traffic variation exists in the Mackenzie system, which supplies the Beaufort oil and gas exploration and development. For example, construction of a Mackenzie Valley gas pipeline could temporarily push annual freight volumes to as much as 400,000 tonnes, almost tripling the current volume on the Mackenzie.

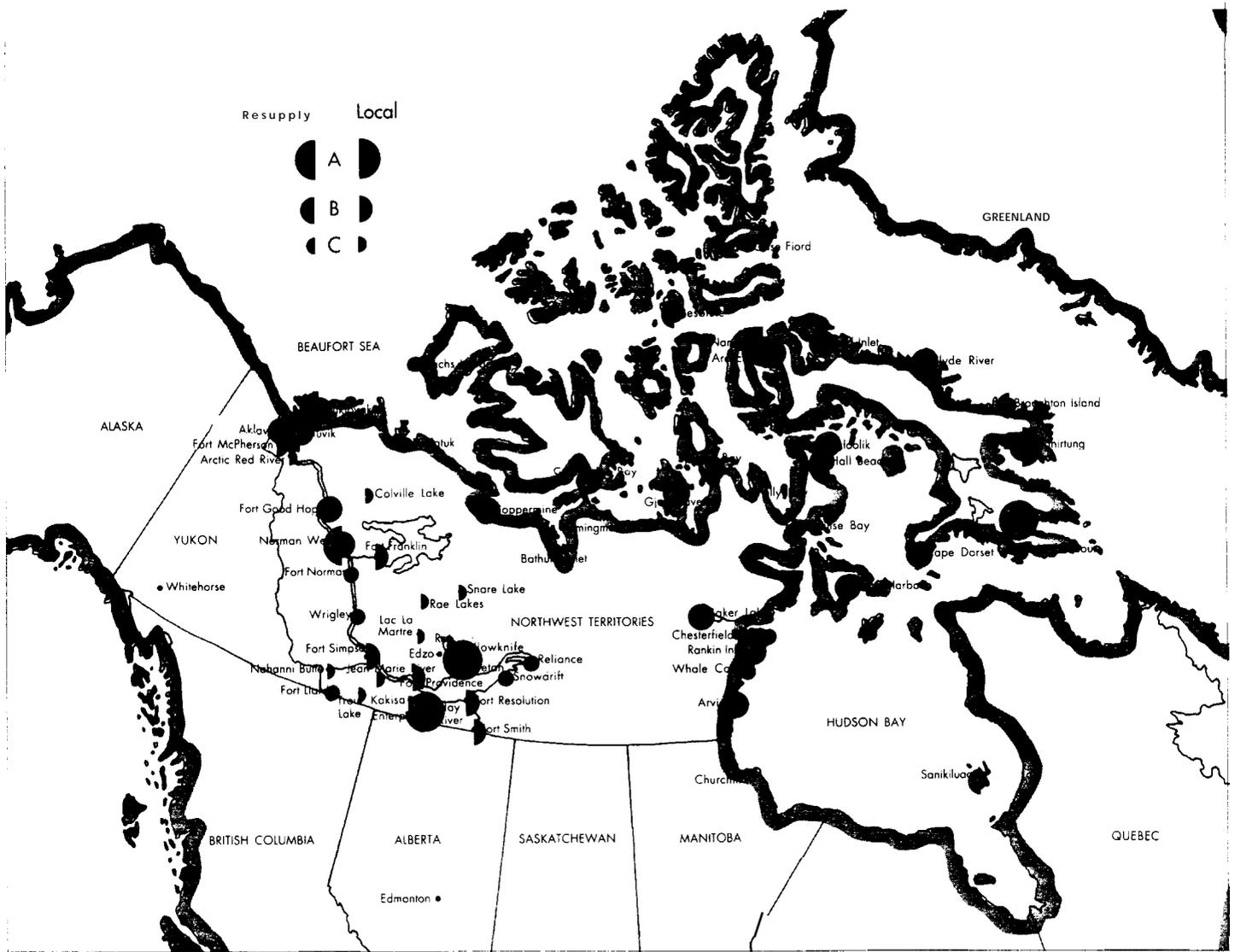
COMMUNITY MARINE FACILITIES CLASSIFICATIONS

COMMUNITY	COMMERCIAL POP FISHERY	LOCAL CLASS	ANNUAL CARGO	RESUPPLY CLASS
Yellowknife	13511 yes	A	>10000 e	A
Iqaluit	3126 yes	A	>10000 e	A
Hay River	2885 yes	A	>10000 e x	A
Inuvik	2773	B	>10000 e	A
Rankin Inlet	1440	B	11111	A
Tuktoyaktuk	970	B	>10000 e	A
Norman Wells	502	B	>10000 e x	A
Hall Beach	485	c	11622	A
Nanisivik	319	c	>10000 e x	A
Pangnirtung	1087 yes	A	4973	B
Arviat	1321	B	4605	B
Baker Lake	1081	B	6480	B
Cambridge Bay	1065	B	>2000 e	B
Cape Dorset	967	B	4028	B
Coppermine	945	B	>2000 e	B
Igloolik	937	B	3797	B
Pond Inlet	909	B	5125	B
Aklavik	762	B	>2000 e	B
Gjoa Haven	742	B	.2000 e	B
Fort Good Hope	589	B	>2000 e	B
Spence Bay	564	B	>2000 e	B
Arctic Bay	554	B	2290	B
Coral Harbour	537	B	2477	B
Clyde River	498	B	2432	B
Sanikiluaq	488	c	2720	B
Broughton Island	473	c	7043	B
Resolute	164	c	2215	B
Fort Smith	2512	B		
Rae-Edzo	1431	B		
Fort Simpson	1000	B		
Fort McPherson	710	B		
Fort Providence	590	B		
Fort Franklin	520	B		
Fort Resolution	498	B		
Repulse Bay	465	c	1846	C
Fort Liard	415	c	.2000 e	C
Fort Norman	365	c	>2000 e	C
Lake Harbour	350	c	1519	C
Holman	335	c	>2000 e	C
Chesterfield Inlet	316	c	1752	C
Snowdrift	256	c	.2000 e	C
Paulatuk	251	c	<2000 e	C
Whale Cove	230	c	1083	C
Wrigley	170	c	<2000 e	C
Sachs Harbour	145	c	<2000 e	C
Bay Chimo	64	c	.2000 e	C
Grise Fiord	52	c	944	C
Bathurst Inlet	16	c	.2000 e	C
Reliance	11	c	<2000 e	C
Lac La Martre	434	c		
Pelly Bay	345	c		
Rae Lakes	221	c		
Hay River Reserve	181	c		
Detah	136	c		
Snare Lake	126	c		
Arctic Red River	114	c		
Nahanni Butte	88	c		
Jean Marie River	67	c		
Trout Lake	58	c		
Colville Lake	52	c		
Kakisa	28	c		

e - estimated

x - major export centre

MARINE FACILITY CLASSIFICATIONS



MARINE FACILITY CLASSIFICATION

ACTIVITY	A	B	C	No Rating
RESUPPLY	> 10,000 t per year dry cargo and fuel in or out	2,000-10,000 t per year	< 2,000 t per year	no marine resupply :
LOCAL	Subsistence harvest for population > 500 and significant commercial harvest	Subsistence harvest for population > 500 or significant commercial harvest	subsistence harvest for population < 500	no local marine activity

MARINE LEVEL OF SERVICE STANDARDS

ACTIVITY	A	B	C
RESUPPLY	protected access at all tide or water levels secure moorage for loading/unloading fuel & dry cargo access for heavy equipment secure marshaling or storage area	protected access at all tide or water levels secure moorage for loading/unloading fuel & dry cargo at least 4 hrs daily access for heavy equipment secure marshaling or storage area	access for loading/unloading fuel & dry cargo at least 4 hrs daily access for heavy equipment adequate marshaling or storage area
LOCAL	secure moorage protected access for loading/unloading all tide or water levels access for loading/unloading equipment access for seasonal launching/haulout	secure moorage protected access for loading/unloading at least 4 hours daily access for loading/unloading equipment access for seasonal launching/haulout	secure moorage protected access for loading/unloading at least 4 hours daily

Current Expenditures

For 1990, the G. N.W.T. will spend an estimated \$750,000 on community wharves. No estimate of overall federal government expenditures is available.

User Costs

General merchandise costs for both the Eastern Arctic and Keewatin range from about \$600 to \$700 per tonne for a typical 5 tonne shipment. This includes packing at source and cartage at destination. Keewatin rates also include rail costs from Winnipeg to Churchill. These rates vary with shipment size and type.

Comparable Western Arctic rates vary from about \$400 to \$800 per tonne, including trucking from Edmonton to Hay River.

Bulk fuel shipping costs average \$100 per tonne in the Baffin, \$200 per tonne in the Keewatin and range from \$30 to \$340 per tonne from Norman Wells to Western Arctic destinations.

Only the Eastern Arctic marine system can carry refrigerated cargos.

1.5.2 Problems

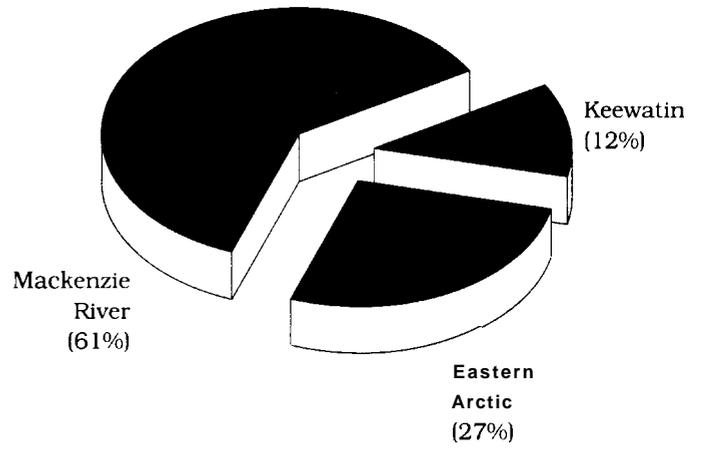
Marine systems in the North have suffered from a lack of co-ordination and integrated planning amongst the various agencies involved. There has been, with a few exceptions, little attention paid to terminal facilities for resupply or local activity, especially in recent years. Current CCG policy in particular emphasizes cost recovery/user pay in ports programs.

Facilities for resupply at many communities fall short of any standard. Cargo and fuel handling is difficult, and in some cases hazardous. Environmental hazards are also a concern at some locations.

