AN ANALYSIS OF
ECONOMIC BENEFITS

IMPROVEMENT PROGRAM FOR THE ALASKA HIGHWAY

While this research report was commissioned by and prepared for the Government of Canada the views and conclusions expressed herein do not necessarily concur with those of the Government of Canada.

Prepared by
STANFORD RESEARCH INSTITUTE

for:
DEPARTMENT OF NORTHERN AFFAIRS AND NATIONAL RESOURCES

IMPROVEMENT PROGRAM FOR THE ALASKA HIGHWAY: AN ANALYSIS OF ECONOMIC BENEFITS

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AND NATIONAL RESOURCES
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I INTRODUCTION

At the request of the Government of Canada's Department of Northern Affairs and National Resources, Stanford Research Institute, in association with Foster Associates Ltd., and Travacon Research Ltd., both of Calgary, Alberta, undertook a study of the economic benefits that would result from a program to improve the Canadian section of the Alaska Highway. The primary objectives of this study were: (1) to measure the overall benefits that would result from paving the Highway and making other improvements and (2) to allocate these benefits between Canada and the United States, and, within Canada, among the provinces and territories involved.

In conducting this study, the authors were particularly conscious of two elements that are considered crucial in benefit analyses of this kind. First, the projections of future economic growth and development of the area that were used to estimate benefits were developed by other investigators and were selected to represent an informed, broad consensus. It would not have been possible within the time and cost limitations of this study to develop new and original projections even if such research had been considered desirable. Second, in detailing the future benefits that can be derived from a highway improvement program, care was taken to enumerate only those benefits that show definite or causal links with the program. The authors strongly believe that the credibility of the entire study hinges on the careful establishment of such links.

The research reported is divided into four major parts: (1) establishment of the present economic environment of the area served by the Alaska Highway and projection of its growth and composition; (2) description of the present transportation facilities and traffic patterns within the area, and limited analysis of the role that these facilities may play in the area's future economic growth; (3) compilation and measurement of the economic effects that can be projected for the years 1975 to 1985; and (4) translation of these effects into benefits, wherever appropriate, and estimation of their allocation among the various beneficiaries.

The study represents the combined efforts of three organizations. Stanford Research Institute of Menlo Park, California, as the principal contractor, bears the ultimate responsibility for overall direction of the project and for the findings reported. However, both Foster Associates Ltd., and Travacon Research Ltd., made significant contributions to the project.

At SRI, the study was conducted under the overall direction of Neil T. Houston, Manager of Regional and Urban Development Research. Ely M. Brandes was project leader, and other SRI staff members included Armando Lago and Mrs. Joanna Paxson. Staff members of Foster Associates who were

actively engaged on the project included H. Gordon Pearce and S. Douglas Allen. R. J. Culkin and J. W. Burrows of Travacon also contributed to the study.

Acknowledgment must be made for the very valuable assistance given to the project team by many individuals and organizations in Canada and the United States. Foremost among these were staff members of the Department of Northern Affairs and National Resources, the Department of Public Works, and the Department of Mines and Technical Surveys. Staff members of provincial governments of British Columbia and Alberta, Officials of the government of the state of Alaska, various U.S. government officials, and a large number of private individuals and business firms also contributed.

II SUMMARY AND CONCLUSIONS

Summary

The principal findings of the research conducted in this study are:

1. With an annual rate of discount of 4.2 percent, the total discounted benefits that could be derived from the proposed improvement program of the Alaska Highway would amount to $46,901,000 over the next 20 years, as against a discounted net cost of $84,051,000 under the most favorable construction alternative (Alternative C). Both the discounted costs and benefits were computed through 1985, and it was assumed that construction would begin in 1966. Under construction Alternative B, which involved considerably less road shortening than Alternative C, the discounted benefits would amount to $34,125,000, and the discounted net costs would be $91,676,000. (All cost estimates in this study are expressed in Canadian dollars.)

2. A third alternative construction program (Alternative E) essentially involved the construction of a new road from Hazelton, B.C., to the Atlin-Carcross Junction (Mile 866) and improvement of the Alaska Highway to the Alaska border. This calculation is omitted because the cost estimates presented in this alternative were incomplete, since they failed to take account of improvement or maintenance of the existing highway up to Mile 866. At the very least, maintenance of the existing highway would be necessary to serve the considerable local traffic originating or terminating on the highway between Mile 0 and Mile 866.

3. An allocation of the projected and discounted benefits, under Alternative C, between Canada and the United States resulted in an apportionment of 53 percent of all benefits to Canada and 47 percent to the United States. Under Alternative B, the allocation percentages were 52.3 percent for Canada and 47.7 percent for the United States.

4. All of the projected costs and benefits were discounted at the rate of 4.2 percent per year, which, according to the evaluation made in this study, is close to the lower limit of economic acceptability for a discount rate used in conjunction with public works projects. The rate represents an average of the Canadian and U.S. prime government rates, with an additional reduction to omit the monetary exchange or inflation risk factor that may be part of the current government borrowing rates.

5. With respect to Alternative C for 1985, 71.8 percent of all benefits were cost savings benefits--resulting from lower vehicle operating costs as a result of the improvement program--and only 28.2 percent of the benefits were generated benefits--resulting from additional activity stimulated by the improvement program. For earlier years, the preponderance of cost saving benefits is even greater.

6. The cost saving benefits were assumed to amount to 4.5 cents per vehicle-mile for trucks as a result of paving, plus an avoidance of costs because of road shortening, amounting to 34.5 cents for Canadian trucks and 49.7 cents for U.S. trucks. For passenger cars, the equivalent savings were 1 cent per vehicle-mile as savings because of paving and 6 cents per vehicle-mile as an avoidable cost because of road shortening. All of these data are based on the actual operating experience of organizations in Canada operating trucks and cars on paved and unpaved roads.

7. Of the total generated benefits projected for 1985, some $2,711,000 would be derived from increased tourism in the area, while $120,000 would constitute savings and profits resulting from possible increased export of agricultural commodities from Canada to Alaska.

8. With the exception of tourism (and perhaps agricultural production in Northern Alberta and Northern British Columbia), no other economic sector in the area served by the Highway would receive growth stimulus as a result of the improvement program. This is particularly true of mining, forest products, and oil and gas production. These industry sectors might obtain some cost savings benefits as a result of the paving program (these benefits were taken into account in this projection); however, their rates of growth and development would not be influenced by the highway improvement program.

9. It cannot be expected that the paving of the Alaska Highway would be a significant factor in stimulating truck traffic between the continental United States and Alaska. At the present time, less than 5 percent of the total tonnage moving between the continental United States and Alaska moves by truck, primarily as a result of significant cost advantages that ocean shipment has over trucking. Savings because of paving will not begin to offset the basic cost advantage that ocean shipment--including trailer-on-ship movement--has over truck movement.

10. The relative predominance of ocean shipment to Alaska, as compared with truck shipment, will be increased by the fact that the area around Anchorage is expected to grow and develop much faster in the future than will the interior of Alaska. The latter would be more favorably situated with respect to land transportation, while the former can be more efficiently supplied by ocean transport.

11. As was the case with basic industries in Northwestern Canada, no actual or potential industry was found within Alaska (tourism excepted) that would receive a significant growth stimulus as a result of paving the Alaska Highway. An industry sector in Alaska would have to be export oriented to experience rapid growth in the next 20 years. Export orientation would require a policy of minimizing all cost, including transport costs, to offset the disadvantage of Alaska's distance from major market centers. A policy of minimizing transport costs would tend to discourage the use of trucks for long distance shipment.

12. With respect to projected benefits from increased tourism in the area, it is estimated that additional tourist facilities, consisting primarily of hotels or motels, restaurants, and camping sites, amounting to $20 million must be constructed along the Canadian section of the Alaska Highway to accommodate the additional visitors and to induce a higher level of spending by tourists than currently exists.

13. In estimating the volume of additional tourist vists to the area, as a result of the improvement program, it was assumed that the number of tourists would grow rapidly--at the rate of 15 percent per year--following completion of the improvement program. A limitation on the rate of growth during this period might well be the speed with which new facilities can be constructed to accommodate tourists. However, during the bulk of the construction period, which is expected to last 10 years, the rate of tourist growth is projected at only (3) percent per year; this rate is considerably below the level currently experienced.

14. In regard to net benefits derived from increased tourism, it is estimated that the benefits would be only 10 percent of total tourist spending in the area. The remaining 90 percent of spending constitutes the cost of goods and services furnished to the tourists and the return on the investment in tourist facilities that could be invested, with good expectations of success, in many other parts of Canada.

15. In addition to the measurable benefits that would be generated as a result of increased tourism in the area served by the highway, there would be intangible benefits accruing to the visitors, the majority of whom will be from the continental United States. These benefits, while not measurable in monetary terms, should not be considered as insignificant.

16. The cost estimates for the improvement program used in this study were furnished by the Department of Public Works of the Government of Canada and represent yearly estimates of net additional spending required to improve, pave, and maintain the highway, instead of merely maintaining the existing highway in its present condition. By using net additional cost estimates, it was not necessary to list as an additional benefit the lower maintenance cost that would result from the paving program.

17. An examination was made of the appropriateness of using a toll scheme to finance (at least partially) the proposed improvement program. It was found that while in one respect--the preponderance of cost saving benefits--the improvement program might be suitable for a toll collection scheme, other considerations argue against it. These additional considerations would include the expected high administrative costs involved in assessing tolls equitably for all users, including local traffic, and the relatively low level of total benefits as compared with total costs. The latter consideration might induce administrators to raise tolls to the point where they might equal or even exceed the benefits accruing to the individual user; thus, the imposition of tolls might have a detrimental effect on traffic growth.

Conclusions

On the basis of the above findings, the following major conclusions appear appropriate:

1. A primary, if not the most important, factor responsible for the low level of projected benefits as compared with projected costs is the relative absence of generated benefits that could be traced directly to the paving of the highway. With the exception of tourism and some agricultural development, the pace of growth and development in the other sectors of the economy in the area served by the highway will not be affected by the projected program.

2. The total volume of projected benefits was also unfavorably affected by the relatively long construction period of 12 years. Although cost savings benefits will tend to accrue during the construction period, the major tourist-generating effect of the program must await the completion of the highway paving.

3. The delaying effect of the long construction program was unavoidably worsened by the discounting of both costs and benefits to their present values. Since the major costs are incurred earlier, the weight of discounting falls less heavily on the costs than on the later benefits. Incidentally, it would serve no useful purpose to extend the period of cost-benefit projections, since the discounted values of cost and benefits to be experienced more than 20 years hence are not of sufficient magnitude to change the current totals significantly.

4. The considerable variation in traffic density along the highway--and the expectation that the range of densities will tend to become even broader in the future--points to the fact that the paving of the entire highway would include the improvement of stretches of the highway where current and prospective traffic densities simply would not justify the costs involved.

5. As a corollary to the above conclusion, it is apparent that a very significant proportion of all projected cost savings benefits would be realized by a partial improvement program that concentrates on those stretches of the highway where traffic densities are higher than average.

6. The fairly rapid current growth of normal traffic on the highway suggests that a reevaluation of the total improvement program some ten years hence might well result in a positive finding. But, as indicated earlier, the benefits that could be achieved in the late 1980s or early 1990s cannot be measured adequately at present, since the weight of discounting makes them appear insignificant.

III THE ALASKA HIGHWAY: A PHYSICAL SETTING

In 1942, following the attack at Pearl Harbor, the U.S. government decided as a measure of continental defense to construct a highway link between the United States and Alaska. The Highway was begun at Dawson Creek, British Columbia, and carried northwestward for 1,525 miles to Fairbanks, Alaska; it was finished in 1944. In 1946, the U.S. Army transferred the portion of the highway located in Canada to the Canadian government, whose responsibility it has been ever since.

From Mile Post 0 at Dawson Creek, the Highway first passes in a northerly direction through Fort St. John to Fort Nelson (mile 300); there the highway turns west into the northern part of the Canadian Rockies. Near mile 490, the Highway reaches the River Liard and for more than 140 miles beyond the Highway roughly parallels the course of this mighty river. Above Watson Lake, near mile 642, the Highway crosses the Liard for the last time and travels west by Teslin Lake to Whitehorse--the capital of the Yukon Territory (mile 912). From here, the Highway travels northwest to Haines Junction (mile 1,016), and then north on the eastern slope of the St. Elias Range to the Alaska border.

At the time the Alaska Highway was built, it was a solitary land transportation vein that wound through the north-northwestern part of the continent. Today, however, the Highway is a part of a somewhat more complex land transportation system that traverses the area.

At the south end, the Alaska Highway joins the Hart Highway and proceeds west to Prince George, B.C. From there, Highway 16 extends to Prince Rupert on the coast. Prince Rupert is the terminal for the Alaska Ferry service that links the towns on the Marine Highway in the Alaska panhandle.

Near the beginning of the Alaska Highway, Hudson Hope Road branches off to the west to Portage Mountain Dam on the Peace River. This dam is now under construction and it is planned to be the largest hydroelectric project on the North American continent.

Near mile 649, the Cassiar-Stewart Road branches to the south. This road is used primarily for the trucking of asbestos from the Cassiar mine, and the ore is transported primarily by truck to Whitehorse and then by rail to Skagway. This Highway is approximately 90 miles short of completion. It will reach Stewart on the Portland Canal and, when completed, it will provide another link between Alaska and the Pacific Ocean.

Several roads in the Yukon Territory branch north and south off the Alaska Highway. Near mile 835, the Canol Road leads north to the Ross

River, and it is planned to extend eventually to Norman Wells in the Northwest Territory. Past Whitehorse, the Whitehorse-Keno Highway branches to the north, leading through Stewart Crossing to Mayo and Keno, from Stewart Crossing to Dawson City, and then across the Alaska border back to the Alaska Highway, forming the so-called Klondike Loop.

Finally from Haines Junction, the Haines Highway leads southward to Haines on the Alaska Ferry Route.

The existence of this extensive highway system in the area, and its probable continued expansion in the future, is significant to the purpose of this study in a number of ways. First, it indicates clearly that the Alaska Highway undoubtedly had a positive influence on the development of the area that it serves. The highway provided partial access to a number of development areas, particularly in the field of mining. The second significant aspect is that the projected highway construction indicates an obvious shortcoming: namely, it is too far removed from water transportation and several additional highways--completed or under construction--must find shorter outlets to the sea. (Examples are the Haines Road, the Cassiar-Stewart Road, and the projected Atlin-Juneau Highway.)

Finally, while the multiplication of highways will undoubtedly tend to diminish the importance of any one highway, growth of the highway system will have a favorable impact on tourist travel. One of the deterrents to automobile travel to Alaska would be the lack of an alternate return route. It is now possible to take the Haines Road to Haines and from there, via the Alaska Ferry, to Prince Rupert. Thus the growth of a highway system that branches from the Alaska Highway must be viewed as an inevitable and beneficial development.

IV PRESENT AND FUTURE ECONOMY OF AREA SERVED BY ALASKA HIGHWAY

Alaska

Population changes play an important part in a community's economic development, not only because they affect production costs by changes in the quality and availability of labor force, but they also influence the size of internal markets. Thus it is necessary to begin a projection of Alaska's economy by considering its past changes and its population prospects for the future.