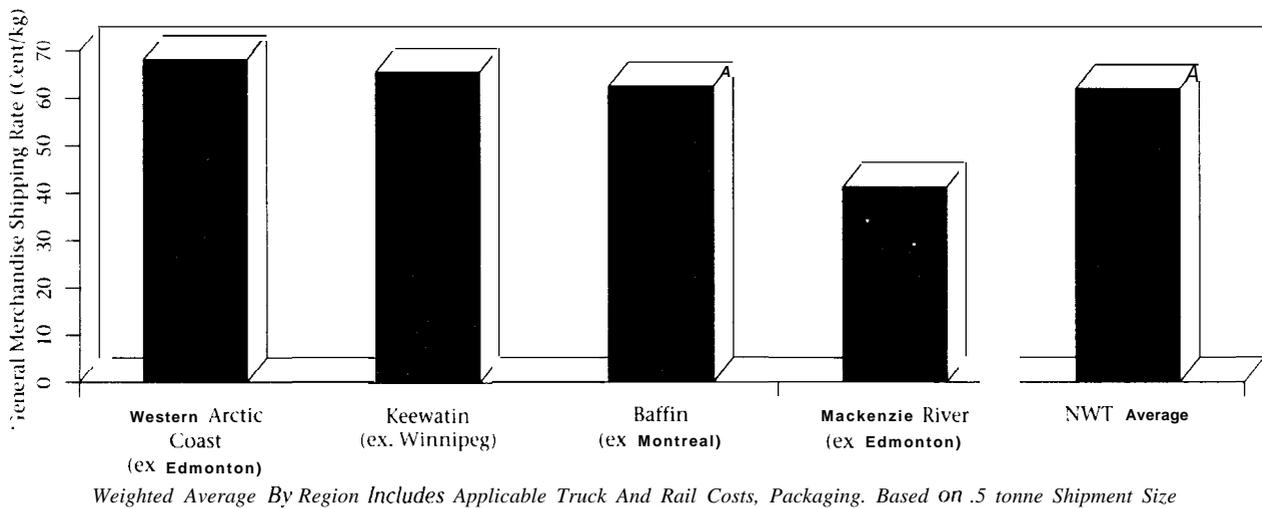
For most communities, local marine facilities are either non-existent or inadequate. This problem has, and will continue to become more serious as residents invest in larger craft.

There is a growing interest in harvesting the coastal fisheries in the Keewatin and Eastern Arctic. However, few locations have suitable facilities to support commercial fishing fleets.

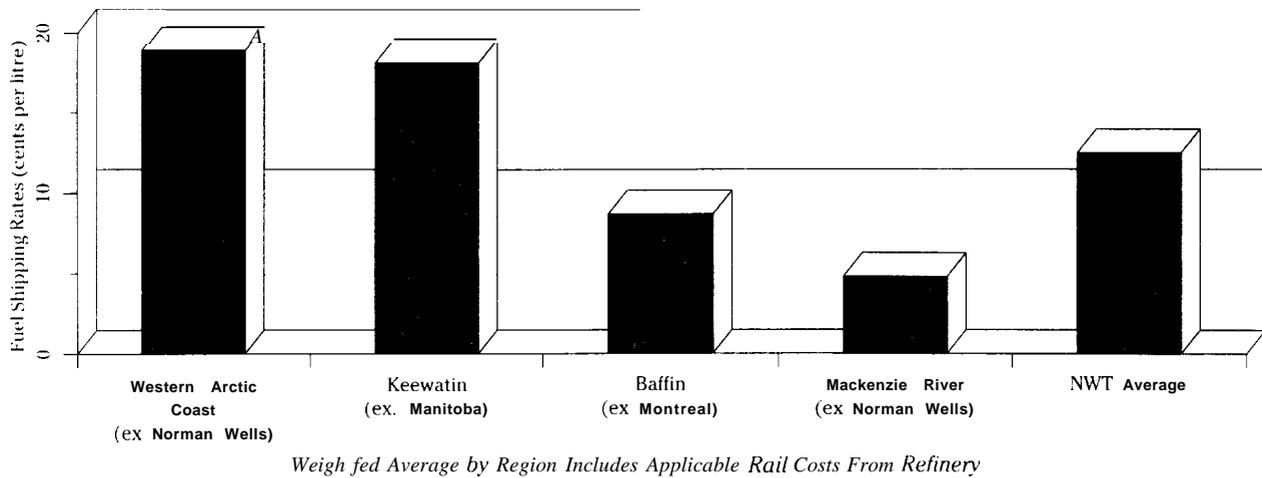
MARINE RESUPPLY TRAFFIC DISTRIBUTION BY SECTOR



MARINE SHIPPING RATES - GENERAL MERCHANDISE



MARINE SHIPPING RATES - BULK FUEL





Local marine facilities are non-existent or inadequate at most communities (Pangnirtung).

Highway improvements in the south Mackenzie and construction of the Dempster Highway have contributed to a steady decline in Mackenzie River traffic. Traffic has been further eroded by reduced oil exploration activity in the Mackenzie Valley and Beaufort. Under current conditions, it is estimated that Northern Transportation Company Limited (NTCL) could more than double current barge volumes, with no river improvements or fleet expansion. Furthermore, any temporary traffic overload resulting from pipeline construction could be eased by shipping from the west coast to the Beaufort.

Nevertheless, there are strong arguments for improvements to the Mackenzie River waterway. The 1987-88 Acres report demonstrated that dredging channel improvements at 26 locations would improve efficiency and reduce operating costs for current and projected traffic. The Mackenzie River remains the largest single shipping route in the Territories and will continue to be viable for many years. A resurgence of oil and gas



Channel improvements on the Mackenzie River have been recommended.

activity and/or construction of a pipeline(s) is probable. These activities could double or triple river system traffic.

There are customer concerns, particularly in the Western Arctic, about the handling and delivery of freight. There are also concerns regarding the relatively high shipping costs of bulk petroleum to the Western Arctic coast.

Given recent cutbacks to rail services in southern Canada, there is some justification for worry about the future of the Churchill rail line and the effects its closure would have on the Keewatin resupply.

1.5.3. Program Objectives

1. Co-ordinate Marine Facilities Programs.

Efforts must be made to co-ordinate the planning, prioritizing and delivery of marine facility programs. These efforts should include government (Canadian Coast Guard, Fisheries & Oceans and G. N.W.T. Transportation) as well as carriers (NTCL, Canarctic) and major customers (oil companies, pipeline companies, DND, G. N.W.T. Government Services & G. N.W.T. Economic Development).

2. Upgrade Marine Resupply Facilities to Standard.

Substandard marine resupply facilities should be upgraded to current level-of-service standards. More work needs to be done to identify and quantify all needs. However, many of the most serious shortcomings are well known. Priority should be given to safety and environmental concerns. The following communities have been identified as high priority for improvement:

Iqaluit	Rankin Inlet
Pangnirtung	Repulse Bay
Sanikiluaq	Coppermine
Paulatuk	Gjoa Haven
Sachs Harbour	Holman
Spence Bay	Aklavik

3. Upgrade Local Marine Facilities to Standard.

Substandard local marine facilities should be upgraded to current level-of-service standards. Priority should be

given to safety and environmental concerns and to promoting and supporting establishment of viable commercial fisheries.

The following communities have been identified as having a high priority for improvement:

Arctic Bay	Resolute
Broughton Island	Sanikiluaq
Cape Dorset	Coral Harbour
Clyde River	Rankin Inlet
Grise Fiord	Repulse Bay
Hall Beach	Whale Cove
Igloodik	Pelly Bay
Iqaluit	Spence Bay
Lake Harbour	Rae Edzo
Pangnirtung	Aklavik
Pond Inlet	

4. Mackenzie River Dredging.

Immediate action should be taken to alleviate the most serious navigational restrictions/hazards on this waterway. Six locations have been identified as having priority. Longer-term needs should be the subject of ongoing evaluation.

5. System Studies.

Five areas have been identified which warrant further study:

- 1) Keewatin resupply options
- 2) Western Arctic coast shipping costs
- 3) Marine access to Pelly Bay
- 4) Containerization/other systems approaches to cost/damage reductions.
- 5) Potential for high speed marine transportation of passengers and freight.

1.5.4 Program Schedule and Costs

The following tables show the estimated capital and maintenance costs over the next 20 years for accomplishing each of the stated program objectives. Each task may represent a single major project or a series of smaller ones.

Annual capital expenditures average \$4.2 million over the first 5 years and \$3.8 in subsequent years.

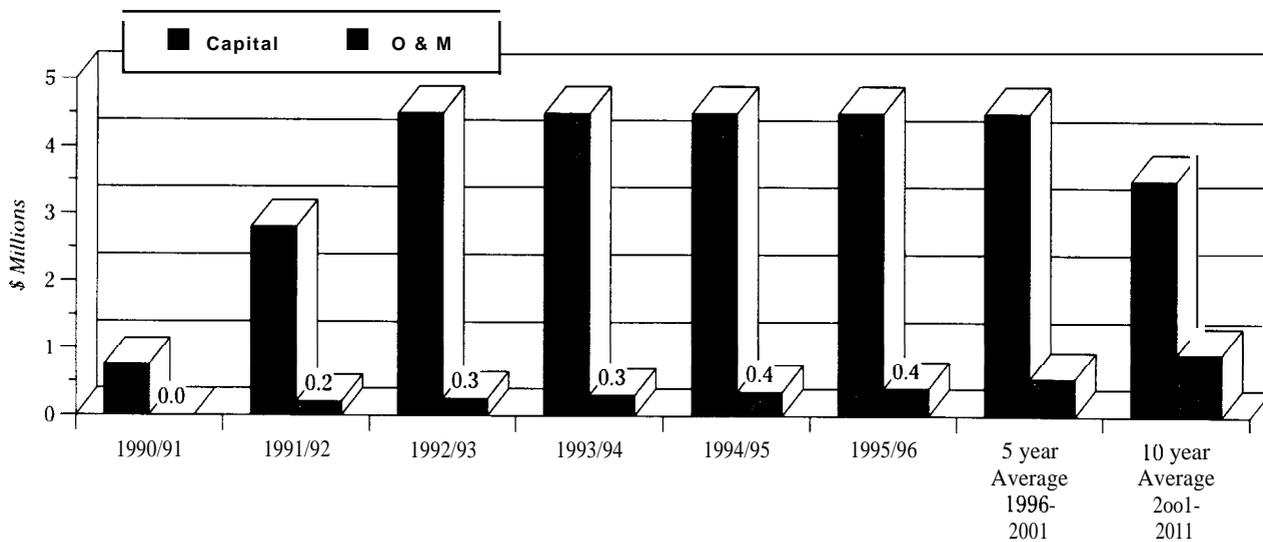
Operation and Maintenance expenditures increase from \$0.2 million to \$0.8 million per year over the 20 years.

These costs do not include Canadian Coast Guard expenditures on ice breaking escort, navigation aids, charting or on the CCG fleet or facilities.



Improved facilities will support development of the commercial fishery.