Since the purpose of this chapter is to provide an indication of the structure of Alaska's economy in 1985, the physical size of Alaska makes a regional approval desirable and necessary. For the purpose of this study, the state of Alaska has been divided into five regions that are homogeneous as possible:

1. The southeast region which is separated from the remainder of the state by Canadian territory and the St. Elias Mountain range. The main population centers of this region are in the state capital of Juneau and the cities of Sitka, Ketchikan, and Petersburg.

2. The south central region, consisting of the Susitna and Copper River Basins, the Cook Inlet and its tributaries, Kodiak and adjacent islands, and the Alaska peninsula drainage into Shelikof Strait. Anchorage, Valdez, Kodiak, Seward, and Cordova are the main cities of this region.

3. The interior Alaska region, covering the Upper Yukon, the Tanana and the Kuskokwim River basins, and the arctic slope east of the Kupavak River basins. The major cities of this region are Fairbanks, Nenana, and Fort Gibbon. The Yukon Flats and Alaska Range are great tourist attractions, and an immense hydroelectric power plant, known as the Rampart Dam, is planned for this region.

4. The northwest Alaska region, consisting of the Seward Peninsula, the Bering Sea and strait islands north of latitude 62° north, the Kotzebue Sound and the arctic slope west of and including Kupavak River basin. Nome, the legendary arctic city, is located in the center of this region.

5. The southwest Alaska region, covering the Aleutian Islands, Bristol Bay, Kuskokwim River basin, the remainder of the Alaska peninsula, the Bering Sea islands south of latitude 62° north, and the lower Yukon basin south of latitude 64° north.

Past Population and Economic Growth

The pattern of economic development in the period before Alaska's statehood was marked by abrupt changes. Its isolation from the more dynamic centers of international development makes Alaska a marginal area that is very susceptible to the influence of events over which it has no control. The relatively high cost structure of Alaska--because of environmental factors and the seasonality of operation--as well as its extreme dependence on markets for certain products have always been major factors in the region's economic instability.

Three markedly different periods describe the changes of Alaska's economy in its prestatehood stage. The first period from the years 1900 to approximately 1912, saw a rapid growth of population and income which was the result of the discovery of gold in Alaska. This growth came to an end with the termination of the gold rush. The second period covers the years from 1920 to 1940 and includes the painful readjustments after the end of the gold rush and the beginning of the recovery during the 1930s as the result of the rising price of gold. The last period, from 1940 to 1960, was marked by rapid economic development and population growth, and it was influenced by the military expenditures of World War II, the Korean war and the cold war. Again these economic developments were influenced by outside considerations.

Description of Population Changes

Table 1 shows the changes in Alaska's population and its regional distribution. In 1960, Alaska's population was 266,167, and its growth rate in the two preceding decades contrasted favorably with the states of Nevada and Wyoming with populations of 285,000 and 333,000 respectively. An analysis of the factors affecting Alaska's population growth must concentrate separately on the changes in the native and nonnative civilian, and the military segments of the population.

The period from 1880 to 1930 was dominated by an influx of immigrants who were attracted by the gold rush. This first wave settled mainly in the interior and the northwestern regions, and at this time, 40 percent of Alaska's native population was concentrated in the southwest area. At the end of the gold rush, however, the population of all regions was nearly equal. During this period of immigration, smallpox and other epidemics caused a decline in the native population, and not until 1910 was this downward trend reversed.

The upsurge in Alaska's population in the 1930s was caused by an increase in the exports of furs and canned salmon, as well as the rise in the price of mineral products--principally gold and silver--which brought marginal producers back into the market. During that decade, the population increased 22.3 percent in the southeast, interior, and south central regions. At the beginning of the 1940s, the southeast

Table 1

ALASKA'S TOTAL POPULATION, BY REGION
1880-1960

Year	Southeast	South Central	Southwest	Interior	Northwest	Total Alaska
1880	7,748	4,352	13,914	2,568	4,844	33,426
1890	8,038	6,112	12,071	2,333	3,498	32,052
1900	14,350	10,000	13,000	5,600	20,642	63,592
1910	15,216	12,900	12,049	13,064	11,127	64,356
1920	17,406	11,173	11,541	7,964	6,956	55,036
1930	19,304	11,880	12,118	8,246	7,730	59,278
1940	25,241	14,881	12,846	10,345	9,211	72,524
1950	28,203	50,093	17,715	23,008	9,624	128,643
1960	35,403	108,851	21,001	49,128	11,784	226,167

Source: George W. Rogers and Richard A. Cooley, Alaska's Population and Economy - Regional Growth, Development and Future Outlook, Volume II, Statistical Handbook.

emerged with 35 percent of the population. It was the most populous region in the territory, and the south central region followed as a close second. The population changes described here show the basic instability that arose from a highly mobile, nonnative population that migrated to Alaska in search of economic opportunity. At the first sign of economic difficulties this population moved south to the United States.

A basic change in Alaska's economic and population structure occurred in 1942 as the result of World War II. During this period, rising costs and military manpower restrictions almost caused the cessation of mineral development. In 1943, the number of military personnel stationed in Alaska sharply increased, to a total of 152,000 persons. At the end of World War II, the military population decreased drastically, but again rose to 50,000 men at the height of the Korean war. Since that time, the number of military personnel dropped to approximately 35,000. Shifts in miliary expenditures have succeeded swings in trade conditions as a primary outside influence, still leaving the Alaskan economy highly vulnerable to exogenous and unforeseeable changes.

The main impact of military expenditures was felt in the south central and interior regions. Military spending changed the regional structure of the country to some extent, and in 1960, the south central region claimed 48 percent of the total population, while the interior accounted for 22 percent. In both of these regions, military personnel constitutes over 20 percent of the present population.

During the 1940s and 1950s, 88 percent of the population increase was military and its dependents and in 1952, the population growth came to a halt.

Alaska's changing economic growth is reflected in the area's urban structure. The gold rush created two great urban centers in Nome and Fairbanks', but in the aftermath, both of these cities almost disappeared. During the 1920s, Juneau and Ketchikan in the southeast began to grow, but soon the impact of military spending increased the population of Anchorage to 44,237 persons in 1960, and Fairbanks became the second largest city in Alaska. In 1960, Anchorage and Fairbanks accounted for 51 percent of the state's population.

In contrast with the high mobility of its nonnative population, a mobility that is primarily between Alaska and the United States, the distribution pattern of the native population has changed very little since 1900 and is still concentrated in the southwest, southeast, and northwest regions. By 1960, only 20 percent of Alaska's population was of native stock. As the result of the high birth rate and declining death rate, the native population became the fastest growing segment, with an increase of 27 percent during the last decade.

For the purposes of projecting Alaska's future population development and its regional distribution, attention must be focused primarily on four aspects: (1) the factors that determine the natural rate of

increase; (2) the determinants of the migratory pattern from the States; (3) the changes in the age structure of Alaska's population; and (4) the interaction between migration flows, labor force, and economic development.

Natural Birth Rate

Alaska's high crude natural rate (defined as the difference between the crude birth and death rates) of increase of 27.6 per 1,000 persons during the 1950 to 1960 decade has been steadily increasing since 1910. The natural rate of increase of the nonnative population has been 25.1. For the native population, it has been 38.4 per 1,000, higher even than the rate of natural population increase in Mexico.

The fertility ratio, which is indicated by the number of children under 5 years of age per 1,000 women, ages 15 to 49 years old, has been steadily increasing for both white and nonwhite population since 1930. Alaska's fertility ratio is now 892 for the nonwhite and 636 for the white Alaskan population--a ratio that is much higher than the 488 ratio for the entire United States.

The steady increase in the crude rate of natural population growth has been due to an increase in crude birth rates and fertility ratios, combined with a decrease in death rates mainly due to the decline in native infant mortality. The rate of infant mortality was still 40.7 per 1,000 births in 1960, as compared with 26.4 in the United States. Therefore, there is considerable room for a continued reduction in the crude death rate.