MARINE FACILITIES PROGRAM COSTS



MARINE Facilities PROGRAM CAPITAL (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97 2000/01	Total 2001/02 2010/11	20year TOTAL
2 Upgrade Resupply Facilities		600	1000	1000	1000	1000	5000	10000	19600
3 Upgrade Local Facilities	750	1200	1500	1500	1500	1500	7500	15000	29700
4 Mackenzie River Dredging		1000	2000	2000	2000	2000	10000	10000	29000
TOTAL CAPITAL	750	2800	4500	4500	4500	4500	22500	35000	78300

MARINE FACILITIES ANNUAL OPERATIONS & MAINTENANCE (1990 \$000'S)

	current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97 2000/01	Average 2001/02 2010/11	20year AVERAGE
1 Co-ordination/Planning		100	100	100	100	100	100	100	100
2 Facility Maintenance		100	150	200	250	300	450	825	575
TOTAL O & M	0	200	250	300	350	400	550	925	675

OBJECTIVE TWO - PUSHING BACK THE ECONOMIC FRONTIERS

2.1 INTRODUCTION

The Northwest Territories Economic Strategy describes an "Economy in Transition" from a traditional land-based to a wage-based, market economy. This Strategy and the report of the Legislative Assembly's Standing Committee on the Northern Economy (the SCONE report) note that this transition has taken place in the major resource, administrative and transportation centres. Group I communities have the requisite economic, population and infrastructure base.

It is the less populated regions and group 11/111 communities which are now struggling with the transition. A growing population faces limited business and employment opportunities. The Economic Strategy focuses on education, business development, improvements in infrastructure, and northern management of our natural resources as ways of ensuring that appropriate business and employment opportunities are created and that residents of all regions can benefit from these opportunities. The Economic Strategy recognizes that "the development of the Northern transportation infrastructure is the key to development of our vast Territory".

Improving our existing transportation facilities can reduce some of the barriers to economic and social de-



The now abandoned N. WT. section of the Canol Road was constructed for military/strategic reasons.

velopment. However, vast areas of the North are simply inaccessible. If we can define accessible, in relative terms, as any area which is within 100 kilometres of all-weather road or an airport, we can see that only a small fraction of the North is accessible. Even if we include seasonal access by winter road or navigable waterways, there are still vast areas outside the range of accessibility.

Pushing back our economic frontiers means providing access where none exists. It means opening new areas of the North for the responsible harvesting of renewable resources, for the development of non-renewable resources and for the promotion of tourism. It means bold initiatives to build roads into our northern hinterlands.

The northern third of this nation is a source of great national pride. It is a fundamental part of the Canadian character. But the enormous economic potential of this region is yet to be realized, let alone fully appreciated. The North can and will evolve from a financial liability to a tremendous asset in the 21st century.

Investment in the responsible development of the North is investment in the future of Canada.

2.2 BACKGROUND

The first highway built in the Northwest Territories was the Canol Road. This road connected Norman Wells to Ross River and Whitehorse in the Yukon. It was built by the United States military in 1942-43 to support construction of the Canol pipeline, which was to supply oil to the Pacific war effort. The pipeline and the N.W.T. section of the road have since been abandoned.

In 1949, the Mackenzie Highway was built along the winter tractor train route from Grimshaw, Alberta to Hay River. This move led to the decline of the Athabasca - Slave River marine route, as Hay River became the main barge terminus for Western Arctic resupply.

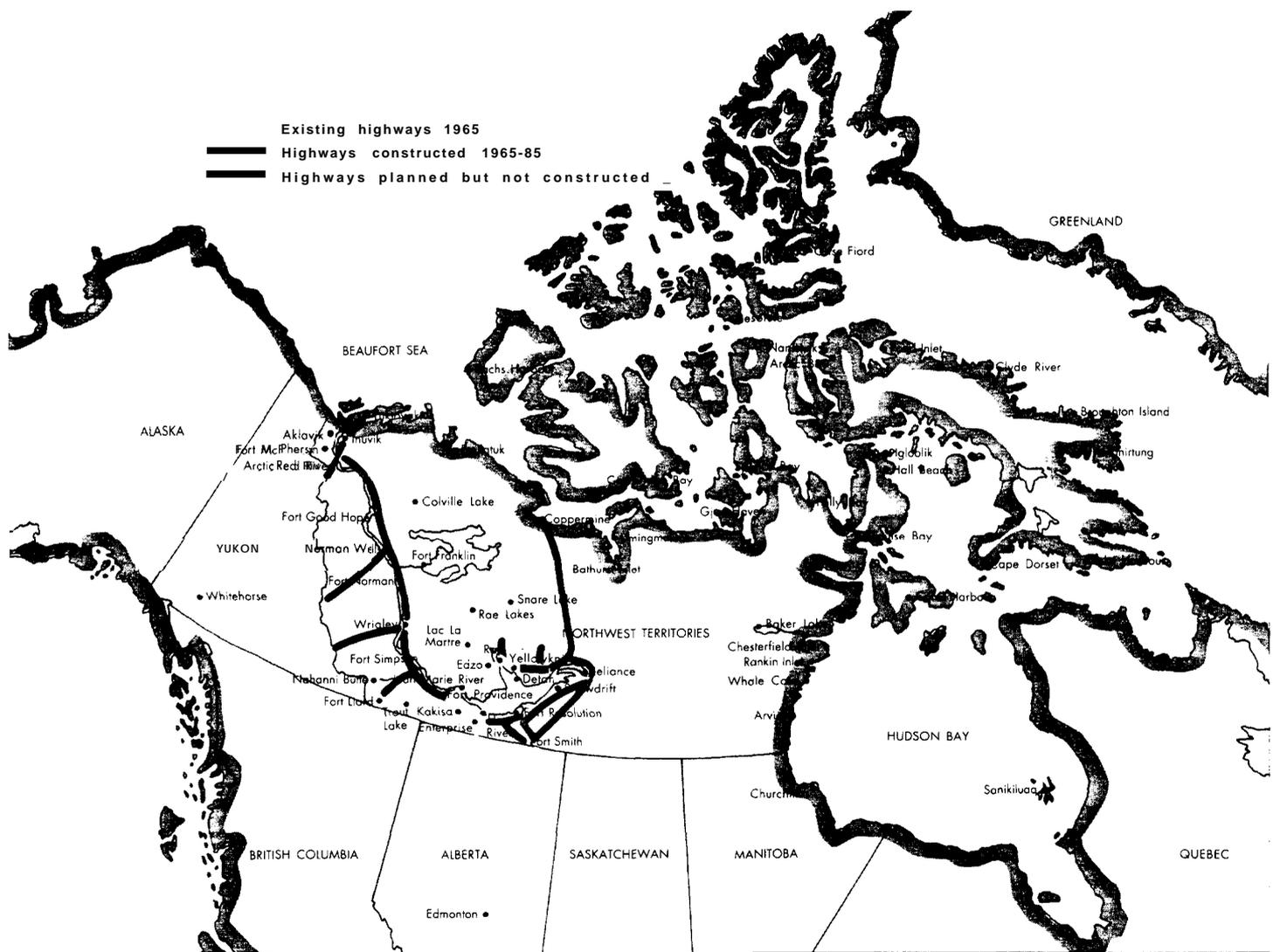
In 1958 Prime Minister John Deifenbaker announced his "Northern Vision" and coined the phrase "Roads to Resources". The goal was to construct a network of highways to open Canada's Northern hinterlands for resource exploration and development. Federal assistance was provided to the provinces, while the federal government undertook an ambitious \$100 million program of road construction in the Northwest Territories and the Yukon. Even after the Conservative defeat in 1963, the Northern Roads Program continued for 20 years.

A 1965 report by the Department of Northern Affairs and National Resources (now I. N. A. C.) recommended

an ambitious 20 year plan of construction for the Yukon and Western Northwest Territories.

In the Northwest Territories, the Yellowknife Highway was completed by 1960. This was followed by connections to Pine Point (1965), Fort Smith (1969) and Fort Resolution (1975). By 1972, the Mackenzie Highway had been extended to Fort Simpson and work was under way to continue down the valley. Work was halted just south of Wrigley, largely due to concerns expressed by native residents. Efforts were then diverted to the Dempster Highway, which was completed in 1977, and the Liard Highway, opened in 1983. Under a recent agreement, G. N.W.T. will undertake completion of the Mackenzie link to Wrigley.

NORTHERN ROADS PROGRAM-20 YEAR PLAN (1965)



During these two decades, considerable work was done. Annual federal expenditures on new roads in the N.W.T. peaked at approximately \$70 million (1990 dollars) in the mid 1970's. However, nothing of significance has happened since the opening of the Liard Highway in 1983. There are no federal plans or funding for any new road construction. For all practical purposes, the federal Northern Roads Program is now defunct.

The job is far from finished. The current highway network falls far short of John Diefenbaker's vision. It falls short of the federal 20 year plan of 1965.

2.3 ECONOMIC PROSPECTS FOR NEW ROADS

Mineral Development

Mining and mineral exploration constitutes a major component of the N.W.T. economy. The industry employs about 2,000 people in the Northwest Territories, of which 65% are Northerners. In 1988, six operating mines produced more than \$750 million in gold, silver,

NORTHWEST TERRITORIES PRIMARY HIGHWAYS



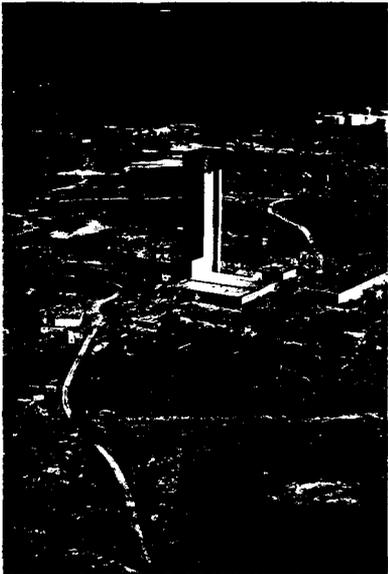
lead and zinc. Approximately \$70 million was spent on mineral exploration.

However, we have only begun to scratch the surface of the vast mineral potential in the North. Known reserves are enormous, while areas of high potential have yet to be fully explored. There is little doubt that many known ore bodies and others yet to be discovered would be in production in southern Canada.

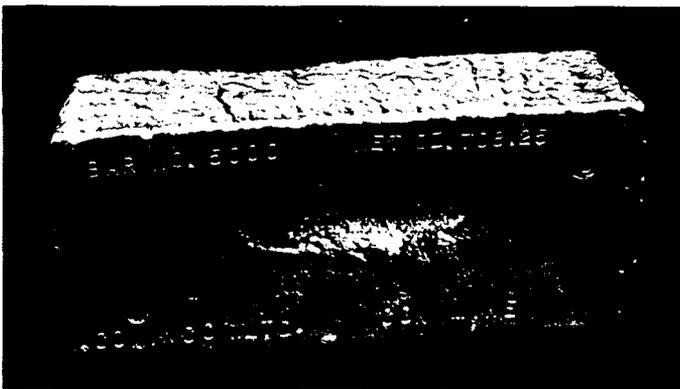
Of the seven mines currently operating in the N.W.T., three are on all-weather highways. Two base metal (zinc/lead) mines are located directly on tidewater. This provides immediate access to cost effective marine bulk transportation for the delivery of mineral concentrates to the marketplace. Production from the more isolated Lupin and Colomac gold mines justifies the annual construction of winter roads for bulk fuel, materials and equipment resupply.

An examination of current mineral reserves and published production rates indicate that five of the currently operating seven mines have production lives of

less than 10 years. New mines must be brought into production during this decade to maintain a strong mining presence in the N.W.T. Failure to maintain a viable sector in the



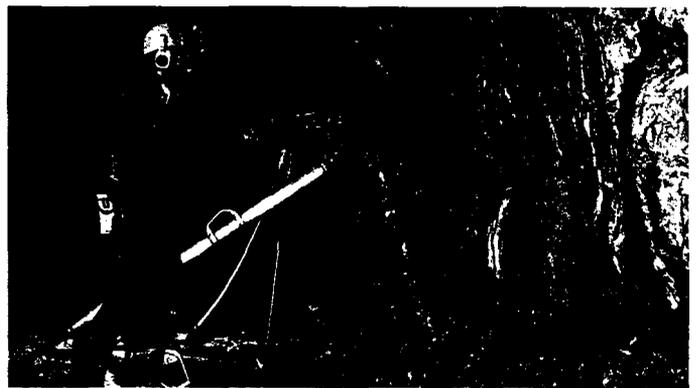
Three of the N. W.T.'s producing gold mines have all-weather highway access (Nerco-Con, Yellowknife).



The N. W.T.'s two operating base metal mines are located on tidewater (Nanisivik).

N.W.T. would have profound effects on all other sectors of the economy.

Development of known reserves in the Kitikmeot Region south of Coronation Gulf is stifled by the lack of adequate transportation infrastructure. The Keewatin Region has high mineral potential. However, exploration activities are again hampered by the lack of adequate infrastructure. A recent decrease in the allocation of exploration incentives in the 1990 federal budget has already precipitated a decline in exploration activities in the N.W.T. over past levels.



Five of the N.W.T. seven mines have estimated reserves for less than 10 years of operation.

A recent study by the Institute of Resource Studies at Queens University concluded that economic mineral deposits are much more easily discovered and developed in northern Canada than in the traditional mining regions of southern Canada. This is the result of the relatively unexplored nature of the mineral rich Greenstone Belts in the North, the thin cover of overburden and the high probability of discovering shallower and less costly ore bodies in northern regions. The major

hindrance to northern mining operations is the cost of transportation. Plant, materials and personnel must be brought into the production site and product must be shipped out to the marketplace.

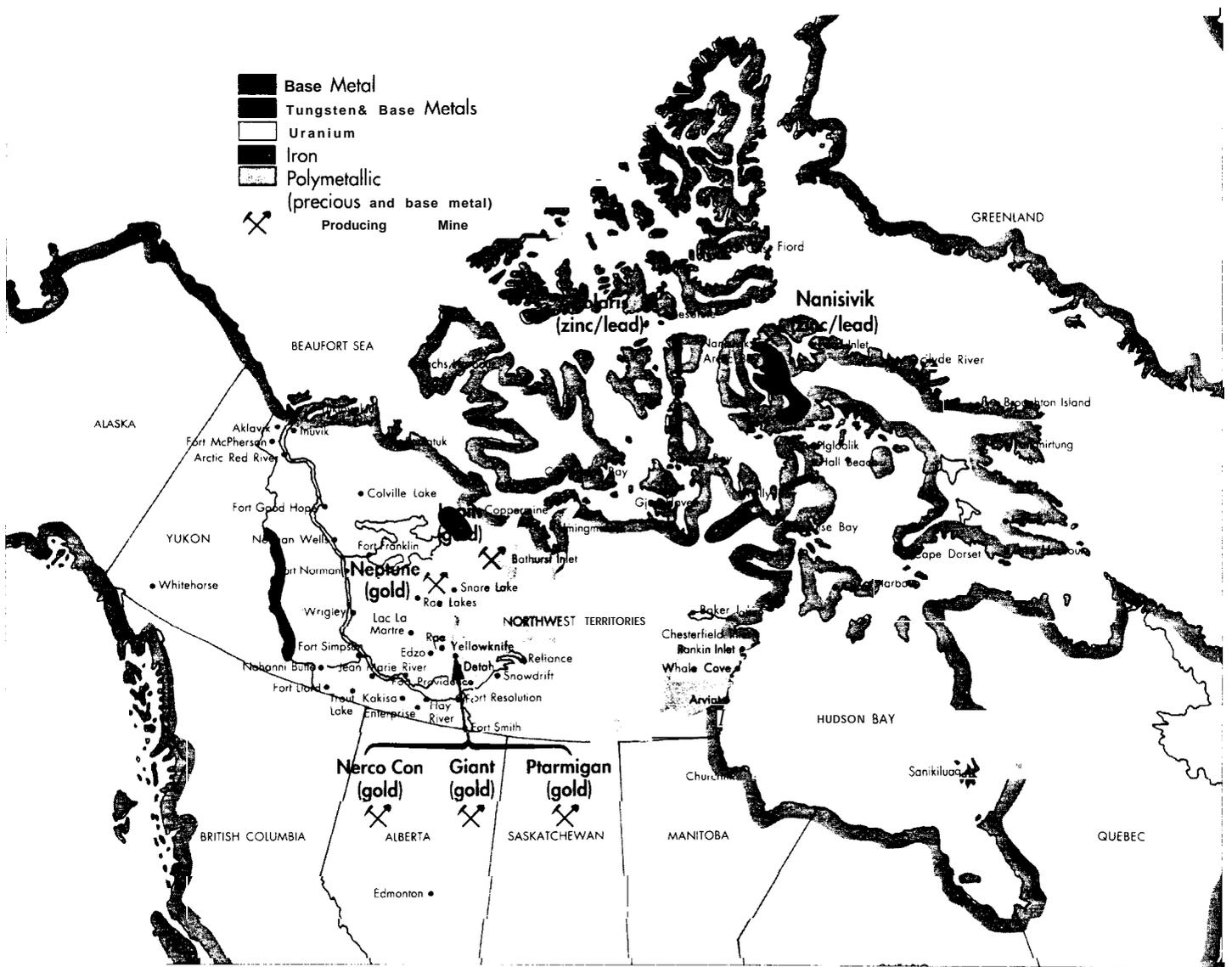
Many of the defined mineral properties in the N.W.T. would go into production if all-weather roads were provided. However, none by themselves justify investment in the hundreds of kilometres of road required. Providing road access will stimulate mining and exploration, creating hundreds of direct mining positions and possibly thousands of jobs in the support sectors.

Oil and Gas

The Northwest Territories has substantial known and potential reserves of oil and gas. The best known of these is the Beaufort Sea/Mackenzie Delta area. This area is not yet producing, although about \$4.5 billion has been spent on exploration, and current reserves are estimated at over 9 billion barrels of oil and 2 trillion cubic metres of natural gas. Construction of a gas pipeline costing in the range of \$4 billion and/or an oil pipeline at \$6.5 billion is being considered.

Norman Wells has been producing since the 1920's. A major expansion of the oilfield and construction of a

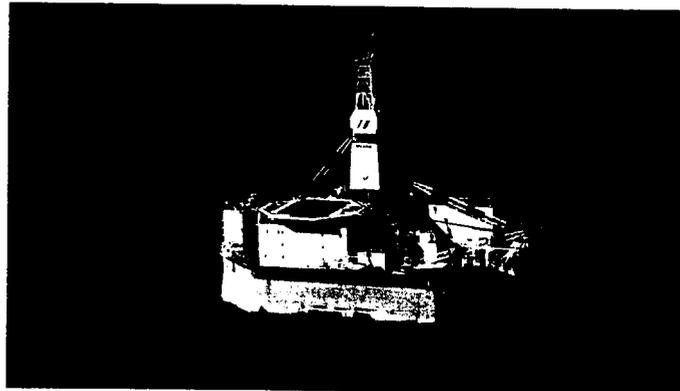
AREAS OF HIGH POTENTIAL FOR MINERAL DEVELOPMENT



pipeline south boosted production to over 6 million barrels in 1985 and 11 million barrels by 1988.

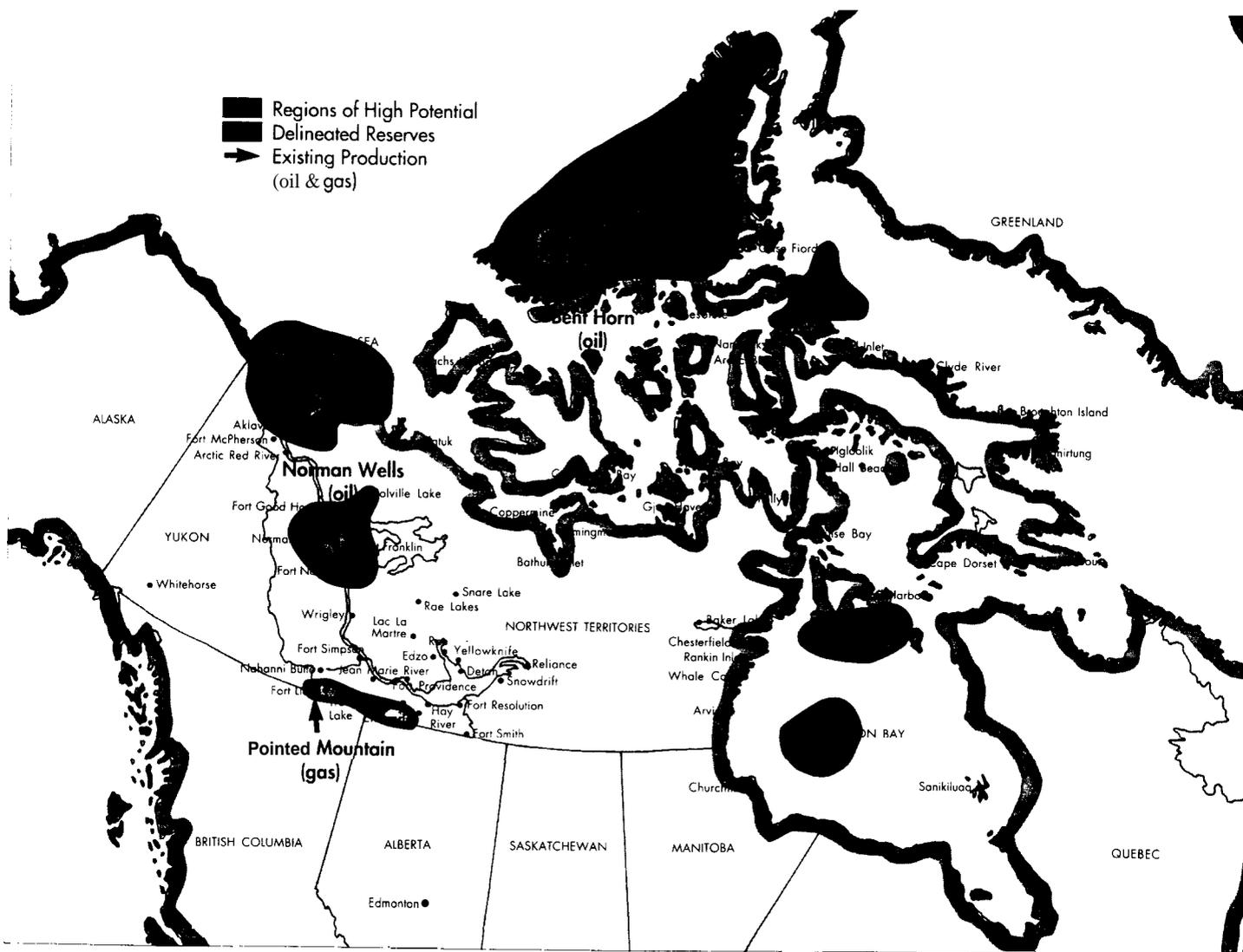
Other producing fields include Bent Horn in the High Arctic, which ships relatively small quantities of oil (250,000 barrels per year) to eastern Canadian refineries, and Pointed Mountain, which has estimated gas reserves for 5 to 10 years at 200 million cubic metres per year.