The prospects for a continued high rate of natural increase during the next decades are good because some future decline in the high infant mortality rates of the native population is indicated; however, continued urbanization and native population migration from the southwestern and northwestern regions might reduce the crude birth rate during this period. On balance, a projection of the rate of natural increase could safely forecast a continued high level in the rate for the next two decades to the year 1985.

Immigration, Emigration, and Population Growth

In the history of Alaska, decades of high immigration were followed by decades of emigration to the rest of the United States. The last immigration wave of military personnel in the 1940s and 1950s is now on the decline. Migrations to Alaska have also been caused by increased economic opportunities in labor-intensive operations, such as gold mining and labor-intensive military activities. In contrast, the projection of future economic activities in Alaska reveals prospects primarily for capital-intensive activities: oil exploration, refinery operations, mineral exploitation, etc. The present high cost of labor in Alaska and the small size of its internal market seem to preclude labor-intensive operations.

The Age Structure of the Population

To forecast the availability of Alaska's future labor force, it is necessary to describe the current population changes and their economic significance. Of special importance is the population in the 20- to 60-year old bracket because it will supply the majority of future manpower requirements. This proportion of population declined sharply after reaching a high of 70.8 percent in 1910. During the 1930s, it began to rise as the result of a revival in immigration, and this rise continued until 1950, when the influx of military personnel of draft age and their families (nearly 60 percent of the population) was in the 20- to 60-year old bracket. By 1960, the reduction in military personnel decreased the population in this age bracket to 52.9 percent.

The most significant change in population during the postwar period was reflected in the increase in the number of children under 15 years of age. In 1950, this age group constituted only 26 percent of the population; in 1960, it increased to 35.4 percent. Thus, the 1960 population pyramid has a much broader base, and it can potentially ensure that significant future increases in labor force requirements can be met from internal resources.

Population and Labor Force Participation

At the present time, Alaska's labor force is far from fully utilized. For example, in 1959, almost 25 percent of the employable population did not work at all and 20 percent worked less than half a year. Only 40 to 45 percent worked full- or part-time for 50 weeks a year. Part of this underutilization was the result of the seasonality of production in Alaska.

The ratio of dependents in 1960 was 61 per 100 employed persons. This amount compares favorably with a ratio of 68 per 100 employed persons in the United States. In the northwest and southwest regions, the ratio of dependents was near 80, which indicates that the presence of a relatively large military establishment keeps the ratio of dependents in Alaska at a low level.

In 1960, the median of school years completed by all residents of Alaska was 12.1 years, but for the nonwhite population, the median is only 6.6 years.

Population Growth Since Statehood

The population developments after Alaska's statehood follow the trends of the late 1950s. The population growth slowed from an annual rate of 4.0 percent in the 1950s, to a rate of 2.6 percent for the period from 1960 to 1964.

Two important factors seem to account for the decline in the rate of population growth. The crude birth rate decreased from 33.4 per 1,000 persons in 1960 to 30.6 in 1963; at the same time, the crude death rates have not diminished as dramatically as during the 1950s, even though the infant mortality rates for both white and nonwhite sectors are still declining. The crude death rate fell from 5.8 per 1,000 persons in 1960 to 5.2 at the end of 1963.

Additional cutbacks in military personnel stationed in Alaska, which were expected as a part of the missile age, did not materialize, and at the end of 1963, the number of military personnel stationed in Alaska was 34,000--almost identical to the number stationed there during 1960.

Economic Growth from 1900 To 1960

The economic development of Alaska from the beginning of the century can be divided into two distinct periods: a "staple" development up to the year 1940; and the period of military buildup which began with World War II.

The early development of Alaska can be described in terms of the staple theory of economic development popularized by Canadian economists. A staple is a product with large natural resource content. If processing is required, it does not involve large amounts of labor or unique skills. The staple must also be able to bear considerable transport charges and it must be in demand outside of the region of its production. The economic growth of Alaska until 1940 can be described by the development and decline of staples such as gold mining, fisheries, etc.

When gold was discovered in interior and Northwest Alaska in 1890, gold extraction was then a highly labor intensive process that required small amounts of capital in the form of tools and a worker's subsistence.

Since the demand for gold came from outside the region and the gold was extracted with the belief that the supply would soon be exhausted, there was no incentive to build permanent plants. The gold rush led to a rapid growth of population in Nome, Fairbanks, and other gold mining centers. After the rush subsided, only a small number of permanent settlements remained, and there was no nucleus of self-sustaining economies. The population of Nome declined--from a peak of 12,488 in 1900, to 852 in 1920--and an income decline affected all Alaska.

Alaska's recovery began in the 1930s with renewed dependence on gold mining and on a second staple: canned salmon. Salmon fisheries influenced the development of the southeast and in the peak years from 1934 to 1938, the average annual catch was nearly 7 million cases. As demand for salmon increased, over-exploitation grew and from 1955 to 1959, the average annual catch dropped to about 2.5 million cases.

Gold production again increased during the 1930s because of the relative rise in the prices of precious minerals. During the years from 1937 to 1941, gold mining reached a peak with an annual production of nearly $24 million. However, at the beginning of World War II, vast military expenditures were made in Alaska, which raised the prices of the scarce production factors, including labor, and accounted for the decline in gold mining that continues to the present day. The high cost of labor made Alaska a marginal producer of gold because wages and salaries constituted nearly two-thirds of total production costs.

Two new elements of growth appeared in the Alaskan economy during the late 1950s that have the potential of developing into the economic base of Alaska for the next two decades: the oil and gas resources in Kenai Peninsula in South Central Alaska, and the growth of a forest products industry in Southeastern Alaska.

Alaska also has hopes for the construction of a massive hydroelectric power plant at Rampart. If this appropriation is approved by Congress, the project would have considerable impact on the economy of the south central and interior regions for the next 15 years. This project is still in the study stage, and many doubts about its economic feasibility remain unresolved. Another hope for Alaska's economic growth is tourism, the prospects of which will be analyzed later in this study.

Economic Structure

The data below concentrate on the decade of the 1950s, for which complete figures on employment and state income are available. Additional information is provided in Tables 2, 3, and 4.

1. Government employment increased from 12 percent of the employed labor force in 1939 to 57 percent in 1960, with military personnel ranging from 1.7 percent in 1939 to 47 percent in 1954, and to 36.0 percent in 1960.

   The trend in civilian government expenditures and employment steadily increased until 1957, and there has been little change since that time. The labor force rose from 10.4 percent to 21.2 percent in 1960. This growth was caused both by the influx of civilians to military installations and by the growth of state and local governments when Alaska was given statehood.

2. Private employment also increased during this period and reached a peak in 1952. It then diminished and stabilized at a lower level plateau with only minor fluctuations.

   The percentage distribution of civilian employment in 1960 was agriculture--0.6 percent; government civilian employment--40.1 percent; mining--2.0 percent; contract construction--10.4 percent; manufacturing--10.2 percent; transportation, communication, and utilities--12 percent; retail and

Table 2

TOTAL EMPLOYED LABOR FORCE, BY CLASS OF WORKER
1939-1960

Labor Force	1939 No. Persons	1939 Percent	1950 No. Persons	1950 Percent	1960 No. Persons	1960 Percent
Government employment						
Military	500	1.7%	20,333	32.4%	32,680	3o.0%
Civilian*	3,000	10.4	13,361	21.3	19,261	21.2
Subtotal	3,500	12.1%	33,694	53.7%	51,941	57.1%
Private employment*						
Wage and salary	15,636	54.0	20,445	32.6	32,622	35.9
Self-employed	9,500	32.9	8,306	13.3	5,996	6.6
Unpaid family	300	1.0	250	0.4	364	0.4
Subtotal	25,436	87.9%	29,001	46.3%	38,982	42.9%
Total	28,936	100.0	62,695	100.0	90,923	100.0

* Estimated distribution based on other sources for government employment data and comparison with 1950 industrial classification by class of worker.