Other identified gas reserves include those delineated in the High Arctic - Queen Elizabeth Islands, the Cameron Hills and the Liard District. Significant areas of future potential hydrocarbon development include Lancaster Sound (oil) and the Hudson Bay area (oil & gas).



About \$4.5 billion has been spent exploring for Beaufort Sea oil and gas.

REGIONS OF HIGH POTENTIAL FOR HYDROCARBON (OIL & GAS) DEVELOPMENT





The Norman Wells pipeline was completed in 1985.

The oil and gas industry is less reliant on all-weather highways than is the mining industry. Highways can reduce costs for resupply of exploration/production activities and provide access for the delivery of pipeline construction supplies and for pipeline maintenance. Maintenance now performed by winter road and air access would benefit by all-weather road access.

pipeline(s) in the Mackenzie corridor would also likely be undertaken utilizing a system of winter roads.

Tourism

Tourism is a growth industry in the N.W.T. Summer pleasure travel expenditures increased by a factor of three in less than 10 years to \$31 million in 1988. This growth trend is expected to continue as the estimated market potential is more than 5 times the existing traffic. World trends to increase leisure and recreation will further enhance this potential.

Upgrading existing transportation facilities and services along with marketing and training will help to realize this potential. New roads into the hinterlands will increase this potential further. Road connections forming a loop or with an 'exotic' terminus (eg. the Arctic Ocean) are considered especially attractive to the motoring tourist.

Because of the geotechnical difficulties inherent in constructing pipelines over permafrost terrain, future construction activities would likely be performed exclusively during the winter period. The Norman Wells pipeline was constructed utilizing winter roads and the construction of a future



The scenery, culture and wildlife of the N.W.T. are major tourist attractions.



Renewable Resources

The Economic Strategy notes that there are substantial untapped sustainable commercial yields of fish, lumber and game.

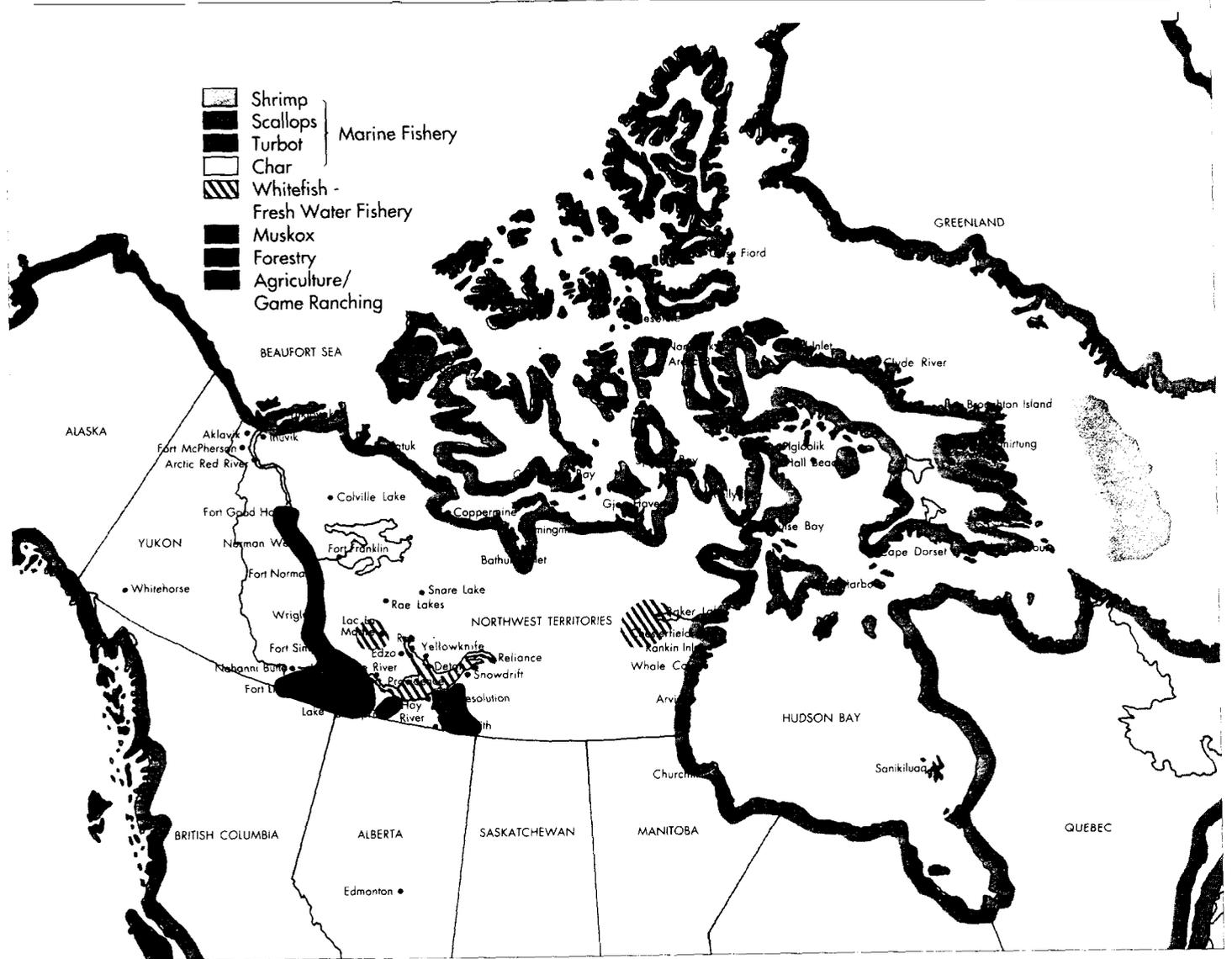
These resources are small in value relative to the non-renewable resource potential. However, they are important in terms of community-based employment and represent opportunities for import substitution.

The expenditure of hundreds of millions of dollars in road access to these resources can hardly be justified by their potential harvest value. However, road construction can, as a spin-off benefit, provide access to these resources and reduce shipping costs.



Only a fraction of the N. W. T. renewable resource potential has been tapped.

REGIONS OF HIGH POTENTIAL FOR COMMERCIAL RENEWABLE RESOURCE DEVELOPMENT



Employment

Road construction and subsequent maintenance results in considerable employment. Every 100 million dollars of construction creates over 700 person years of employment. At least 30 cents of every dollar is realized in direct employment benefits. A large proportion of employment is in unskilled, apprenticeship and trades categories, and considerable training opportunities exist. The wages paid will generate income tax revenues and reduce dependence on social assistance. Spending of new disposable incomes will generate other jobs in the retail, construction and service sectors.

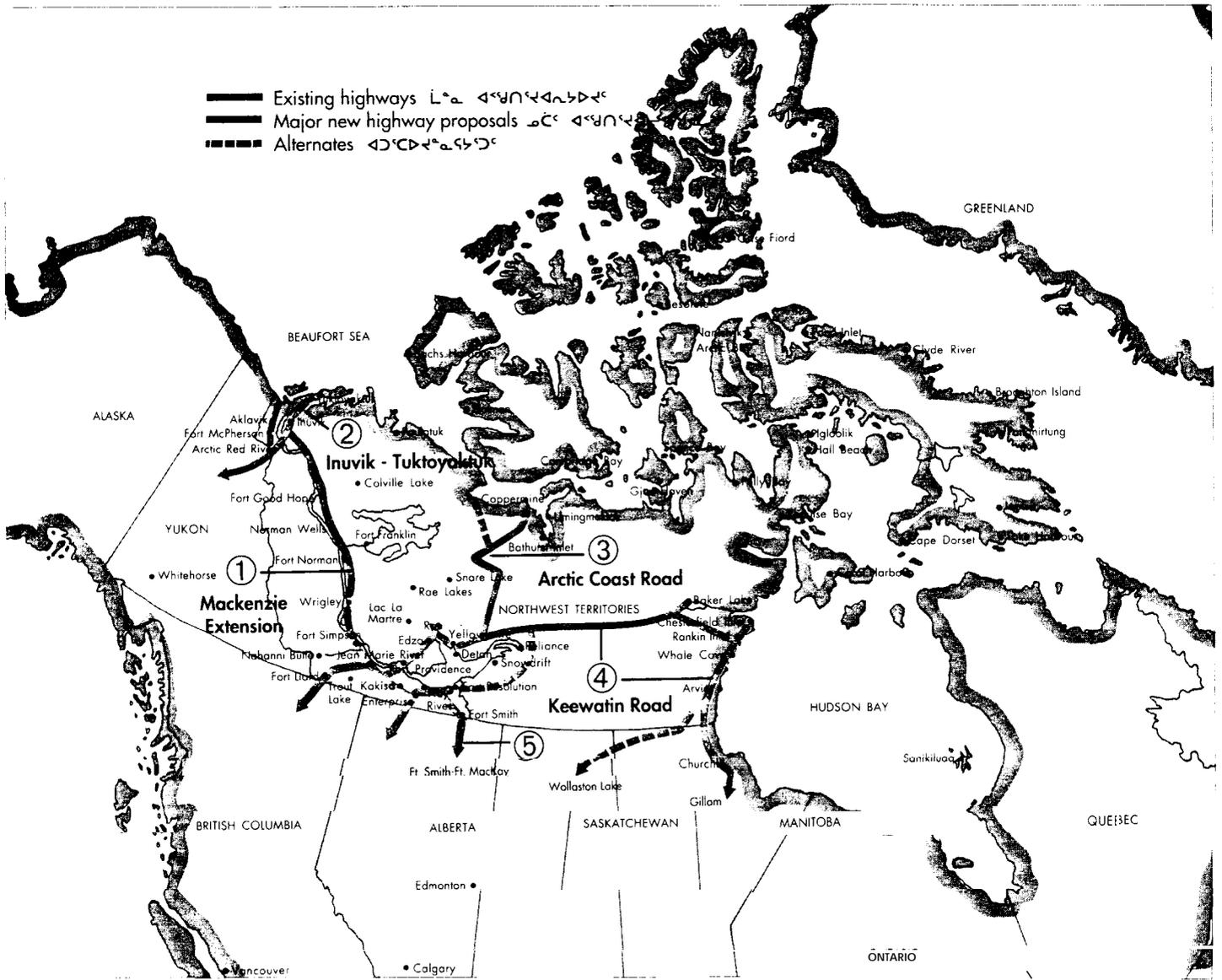
The potential employment benefits to Northern residents are the greatest in areas of high unemployment.

The benefits are also greater if a steady, moderate level of ongoing employment is provided, rather than the short-term, high level of activity characterized by a mega-project.

Living Costs and Mobility

Providing roads to communities will significantly reduce the costs of living and doing business. In addition to the communities served directly, the costs in more remote communities can be reduced as roads are extended north and as new, closer transportation hubs are encouraged. For example, a road to Rankin Inlet would likely result in the growth of this community as a transportation hub, lowering resupply costs for the

PUSHING BACK THE ECONOMIC FRONTIERS



whole region. A road to the Arctic Coast would similarly reduce costs for the Central Arctic region.

Lower transportation costs will improve the mobility and freedom to move, particularly in more remote communities.

The benefits of road access will increase in direct proportion to the growing population. New roads will also support the economic transition of the less advantaged group II and III communities.

2.4 POTENTIAL NEW ROADS

Bearing in mind the economic prospects of the various frontier regions, four major new road projects are proposed within the N.W.T. A fifth road, connecting Wood Buffalo National Park and Fort Smith to the Alberta highway system at Fort Mackay is also of considerable interest to Northerners. Each has varying potential for stimulating activity in the non-renewable resource, renewable resource and tourism sectors. Each would have impacts on employment and living costs.

These five projects are described briefly:

1. Mackenzie Highway Extension to Inuvik

This project has been on the drawing board for many years, and has generally been regarded as the next logical step in highway system expansion in the Western Arctic.

The route could slightly improve access to areas of high mineral potential along the N.W. T. -Yukon border. However, access to this region has generally been through the Yukon, via the Canol and Nahanni Range roads. In the oil and gas sector, a Mackenzie Valley highway would likely help stimulate exploration activity and would certainly reduce the costs of pipeline construction and operation. It would also shorten the distance and reduce costs for road resupply of Mackenzie Delta/Beaufort Sea exploration and development.

This route is regarded as showing high potential for tourism development. The link would create a loop from the Yukon and Alaska via the Dempster Highway. This would attract a share from these two market areas and boost the overall tourism traffic.

The main attraction for renewable resources would be access to the forest reserves of the valley. The con-

struction of this route would provide considerable training and employment opportunities for the smaller, less developed communities in the region. It would also further fuel the economies of the more developed centres of Yellowknife, Hay River, Norman Wells and Inuvik. Living costs would be reduced for all valley communities north of Wrigley.

The cost estimate for construction of the 804 kilometres from Wrigley to the Dempster Highway is \$417 million (1989 dollars). The annual O & M cost would be \$7.6 million per year, slightly under 2% of capital.

2. Inuvik - Tuktoyaktuk

Also on the drawing board, this route was planned to support oil and gas exploration activities based in Tuktoyaktuk. Although activity declined in the eighties, this is regarded as a temporary setback. The Beaufort will no doubt become a significant oil and gas producer as and when demand and prices warrant.

It has recently been suggested that an alternative route to the Beaufort Sea coast should be considered. This route would connect the Dempster to the Stokes Point or King Point area west of the Mackenzie Delta. From an oil and gas development perspective, such a route would access deeper water and be closer to the areas of highest development potential.

New road access to the Mackenzie Delta region would have limited impact on potential mineral development. Although not yet well defined, the Beaufort Sea appears to have promising potential for fishery development. The Tuktoyaktuk area is considered to have a significant tourism potential. Substantial regional employment benefits will result. Living cost reductions will affect the population of Tuktoyaktuk.

The preliminary cost estimate for the 160 kilometre route is \$160 million (1989 dollars). Ongoing O & M at 2% of capital would be \$3.2 million per year.

3. Arctic Coast Highway

A route has been proposed extending north from Yellowknife to the Arctic Coast, connecting currently delineated base metal and precious metal deposits and traversing areas of high potential. This proposed route is regarded by industry, the federal government (I. N.A.C. and E. M. R.) and the G. N.W.T. Department of Energy, Mines and Petroleum Resources as having the



An Arctic Coast Highway accessing enormous mineral deposits, would also have considerable tourism potential.

highest potential for stimulating new mineral production and exploration activity in the N.W.T.

The Canadian Arctic shipping industry has developed the capacity to effectively support current mining operations in the Eastern Arctic. Canada has also developed expertise in shipping in the Arctic ice environment. Road access, combined with sea access at the coastal terminus, would greatly enhance the mineral development potential of this region.

The scenery, wildlife, waterways and sport fishing potential of the region would be very attractive for tourism development.

This region is largely unpopulated and the route would not provide direct access to any existing communities. However, the northern road terminus would almost certainly develop as a road-sea-air transshipment hub, improving access and reducing costs for the whole Central Arctic region.

An alternative routing to a northern terminus closer to Coppermine should also be considered. This would be more attractive from the perspective of employment and mobility for that community, but less attractive in terms of base metal shipping.

The route consists of 3 segments:

Segment	Length (km)	Cost - \$ Million	
		Capital	Annual O&M
1. Yellowknife to Lupin	450	310	6.2
2. Lupin to Izok Lake	80	55	1.1
3. Izok Lake to Coast	340	235	4.7
TOTAL	870	600	12.0

4. Keewatin Road

This route would connect the coastal communities of the Keewatin to the National Highway System and traverse areas of high mineral potential. The route has 3 major segments:

- 1a. Gillam Manitoba to 60th parallel
- 1b. 60th parallel to Arviat
2. Arviat to Baker Lake Community Connections
3. Great Slave Lake to Keewatin Route

The first segment offers high tourism potential and access to fisheries and would move the highway terminus into the region. An alternative route could be considered from northern Saskatchewan. This route would traverse areas of higher mineral potential.

The second segment would provide inter-community connections, increasing mobility and reducing resupply costs. It would also provide mineral area access, enhanced tourism potential and access to freshwater and coastal fisheries.

The third segment would also traverse areas of high mineral, tourism and fishery potential.

.411 project sections would provide high employment opportunity, although the maximum benefits to the underdeveloped Keewatin communities would come from construction and maintenance in the areas nearest these communities.

Taken together, this route would provide access to enormous mineral potential and would provide a highly attractive tourism route. Combined with the Mackenzie Highway, it would create an Arctic Trans-Canada Highway.

As a large portion of the north-south route is within Manitoba, this project would obviously require the participation of that province. The section lengths and costs are:

Section	Length (km)	Cost - \$ Million	
		Capital	Annual O&M
1a. Gillam Manitoba to 60 th parallel	456	410	5.1
1b. 60 th parallel to Arviat	191	160	1.6
2. Arviat to Baker Lake	725	550	5.9
3. Great Slave to Keewatin	1200	840	9.6
Subtotal N.W.T.	2116	1550	17.1
TOTAL	2572	1960	22.2

5. Fort Smith - Fort MacKay Road

This route would provide a more direct link from the Fort Smith area to the northern Alberta highway system and would provide all-weather access to the northern Alberta community of Fort Chipewyan.

There was some interest in this route, or an alternative connection to John D'or Prairie, when development of a Slave River hydro-electric project was under consideration in Alberta. However, this project has been shelved and the recent Northern Alberta Transportation System Study does not place a high priority on development of all-weather road access to the area.

From a Northwest Territories perspective, such a route would have significant tourism potential since it would form a road loop which includes the Wood Buffalo National Park. It would also provide employment benefits and reduce costs for residents of the Fort Smith area.

Alberta Transportation estimates the total construction cost at approximately \$112 million for the 375 kilometre route.

The future of this road is somewhat problematic since the main source of interest is in the N. W. T., while the route is entirely within Alberta.

Summary

The total cost of all five projects is over \$3 billion (including \$400 million in Manitoba and \$112 million in Alberta). These highways would add 4000 kilometres to the N.W.T. highway system.

It is unrealistic to assume that the major N.W.T. projects can be justified for renewable resource development.

Some offer strong arguments in the long-term for development of tourism and/or community access. The Fort Smith connection may eventually be justified by Slave River hydro development in Alberta.

The potential benefits of these roads will include mineral and oil and gas exploration and development, increased tourism and renewable resource development. The construction of the roads and the economic activity which is stimulated in all sectors will generate considerable employment. All these roads have the potential to reduce living costs for N.W.T. residents.

In qualitative terms, we can compare the potential benefits of each route for each of these sectors. The following table illustrates the relative potential impact of each route on the mineral, oil and gas, tourism and renewable resource sectors as well as the potential for providing employment and reducing living costs for Northerners.

Quantification of these benefits will require considerable further study. Most routes have a high potential for tourism development. What does this mean in absolute terms? Are the potential tourism benefits significant compared to the cost of a road? Are they high compared to a high mineral potential?

If we examine the current Gross Domestic Product (GDP), we get an indication of the Northwest Territories economic base. The estimated value of N.W.T. exports is even more telling. Minerals dominate exports, followed by oil and gas and tourism.