Sources: Computed from U.S. Census, 1940 Population, Characteristics, Alaska, pp. 12-14; U.S. Census, Population, 1950, Alaska, Bul. PC-54, pp. 71-74, 64-65; U.S. Census, Population, 1960, Alaska, Bul. PC(1)3C, pp. 3-61.

Table 3

TOTAL EMPLOYED LABOR FORCE
BY INDUSTRY GROUP AND ALASKA REGION
April 1960

Labor Force	Southeast	South Central	Southwest	Interior	Northwest	Total Alaska
Military	608	17,183	3,300	10,842	747	32,680
Commodity producing industries						
Agriculture, forestry, fisheries	623	635	269	235	155	1,917
Mining	19	434	89	235	75	852
Construction	806	2,762	87	1,359	206	5,220
Manufacturing	2,054	1,473	133	387	91	4,138
Subtotal	3,502	5,304	578	2,216	527	12,127
Distributive industries						
Transportation, communication, utilities	1,303	3,505	306	1,219	138	6,471
Trade (wholesale, retail)	1,574	5,300	283	1,729	206	9,092
Finance, real estate, insurance	314	1,254	5	387	13	1,973
Services	3,266	7,299	714	3,082	677	15,038
Public administration*	1,989	5,057	636	2,040	231	9,953
Subtotal	8,446	22,415	1,944	8,457	1,265	42,527
Industry not reported	1,122	1,307	176	664	320	3,589
Total	13,678	46,209	5,998	22,179	2,859	90,923

* Includes only uniquely governmental functions, not all government employees. For example, Education and Health employees are included under "services," Highway and Public Works government employees under "transportation, etc.," and "construction," etc.

Source: U.S. Bureau of the Census, Population, 1960, Alaska, PC(1)3C, Tables 83 and 85.

Table 4

PERCENTAGE DISTRIBUTION OF TOTAL EMPLOYED LABOR FORCE
BY INDUSTRY GROUP AND ALSAKA REGION
April 1960

Labor Force	Southeast	South Central	Southwest	Interior	Northwest	Total Alaska
Military	4.4%	37.2%	55.0%	48.9%	26.1%	36.0%
Commodity producing industries						
Agriculture, forestry, fisheries	4.6	1.4	4.5	1.1	5.4	2.1
Mining	0.1	0.9	1.5	1.1	2.6	0.9
Construction	5.9	6.0	1.5	6.1	7.2	5.7
Manufacturing	15.0	3.2	2.2	1.7	3.2	4.6
Subtotal	25.6%	11.5%	9.7%	10.0%	18.4%	13.3%
Distributive industries						
Transportation, communication, utilities	9.5	7.6	5.1	5.5	4.8	7.1
Trade (wholesale, retail)	11.5	11.5	4.7	7.8	7.2	10.0
Finance, real estate, insurance	2.3	2.7	0.1	1.7	0.5	2.2
Services	24.0	15.8	11.9	13.9	23.7	16.6
Public administration*	14.5	10.9	10.6	9.2	8.1	10.9
Subtotal	61.8%	48.5%	32.4%	38.1%	44.3%	46.8%
Industry not reported	8.2	2.8	2.9	3.0	11.2	3.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

* Includes only uniquely governmental functions, not all government employees. For example, Education and Health employees are included under "services," Highway and Public Works government employees under "transportation, etc.," and "construction," etc.

Source: Stanford Research Institute.

wholesale trade--13.5 percent; finance--2.6 percent; service and miscellaneous--9.3 percent.

In total, only 44 percent of employment was private employment; whereas in 1939, this proportion was 88 percent. Government influence is even stronger if we consider that contract construction is highly dependent upon government expenditures.

3. Personal income in Alaska increased at an approximate annual rate of 7 percent during the 1950s. Table 5 shows that in 1960, in spite of the reduction in government expenditures during the latter part of the 1950s, the government still accounted for one-half of the total personal income received by the Alaska residents.

   Contract construction was the largest source of private income, and it also accounted for 7.8 percent of the state income in 1960. Fluctuations of the construction business--which were determined by fluctuations in population movements and in government contracts--were largely responsible for the changes in the level of private income activity.

   Mining activities, which were the base of the economy before 1940, have again begun to assume a strategic position in Alaska's economy. The total gross value of production of natural resources climbed from $63.5 million in 1950 to $108.3 million in 1961.

   Agriculture and wildlife production (furs, subsistence hunting and fishing) have remained almost constant. Agriculture, concentrated in the southwest region near the population centers, had a modest growth that is minimal as compared with the great expansion of local Alaskan markets in the 1950s. The "wildlife industry" is mainly one of subsistence, and it is concentrated in the northwest and the southwest. Both the agricultural and wildlife industries accounted for only 0.3 percent of the state's personal income in 1960.

   Commercial fisheries had numerous upswings and recessions, but the period of the 1950s ended with a rise that brought gross value of production to a total of $43.5 million in 1961, as compared with $35 million for the beginning of that decade. Fisheries are the most important of the natural resource activities, accounting for 40 percent of the gross value. The salmon catch, which accounts for 80 percent of the value of the products of commercial fisheries, has continued to decline since the mid-1930s, but because of the high elasticity of demand and the general rise in price levels, the gross value of production has actually increased with the depletion.

Table 5

PERSONAL INCOME, BY MAJOR SOURCES--TOTAL ALASKA
(Millions of Dollars)
1950-1960

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Total personal income	$319.0	$439.0	$485.0	$506.0	$493.0	$500.0	$548.0	$537.0	$527.0	$554.9	$629.0
Wages and Salaries	105.6	172.9	176.0	172.6	159.0	155.6	196.9	184.5	182.9	203.0	244.0
Farms	0.1	0.1	0.1	0.2	0.2	0.2	0.3	0.3	0.3	0.3	*
Mining	10.0	9.6	11.2	10.6	8.6	8.1	8.4	9.2	8.2	9.3	8.0
Coal	1.6	1.8	3.2	3.6	2.6	2.3	2.8	2.9	2.5	2.6	2.0
Petroleum and natural gas	3.7	3.9	3.2	1.6	0.4	0.5	0.5	0.8	1.4	3.0	3.0
Mining and quarrying (except fuel)	4.7	3.9	4.8	5.4	5.6	5.3	5.1	5.5	4.3	3.7	4.0
Contract construction	35.4	78.4	70.2	64.9	56.0	50.0	74.1	54.6	47.4	48.0	49.0
Manufacturing	12.4	12.4	14.2	15.5	14.3	16.3	20.2	19.7	17.6	21.3	27.0
Fish processing	6.5	5.5	6.4	7.1	3.1	3.3	5.2	4.6	3.3	2.7	5.0
Other	5.9	6.9	7.8	8.4	11.2	13.0	15.0	15.1	14.3	18.6	22.0
Transportation, communications, utilities	12.7	18.0	22.0	23.8	23.6	23.9	28.7	30.5	38.3	40.8	50.0
Wholesale and retail trade	20.4	30.2	33.5	34.8	33.9	33.7	37.7	40.7	39.1	46.0	64.0
Finance, insurance, real estate	1.7	2.5	3.4	4.5	4.7	4.7	5.0	5.8	6.7	7.6	9.0
Services	8.9	16.8	16.6	14.5	12.7	14.4	17.0	18.8	20.6	25.1	32.0
Other industries	4.0	4.9	4.8	3.8	5.0	4.3	5.5	4.9	4.7	4.6	5.0
Fishing	3.7	4.4	4.4	3.2	4.4	3.7	4.8	4.2	4.0	3.7	4.0
Other	0.3	0.5	0.4	0.6	0.6	0.6	0.7	0.7	0.7	0.9	1.0

* Less than $50,000.

Table 5 (concluded)

	1950	1951	1952	1953	1954	1955	1956	1957	1958	1959	1960
Total personal income	$319.0	$439.0	$485.0	$506.0	$439.0	$500.0	$548.0	$537.0	$527.0	$554.9	$629.0
Wages and salaries	105.6	172.9	176.0	172.6	159.0	155.6	196.9	184.5	182.9	203.0	244.0
Government wage and salary disbursement	158.6	195.3	230.0	252.2	249.7	260.1	260.5	261.7	251.5	254.6	283.0
Federal, civilian	63.9	69.7	78.1	87.3	84.7	90.1	91.5	92.2	101.7	107.8	102.0
Federal, military	83.9	111.7	137.3	147.8	147.4	149.1	142.6	142.7	119.5	113.0	138.0
State and local	10.8	13.9	14.6	17.1	17.6	20.9	26.4	26.8	30.3	33.8	44.0
Other labor income	2.2	2.9	4.2	4.9	5.3	5.7	7.9	8.8	9.9	10.8	12.0
Proprietors' income	32.6	46.5	46.1	42.3	41.8	39.1	42.3	39.0	38.2	41.9	46.0
Farm	0.9	1.1	1.4	1.4	1.4	1.6	2.0	2.1	2.0	1.8	2.0
Nonfarm	31.7	45.4	44.7	40.9	40.4	37.5	40.3	36.9	36.2	40.1	44.0
Property income	15.9	19.1	22.6	25.8	27.4	28.8	30.7	32.3	32.0	34.1	35.0
Transfer payments	10.3	8.9	11.8	14.5	16.4	17.5	17.8	20.3	22.6	22.5	24.0
Less contributions to social insurance	(6.0)	(6.6)	(6.0)	(6.0)	(6.2)	(7.2)	(8.3)	(9.2)	(10.3)	(12.0)	(16.0)

A significant new development is the increase in the marketing of shellfish in the south central region, which, from a value of $810,000 in 1950, rose to $3,138,000 in 1960. Most of this increase is accounted for by the sale of Alaska king crab.

The major long term increase in natural resource activities has been the development of the forest products industry in the southeast. Total gross value in this sector rose from $4.6 million in 1950 to $18.8 million in 1960. It is reasonable to expect further increases in production as market conditions warrant expansion.

Mineral extraction has continued to decline from the high level attained in the late 1930s. The value of gold and silver production declined from $10,172,000 in 1950 to $3,983,000 in 1961. Although coal production doubled during the decade, it has since begun to diminish. The development of petroleum and natural gas production in the south central region rose from almost nothing to $17,817,000 in 1961, and at present, this production constitutes 59 percent of the total value of mineral products. New labor-saving techniques and devices in mining and exploration development have made this sector very capital intensive and have drastically reduced personal income originating in this sector. In 1960, personal income from mining was only 1.3 percent.

The final item of interest in natural resource extraction is the processing of sand, gravel, and stone in the interior region, which was stimulated by the construction boom of the early 1950s, and rose to a peak value of $11,926,000 in 1952. It has since declined, and in 1960 the gross value of production was $6,336,000.

Manufacturing accounted for only 4.3 percent of Alaska's total personal income in 1960. Salmon canning, which is territorial, and provided the bulk of the manufacturing earnings in colonial Alaska, has continued to decline. Employment in that industry fell from 7,316 workers in 1918 to only 4,868 in 1960. The only expanding sector is forest products, where highly efficient and automated pulp mills have been recently established. It is expected that further expansion will occur in this industry.

The distributive industries have continued to grow steadily over the past decades. Employment in these industries rose from 30 percent of total private employment in 1940 to 61 percent in 1960.

In summary, an analysis of past trends in Alaska shows many of the shortcomings and weaknesses typical of staple economies that were mentioned earlier. Only with further development can maturity and stability be achieved.

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Economic Growth Since Statehood

Cutbacks in military expenditures that were generally anticipated in the late 1950s did not materialize and personal income in Alaska continued to grow from 1960 to 1964 at an annual rate of 5.5 percent; per capita income grew 3.2 percent annually. Table 6 shows the major forces that determined the increase in personal income up to 1963.

Impact of Military Spending

The income generated by the federal military expenditures diminished from a peak of $138 million in 1960 to $127 million in 1963. However, this decline was offset by the new state and local government spending that has grown rapidly during the last three years. The federal government recently increased civilian expenditures in Alaska so that government participation in the state income rose slightly in this period. This growth, however, cannot be expected to continue, since a major portion of this spending was accounted for by the unique circumstances accompanying Alaska's admission to statehood.

Growth of Selected Industries

Mining. The income generated in the mining sector grew up to 1961 as the result of increased production of petroleum and gas. Since then, it has remained at the 1961 level as further increases in petroleum and natural gas have been compensated by declines in gold mining and quarrying.

Gold mining continued to decrease from a 1960 level of 173,000 ounces to 99,600 ounces in 1963. Silver also diminished from 27,000 ounces in 1960 to 14,000 ounces in 1963. The value of coal production remained at the same level--approximately $6 million. In contrast, the value of natural gas and petroleum increased from $17,817,000 in 1961 to $32,761,000 in 1963. The future of this business appears to be favorable, but much will depend on future successes in exploration.

Contract Construction. The personal income originating from the construction sector reached a peak in 1960 and reversed the downward trend during the late 1950s. It again diminished, however, in 1961 and began recovering in 1962 and 1963. As construction after the 1964 earthquake gathers momentum, it seems likely that construction will remain a volatile force in Alaska's economy, and it will depend upon outside factors for support.

Manufacturing. In 1963, the manufacturing sector remained at a slightly lower level than in 1960, following some decline in the

Table 6

PERSONAL INCOME, BY MAJOR SOURCES--TOTAL ALASKA
(Millions of Dollars)
1961-1963

	1961	1962	1963
Total personal income	$628	$661	$704
Wages and salaries	515	539	578
Farms	*	*	*
Mining	10	10	10
Coal	2	2	2
Petroleum and natural gas	4	5	6
Mining and quarrying	3	3	2
Contract construction	34	35	38
Manufacturing	28	25	26
Wholesale and retail trade	56	57	62
Finance, insurance, and real estate	10	13	14
Banking	5	6	7
Insurance real estate	5	5	7
Transportation	29	30	31
Railroads	1	1	1
Highway freight	7	7	8
Others	22	22	22
Communications	31	29	28
Telephone and telegraph	27	25	24
Electric gas and utilities	3	4	5
Services	32	36	37
Hotels	4	4	4
Personal services	4	4	4
Business and repairs	9	12	12
Amusements and recreation	1	1	1
Professional and social	3	4	5
Government	279	299	325
Federal civilian	105	110	120
Federal military	120	121	127
State and local	54	68	78
Other labor income	15	16	18
Proprietor's income	47	51	52
Farm	2	2	2
Nonfarm	45	49	50
Property income	39	44	47
Transfer payments	28	28	28
Less contributions to social insurance	16	17	18

Note: Totals may not add due to rounding.

* Less than $50,000.

production of canned salmon. The catch of salmon rose from 207,000 pounds in 1961 to 277,848 in 1962, but it declined in 1963 to 223,063 pounds. The catch of crabs, however, increased from 33,303 pounds in 1960 to 90,824 pounds in 1963.

Timber sales for Alaska's national forest rose from $118,131 in 1960 to $212,432 in 1961, but decreased to $171,592 in 1962. By 1963, sales totaled approximately $213,174. Therefore, there has been only a slight growth in this industry.