Like it or not, the main economic justification for the enormous investments suggested will have to be found in the non-renewable resource potentials of these regions. Western Arctic oil and gas and Mackenzie,

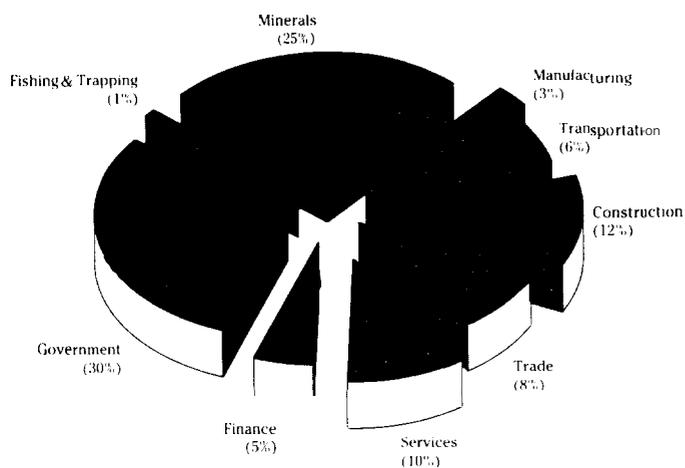
ECONOMIC PROSPECTS OF POTENTIAL NEW ROADS

Sector	Mackenzie -Inuvik	Inuvik -Tuk	Arctic coast	Keewatin South	Keewatin West	Fort Smith Fort MacKay
Minerals	Med.	Low	V High	High	Med.	Low
Oil & Gas	Med.	Med.	Low	Low	Low	Low
Tourism	High	High	High	High	Med.	High
Ren. Res.	Med.	Med.	Med.	High	High	Med.
Employment	High	High	Med.	High	High	Med.
Living Costs	Med.	Med.	Med.	High	Med.	Med.

Keewatin and Baffin region minerals will likely dominate N.W.T. exports well into (and perhaps through) the twenty-first century.

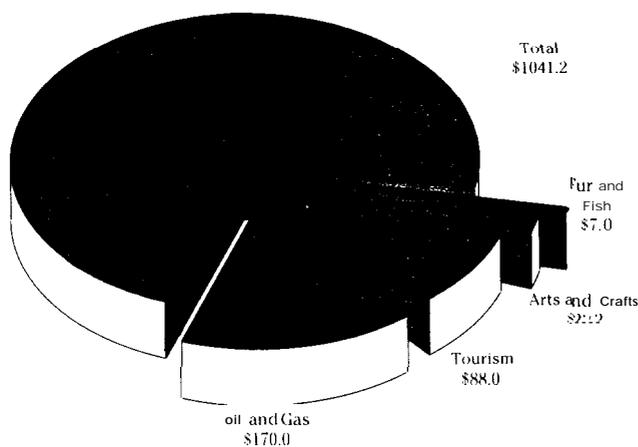
These developments will likely proceed eventually. We must ensure that they do so in an orderly and responsible manner. This means ensuring that our environment is treated with respect and that development proceeds in a way which will complement the management of renewable resources and tourism potential. It means ensuring that Northern residents benefit from the resulting employment, business and revenue opportunities. Some projects will very likely require negotiations (for the first time in the N.W.T.) with private land owners, as land claims are settled.

GDP CONTRIBUTION



Distribution of the GDP (By Sector - Percent of GDP, 1989)

ESTIMATED VALUE OF EXPORTS



1,988/89 (\$ Millions')

2.5 PROGRAM OBJECTIVES

1. Agreement-In-Principle

The first objective is to obtain an understanding of the importance and the eventual inevitability of major investment in new highway construction in the North. This starts with territorial public and political support. We must then obtain national support through federal and provincial consultations. Without a general understanding and support, there is little likelihood that these projects can successfully compete with other priorities.

2. Detailed Studies

Some detailed engineering studies have been conducted on the Mackenzie Valley Highway. Other routes have had preliminary, somewhat cursory, study only. An immediate commitment is required to commence detailed socio-economic, environmental and engineering studies and public consultation. This will lead to alternate route selection, proposed priorities and schedules and more accurate cost estimates.

3. Implementation

Implementation cannot commence until adequate studies and consultation have been completed. This may be possible within 5 years. It is recommended that winter roads be phased in earlier, particularly in the Keewatin. All-weather roads will take many years to plan, design and construct. Seasonal winter roads will provide an interim improvement in community and renewable resource access, encourage mineral exploration and support the necessary preliminary engineering work for all-weather road design.



Seasonal winter roads will provide improved access, pending completion of all-weather roads.

It is recommended that these projects proceed in parallel, rather than in series. The construction work should be spread over at least two projects at any given time and at different locations within each project. This will ensure the highest possible employment and business benefit to the North and the least possible negative economic/social impact. Attacking these as a series of mega-projects would result in a short term boom-bust cycle, with most of the benefits going to 'migrant' construction businesses and labour force, and little time or patience for training.

2.6 PROGRAM SCHEDULE AND COSTS

The total capital cost of the four N.W.T. routes would exceed \$2.7 billion. The Keewatin north-south route would require expenditure in Manitoba of \$410 million. The Fort Smith - Fort MacKay road would require ex-

penditure of \$112 million, entirely within the province of Alberta.

The proposed capital program would include three to five years of initial detailed studies, with implementation expenditures phasing in and increasing to a level of \$125 million per year.

At this rate the total capital expenditures of 1.8 billion over 20 years would be adequate to complete only 2/3 of the proposed network. If all projects proceeded, it would take about 30 years to complete the program.

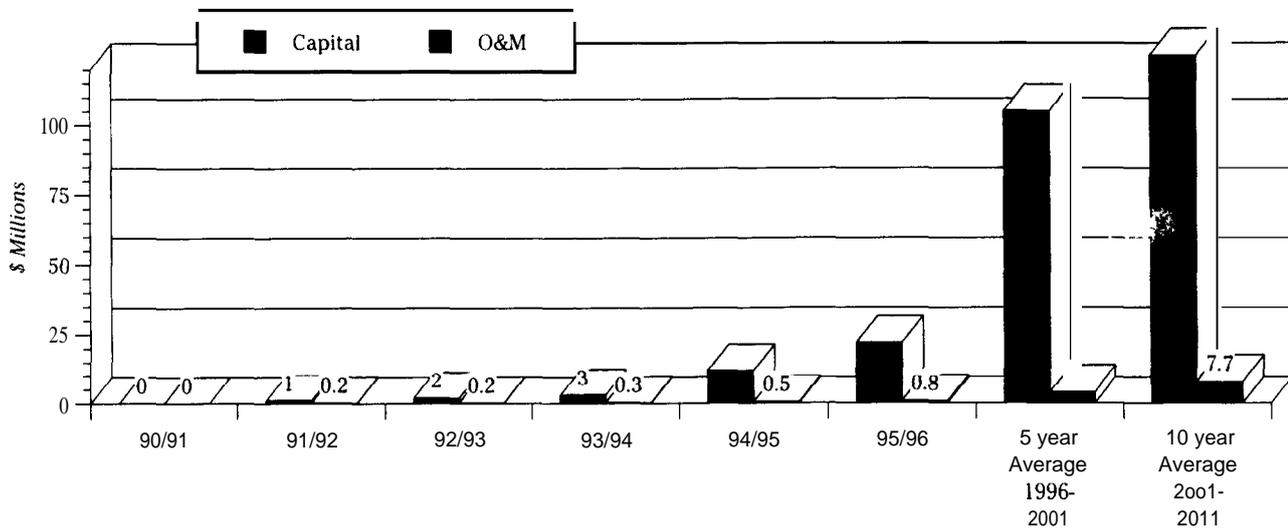
The schedule and costs do not include proposed work in Manitoba or Alberta.

Operation and maintenance costs would phase in as road sections are completed. Annual O & M costs are estimated at 2% of the cumulative capital.

CAPITAL COST ESTIMATES - NEW ROADS

Route	\$ Million	km
Mackenzie - Inuvik	417	804
Inuvik - Tuktoyaktuk	160	160
Arctic Coast	600	870
Keewatin		
Inter-Community	550	725
Arviat-Manitoba	160	191
East-West	840	1200
Subtotal N.W.T.	2727	3950
Keewatin-Manitoba	410	456
Fort Smith-Alberta	112	375
TOTAL	3249	4781

MAJOR NEW ROADS PROGRAM COSTS



NEW ROADS PROGRAM CAPITAL (1990 \$000'S)

PROGRAM OBJECTIVE/TASK	current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Total 1996/97-2000/01	Total 2001/02-2010/11	20year TOTAL
2 Detailed Studies		1000	2000	3000	2000	2000			10000
3 Implementation					10000	20000	525000	1250000	1805000
TOTAL CAPITAL	0	1000	2000	3000	12000	22000	525000	1250000	1815000

NEW ROADS ANNUAL OPERATIONS & MAINTENANCE (1990 \$000'S)

	current 1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	Average 1996/97-2000/01	Average 2001/02-2010/11	20year AVERAGE
1 Coordination/Planning		200	200	300	500	800	2000	2400	1800
2 Facility Maintenance							2000	5300	3150
TOTAL O & M	0	200	200	300	500	800	4000	7700	4950

OBJECTIVE THREE - FILLING THE GAPS - Transportation Subsidies

3.1 INTRODUCTION

Background

We know that transportation costs in the North are very high. Gross expenditures on the transportation services in the N.W.T. exceed \$200 million.

The issue of transportation costs has three basic dimensions:

1. High Absolute Costs

In the Northwest Territories, we have 0.2% of Canada's population dispersed over 1/3 of Canada's land mass. We share borders with six provinces and one territory. This naturally results in higher costs to travel between



Transportation costs in the North are high in both absolute and relative terms.

communities, to import goods and materials and to export products. Our sources and our markets are simply farther away.

2. High Relative Costs

To compound the problem of distance, the North has smaller, dispersed markets, higher operating costs and an underdeveloped transportation infrastructure. Not only do we have to move people and goods over longer distances, but the rates are higher (cost per passenger-kilometre or tonne-kilometre).

3. Regional Inequities

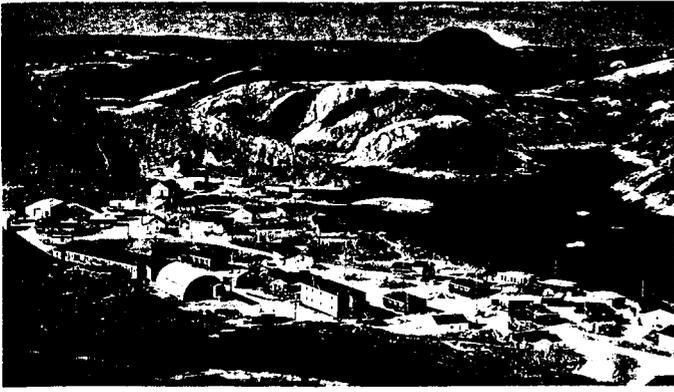
The high costs of transportation do not affect all areas of the Northwest Territories equally. The Mackenzie Valley is less remote from sources and markets and has more traffic and better transportation facilities than does the rest of the N.W.T. As a result, both the total costs and the rates are generally lower.