Projected Growth--1965 to 1985

Special Factors Associated with Economic Growth in the North

Any projection of growth possibilities in Alaska must take into account the special factors that will determine, to a great extent, the nature of this process of growth. Perhaps the most important factor is the seasonality of operations in Alaska. This factor, as well as the high costs of labor and transportation to the market centers, adds cost burdens to all products of the Alaskan economy. These considerations rule out anything but high-quality, capital-intensive resource development. Production for internal markets will, in all probability, be very small because of the small size of markets.

Population Projections

Population or economic projections of Alaska must be approached as studies in the rationale of economic growth rather than as mathematical exercises in curve-fitting, because an economic base that will support long term growth must yet be built. There is no doubt of the need for a structural change in the economic base of Alaska, since it appears inevitable that there will be an eventual cutback in military expenditures as the result of changing military technology.

The projections given in Table 7 are contingent upon the assumption that certain political conditions will prevail in the future. Therefore, it is assumed that international tensions will continue, but that no major war will occur during this period. It will also be assumed that no new trade barriers will be raised--against foreign countries in general and Japan in particular--that might lead to restrictions in the future Japanese economic involvement in Alaska. Population projections for Alaska cannot be based on population growth during the 1950s, because that decade was dominated by the increases in military population.

A recent projection that seems to avoid this error is the Series IB Population Projection for Alaska prepared by the Bureau of the Census. This projection assumes a moderate drop in the fertility ratio of Alaska to reach the national level in fifty years. Also, the gross

interstate net migration pattern from 1955 to 1960 is assumed to continue throughout the period. This is a very realistic assumption for a future projection, because the period from 1955 to 1960 was not characterized by a large scale influx of military personnel. This projection is given in Table 7.

Table 7

PROJECTION OF THE POPULATION OF THE STATE OF ALASKA
BY SERIES IB OF THE BUREAU OF THE CENSUS
(In Thousands of Persons)

	1970	1975	1980	1985	Projected Change in Population 1960-1985				
					Number	Births	Deaths	Net Migration	Rate of Increase
Series IB	290	334	381	428	202	244	40	-2	2.6%

Source: Bureau of the Census, Illustrative Projections of the Population States. Cement Population Reports. Population Estimates., Series P-25, No. 301, February 26, 1965.

This projection assumes that civilian migration to Alaska during the period will be large enough to offset the outmigration of the military and their dependents. This appears to be a realistic assumption, and it takes into account the capital-intensive characteristics of future development projects that are expected to grow more rapidly during this period. Given the high costs of labor in Alaska, the growth of such sectors as petroleum and natural gas, pulp, etc. will generate relatively small employment requirements due to the capital intensity of these sectors. Even the industrial development, which some predict would result from constructing Rampart Dam (aluminum, etc.), will be a capital intensive development.

The expected annual rate of population increase is projected at 2.6 percent, which corresponds to the 1960 to 1964 statistics. An implicit assumption of this forecast is that the federal government will initiate federal programs in various fields of development to balance the outmigration of military personnel. With the eventual curtailment of military operations, it is assumed that the interior region around Fairbanks will suffer a relative decline within the next 20 years, and much of the expected growth will occur in the south central region.

Overall Economic Projections

Alaska is now in a condition where structural economic changes must be initiated if the state is to maintain the rates of growth it has attained during the last decades. Rather than attempt to predict the precise pattern of the structural change, it will be assumed that the federal and state governments will act to maintain a reasonably high rate of regional growth. This assumption is permissable and justifiable when we look at recent examples of this income-redistribution type of policy in our farm sector, in Appalachia, in the federal urban programs, etc. These policies seem to reflect a conscious or unconscious policy of equalization of regional incomes, in spite of the different resource inventories of the region.

In the absence of price deflators for state incomes, we will have to work with national deflators, as shown below in Table 8.

Table 8

ANNUAL RATES OF GROWTH OF STATE INCOME AND PER CAPITA INCOME IN ALASKA
(In Percentages)

Period	State Income	Per Capita Income
1950-60	7.0%	2.0%
1960-64	5.5	3.1
1950-64	6.6	2.45
1956-64	4.5	2.9

The real growth of state income will be projected at the annual rate of 5.7 percent, which is somewhat higher than the 1960-64 level and above the growth rate of personal income in the United States for that period. This projection is equivalent to an annual rate of increase of 3 percent in per capita income, and this figure is justified by the assumption that developing a regional economic base must be accompanied by an economic growth that is higher than average. However, to provide for an annual increase in personal income of 5.7 percent efficient federal and state programs will be needed in the presence of military cutbacks. In addition, there must be an acceleration in the growth of the private sectors. This projection places the 1985 state income at about $2.5 billion (in terms of 1964 constant dollars) and per capita personal income of $5,820.

We are now ready to examine the development strategies available to the state of Alaska to achieve such a rate and to determine what degree government assistance would be necessary.

Projection of Specific Industries

A forecast of the Alaskan economy structure for 1975 and beyond cannot be made in the traditional manner because existing bases in the several Alaskan industries at present are insufficiently developed to permit straightforward projections of their growth. It is more realistic to assume that the pattern of future development will be the result of conscious development efforts. The future structure of Alaska's economy will, therefore, be largely a reflection of the sum of development efforts that will be undertaken. The following conclusions about the probable composition of this pattern can be reached.

The first major conclusion that emerges from an analysis of the development alternatives is that the future development of Alaska will probably take the form of a diversified export economy--consisting of gas and petroleum products, fisheries, wood products, tourism, and some mineral development.

It is unlikely that, in 20 years hence, the Alaskan economy will have only one major orientation, mainly because none of the industrial alternatives being considered currently appears capable of the rapid growth necessary to carry the state economy. In some markets, the economy cannot be expanded rapidly enough, but in other markets, the availability of natural resources would limit the rate of development. In other industries such as oil and gas, the beneficial effects on the rest of the economy are small. The following sectors appear to be the probable areas of future growth efforts:

Forestry. Although the Alaskan forestry industry, which is comprised of woods operations, wood-using industries, lumber and pulp, etc., will undoubtedly grow, there are several reasons why it cannot be expected to become a rapid and leading sector.

From the standpoint of demand, market growth is being slowed because of the steady trend to substitute other products for lumber. Technological changes have resulted in the development of new building materials that are cheaper and, in some cases, more satisfactory than wood. The rising price of lumber as compared with other building materials will also tend to restrict the growth of the Alaskan lumber industry. The absence of economy of scale in mill operations, the high distribution and transportation costs of Alaskan timber, and high costs of labor in Alaska are also growth-limiting factors.

The present construction boom in Alaska is not likely to continue at the same rate in the future. The cessation of earthquake

reconstruction and the absence of major waves of migration into Alaska also indicate that the construction industry will play a lesser role in Alaska's economic future. These factors suggest that overseas export must provide the main market for Alaska's economic expansion; Japanese export appears to offer the most promising market for Alaskan forest products.

Other supply and competitive considerations that will restrict the growth of this industry in Alaska concern the availability of commercially exploitable timber stands that are not as large as those of its main area competitor, British Columbia.

Within the continental United States, the Alaskan forestry industry will also face continuous competition from other areas such as the southern region of the United States, where technological change has developed newsprint production from resinous, fast-growing softwoods that require lower wood, power, and transportation costs.

Geographically, the development of the forestry industry will occur in Southeastern and South Central Alaska, which have the only economically accessible stands.

Finally, the great success of using sawmill waste in the pulp and paper operations in British Columbia will, in the future, tend to attract pulp and paper operations major lumber centers, and this factor will have an unfavorable effect on the Alaskan industry. In view of these uncertain supply and demand factors, the future development of this economic sector cannot be expected to have a very significant effect on employment growth.