We can see the compounding effects of these factors when we compare transportation cost and rates within the North and between the North and the South. We find that:

- Overall transportation rates and costs are higher in off-highway communities.
- Air (travel and freight) rates are higher outside the Mackenzie Valley.
- Air costs are highest in the Baffin and Kitikmeot.
- Surface transportation costs (barge, ship, rail and/or truck), for shipping cargo and bulk fuel are highest in the Kitikmeot and Keewatin.

The effects of high transportation costs and rates include restrictions in mobility, social interaction, education, employment and business opportunities.

High costs discourage tourism and the development of our renewable and non-renewable resources. Dependence on social assistance is high, as are the costs of providing it. The cost for delivery of a whole range of public programs and services is extremely high.



Rates in smaller more remote communities are higher (Lake Harbour).

Current Subsidy Programs

These problems are, to some extent, mitigated by a variety of direct and indirect transportation subsidies. Assistance is available for medical, educational, recreational, vacation and employment purposes. There are direct transportation subsidies for the few communities which rely solely on air transportation. Some renewable resource harvests are subsidized. Public sector employees receive isolated post/settlement allowances while major industries pay higher salaries to compensate for higher living costs. Housing, heating and utility costs are highly subsidized in more remote communities, either by employers or through public housing programs. There is some tax relief through the northern residents deduction. Social assistance payments are indexed to the cost of living.

It has been estimated that a large proportion of air travel is paid for by government, in one way or another. Furthermore, government picks up the cost for a large proportion of the fuel and materials shipped to more



Larger Western Arctic communities benefit from shorter distances and highway access (Yellowknife).

remote regions. Direct and indirect government expenditures on transportation services are enormous.

So, What's the Problem?

So why do we need more transportation subsidies? Aren't we just speaking of government subsidizing itself? The current subsidy system has four main problems:

1. Inequity

Subsidies are not universal. Many of these programs are only available to certain employment/income groups. Some are not available to small businesses or their employees.

2. Mobility/Isolation

Although 'necessary' travel such as medical evacuations is subsidized for all residents, inter-community and inter-regional travel can be prohibitively expensive for unsponsored individuals. For example, an economy class return trip from Pond Inlet to the nearest city, Montreal, would cost \$8000 for a family of four. This leads to a feeling of isolation from the mainstream of Canadian society.

3. Imbalance

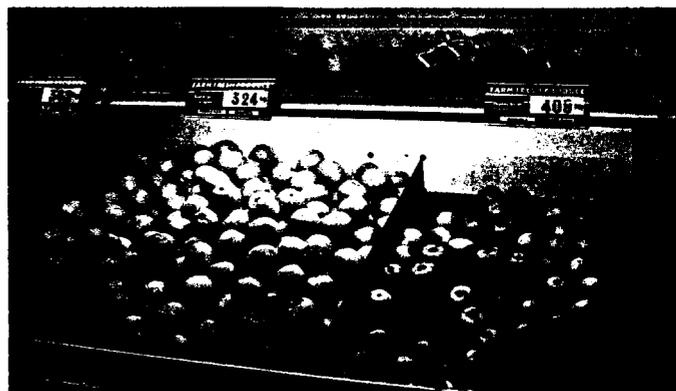
Transportation of goods is generally based on weight. The transportation premium is therefore exaggerated on higher weight/value items. For example, the price of enough mix to make a litre of sugary 'fruit flavoured' beverage is 64 cents in Yellowknife. Weighing less than 0.1 kg, the price rises only 30% to 83 cents in Iqaluit. Meanwhile, the price of a litre (1 kg) of milk which costs \$1.17 in Yellowknife, rises by 168% to \$3.13 in Iqaluit. Both items have a price premium of approximately \$2/kg in Iqaluit. Unfortunately, the impact on the price of milk, fresh or frozen fruit, juices, vegetables and eggs is much higher than it is on flavoured beverages, chocolate bars, cookies, sugared cereals and other 'junk' foods.

4. Tourism

Governments and major industries provide their employees (and families) with annual, or more frequent, assistance to travel south for a holiday. Yet little is done to reduce costs for tourists to come north. Current air

travel costs, particularly in the east, discourage all but the wealthiest and most determined 'adventurers'.

In summary, the current subsidy regimes respond to a variety of specific target groups. A cursory review of existing programs has identified some sixty federal and territorial government programs with a transportation subsidy component. Direct and indirect transportation subsidies exceed \$100 million. We are not addressing the problem in a co-ordinated or comprehensive manner.



Transportation costs raise the prices for healthy perishable foods.

3.2 PROGRAM PROPOSAL

It is proposed to develop and implement an overall transportation subsidy program which will narrow regional disparities in transportation rates and reduce costs to more equitable levels. The obvious target will be off-highway communities.

Further detailed analysis of options and costs will be required. However, it is known that a major beneficiary will be government departments and agencies. The net cost will therefore be substantially less than the program cost.

Close consultations will be required with the transportation sector and the Government of Canada. A primary consideration in final recommendations will be simplicity of administration.

Pending further analysis, program net costs are estimated at \$10 million.

OBJECTIVE FOUR - EXCELLENCE IN TRANSPORTATION PROGRAMS

4.1 DOING THINGS RIGHT

The first three strategic objectives describe what we need to do. Our strategic objectives of upgrading existing infrastructure, expanding our highway system and rationalizing transportation subsidies will guide us to accomplishing our goal.

Doing things right means constant improvement in effectiveness and efficiency. It means being aware of a social, economic and physical environment and the impacts, both positive and negative, that transportation programs can have. It means improving our service to the public.

4.2 PROGRAM OBJECTIVES

1. Public Safety/Service

Providing safe facilities for public transportation is paramount. The government must continue to promote public awareness programs in such areas as seat belt use, defensive driving, vehicle safety and substance abuse. We must also monitor, and improve where necessary, legislation and regulation under the Vehicles Act, the Public Highways Act, Transportation of Dangerous Goods and National Safety Code. We must continue also to improve highway conditions, winter and ice road safety and highway signage.

Efforts must also continue in improving service to the public. For example, improvements in access to testing, licensing and renewals must be made.

2. Sustainable Development

We must, of course, comply with legislation, regulations and policies established for environmental protection. The department must be vigilant in areas such as quarry and pit management, water crossings, route selection and habitat protection.



Any development must ensure protection of our renewable resources.

We should go beyond simple compliance and where possible, enhance our physical environment and support efforts in sustainable development of renewable resources. Tourism potentials can be enhanced through route selection and roadside improvements.

3. Integration

We must examine all transportation options from a local and regional perspective, ensuring that federal, territorial, local government and private sector plans are co-ordinated. This includes sensitivity to inter-modal competition and displacement. We must look for more effective/efficient solutions to transportation challenges.

4. Opportunities for Northerners

The size, distribution and scheduling of projects will be tailored to maximize opportunities for Northern businesses and workers and to minimize leakage. Contracting policies will further enhance Northern content. Training programs and hiring policies will promote Northern employment in construction, maintenance and operation of transportation facilities. The Strategy will provide thousands of jobs in professional, para-professional, trades and support areas. This should encourage individuals to seek careers in these areas

and provide opportunities for training, apprenticeships and long term employment.

5. Regional Disparities

The methods for evaluating benefits and setting priorities must continue to include factors for regional and local disparities in employment and access to transportation services. The Benefit/Cost analysis used includes factors for regional unemployment and mobility in determining potential benefits.

6. Research and Development

We must continue to research and develop new and better ways of designing, constructing and maintaining transportation facilities. Arctic marine research and development, ice bridge construction and ice strength evaluation are examples of current initiatives. We can also benefit from exchange of ideas and experience with other agencies and nations. Participation in the Roads and Transportation Association of Canada and National Research Council efforts, as well as involvement in selected international associations and exchange programs on Arctic engineering, will ensure that we are taking advantage of the most current technology.



We must ensure that the benefits of investment are available to Northerners.

4.3 COSTS

The proposed budget for this objective amounts to less than 1% of total transportation expenditures. It includes \$1 million per year in capital for research and development initiatives plus \$1 million per year for training and improvements in public services, such as testing and licensing.

Table 1. Incremental Annual Sales and Expenditures Resulting From Improvements and New Facilities.

Estimated Expenditures (1990 \$'s)

	Incremental Annual Sales or Expenditures Resulting From Improvements and New Facilities (\$'000's)	Incremental Percentage Increase
Air System Improvements		
All Personal Expenditures	\$10,824	
Arts and Crafts Sales	570	
Total Personal Expenditure	\$11,394	10%
Docks Improvements		
Renewable Resources	1,500	
	1,500	
Highway Improvements		
All Personal Expenditures	6,365	
Arts and Crafts Sales	335	
Total Personal Expenditure	6,700	30%
Highway (New Construction)		
MacKenzie Highway Extension to Inuvik		
AH Personal Expenditures	297,015	
Arts and Crafts Sales	15,632	
Arctic Coast Highway		
All Personal Expenditures	4,700	
Arts and Crafts Sales	250	
Renewable Resources	50	
Keewatin Road		
All Personal Expenditures	62,976	
Arts and Crafts Sales	3,350	
Renewable Resources	670	
Total Personal Expenditure	384,643	1736%
Docks (New Construction)		
Renewable Resources	3,500	
Tourism	500	
Increased Sales	4,000	
Total	<u>\$407,737</u>	

Note: Air Travel personal expenditures is estimated to be \$114 million and highway travel expenditures is estimated to be \$114 million.

at \$22 million with no improvement or new facilities, for the year 2010. This represents a 4% annual growth rate in the number of travelers and their expenditures.

Table 2. GNWT Estimated Expenditures for New Facilities and Services To Service New Road Construction

	Capital Costs	O&M
Parks	6,000,000	1,200,000
Pull offs	2,900,000	270,000
Small Business	6,000,000	750,000
Total	14,900,000	2,220,000

Notes and Assumptions:

- 1) 1989 Air traffic estimates of 50,000 visitors/year and expenditures of \$1000/person.
- 2) 1989 Survey of vehicles to the NWT. In total there was roughly 14,000 visitor/year entering the NWT and expenditures of \$700/person. Arts and Crafts account for 5% of total personal expenditures. This amount is displayed in all sceneries.
- 3) Approximately 1.2 parks and 4 roadside pull offs were estimated per 200 kilometres. This approximates current density of these facilities.
- 4) Annual visitor traffic to the NWT for both road and air doubles by the year 2010 with no additional construction or improvement. This is based on an annual 4% increase in traffic.
- 5) Renewable Resources Division indicate overall value of exports primarily for fish and caribou quotas available. Baffin fisheries resulting from docks etc. will produce between \$2 million to \$5 million annually through the ability to off load and process offshore fisheries species.
- 6) Small business comprise of gas station/restaurants establishments.
- 7) Only direct expenditures have been estimated. Indirect and induced expenditures will have to be determined through the NWT Economic Model, as will induced investment.