Fisheries. With the exception of gold mining, Alaska's fisheries industry has experienced the slowest rate of growth, and its development prospects are basically restricted by the lack of U.S. consumption of fish per capita. Annual fish consumption in the United States has remained almost static--at 11 pounds per person for the past twenty years. From the standpoint of supply, growth prospects are also somewhat clouded by the uncertainties regarding the long-run availability of salmon. At present, the outlook for continued increases in salmon production appears to be very good, and the controls to prevent depletion seem to be working satisfactorily. However, long range uncertainties persist because future construction of hydroelectric dams might adversely affect salmon breeding grounds. The foreign demand for Alaskan fish is both small and unstable and cannot be counted on to stimulate exceptional growth.

One favorable development in the fishing industry in recent years has been the expansion of crab-fishing. Although supply considerations tend to limit further growth, crab-fishing, even in its present size, is a valuable segment of the fishing industry because it is most active during the winter months when other fishing is dormant.

Further development of the fishing industry would require the expansion of the domestic U.S. market and modernization of fishing vessels and techniques. The decline in the demand for fish is, at least in part, traceable to inefficient marketing and distribution methods. Modernization of fishing techniques and equipment may raise the productivity of the industry and decrease the unit cost; but it might also promote improved food preparation and marketing techniques by processing at sea. Although a more efficient and better equipped fishing industry could be an important ingredient in Alaska's future growth, the time required to achieve this development would be considerable.

Oil and Natural Gas. The future growth of the petroleum industry in Alaska will undoubtedly depend on the success in exploration and drilling, however, the probability of major new strikes remains speculative. Recent drilling experience on the Kenai Peninsula and Cook Inlet indicate that chances for further growth appear to be very good; however, this optimism must be tempered somewhat by the recognition that, in addition to the uncertainty mentioned above, oil exploration in Alaska must carry an additional handicap of distance from markets.

All mining activities in Alaska and Northern Canada, including oil and gas exploration, carry the burden of high transportation costs. Because of the prevalence of integrated companies in the petroleum industry, this transportation cost burden is not as visible as in other mining activities; but it exists, and it expresses itself in the widely accepted notion that only very large oil or gas deposits are likely to be developed in the remote northern areas. Since production costs are inversely related to the size of an oil or gas discovery, this added transportation cost has increased the minimum size oil or gas pool that can be considered for commercial use.

The oil and gas discoveries made in recent years actually have been in economically favorable locations within the area. These major discoveries were either close to the sea or offshore as at Cook Inlet, near Anchorage. Although transportation costs to a sea-terminal are not excessive, the problem of distance to consumer markets still exists.

Because of the limitation of crude oil imports to the United States and the relatively higher price for domestic crude oil, oil discoveries offer more opportunity for rapid exploitation than finds of natural gas. In recent years, the technical problems associated with liquifying natural gas and shipping it in special tankers were solved. One commercial liquefaction plant is already in operation, and several additional plants are in the active planning stage. Although the construction of a liquifying plant in Alaska is a definite possibility, the economic feasibility of such a plant has not been determined. Since natural gas is potentially available for export in many parts of the world, price competition could be very strong.

From the standpoint of overall employment, the impact of oil and gas developments would not be very great. All relevant segments of the petroleum industry--exploration, production, refining, and even petrochemicals--are very capital intensive. The employment impact of associated services may be somewhat greater.

In summary, a realistic assessment would project continued growth of the petroleum and gas production and its associated industrial development--but there will be only a moderate growth in the employment in this industry.

Mining Industry. Since gold mining has declined to a very low level, the future of metal mining in Alaska rests primarily with copper and iron ore. A number of low-grade deposits of copper and iron ore have been found, but present indications show that their development is many years away because at present, the prevailing high costs of labor and transportation make them economically unattractive.

Future mining prospects must not be judged entirely on the basis of finds which have already been made. Only a small portion of Alaska's land mass has been thoroughly surveyed and many significant discoveries will undoubtedly be made in the future. Because of the world's increasing need for metals and minerals, exploration prospects in Alaska may look far better twenty years hence than they do today.

Tourism. There is no doubt that tourism to Alaska should grow at a rapid rate within the next twenty years, and a number of separate developments will contribute to this expansion. First, there is the general growth of travel, both as a reflection of the increasing prosperity and the increase in all leisure time activities. Second, there is an even more rapid growth of the "outdoor" and "active" tourism that Alaska represents. Many studies in recent years have emphasized the growing shortage of recreational areas for camping, fishing, and hunting.

The development of jet air travel as a low-cost passenger carrier for long distances will undoubtedly enlarge the potential tourist market because it would reduce the time and cost of an Alaskan vacation. Although the growth of Alaska tourism may be limited at times by the availability of facilities, the overall expansion should be fairly rapid. One major drawback to the growth of Alaskan tourism is that it is a very seasonal industry, with a peak concentrated in the months of June, July, and August. These are also peak months for other seasonal industries, such as construction and fishing. The seasonal pattern of Alaskan economy would be reinforced and not corrected. Although seasonal migration would solve some of the problems associated with seasonal work, migration is in itself wasteful and tends to increase the labor costs within an economy.

Conclusion

In summary, it appears that in the next 10 to 15 years, the growth potentials of the industrial sectors areas discussed here will range from modest to good, but in no case, is it likely any one area will grow so rapidly that it would bring about a new era of single industry orientation. Thus, a forecast of Alaska's economy is not only a reflection of the general limitations on growth, but it is also an indication that some economic success will be made in several areas.

Northwestern Canada

The principal objectives of this section are: (1) to forecast future population levels and also the growth and nature of economic activity that can be expected through 1985 in the three areas of Northwestern Canada under consideration, i.e., Northern British Columbia, the Yukon Territory, and Northwestern Alberta; and (2) to attempt to determine the logical transportation flow of major products or commodities from these areas of Northwestern Canada to ultimate markets. The second objective includes an effort to determine the extent to which the Alaska Highway would be an important factor in future economic growth, transportation flows, and broadly speaking, the benefits that might accrue if the Alaska Highway were paved.

For the following reasons, no attempt has been made to prepare comprehensive projections of demand for all commodities, products, or services that might contribute to overall economic activity in these northern areas over the forecast period. Since the bulk of such production in Northwestern Canada will likely have to be sold in export markets in competition with production from other countries, such an approach would require preparation of a comprehensive worldwide supply-demand-price analysis for each of these products. This approach is outside the scope of this study. In the case of mineral production, there is no reliable way to predict if and when new ore bodies might be discovered in Northwestern Canada or elsewhere in the world. These discoveries could result in shifts in present supply-demand flow patterns.

The broad approach used in evaluating the impact on transportation of possible resource development was to determine the logical direction and method of flow of major products or commodities to ultimate markets, knowing the general areas favorable to resource development and the most likely general location of world markets. By studying the state of development of specific resources, or manufacturing industries in adjoining regions or developed portions of the provinces under consideration, (e.g., Central and Southern British Columbia), it is possible to get some indication of the probable timing of development in areas of Northwestern Canada. For example, the expected development of the forest products industry in Northern British Columbia can serve as a guide to probable timing of development of this industry in the Yukon. In addition, this British Columbia development can indicate logical transportation flows to export markets of Yukon production.

In the following analysis of Northwestern Canada, consideration has not been given to all major industries. The analysis has been restricted to those industries or other components of economic activity that could be accessible to the Alaska Highway and that potentially could benefit from paving of the Alaska Highway. For example, the potential hydroelectric power industry in Northwestern Canada has purposely been excluded from this study for several reasons. Although it is recognized that some sizable hydroelectric developments may be completed in Northwestern Canada by 1985, they are not likely to cause a significant increase in the permanent labor force of the area. Once completed, these developments will have no real significance relative to the Alaska Highway or any other major highway. Virtually all such developments will be located relatively close to tidewater, primarily because the choice sites are located on rivers near the coast (with one possible exception).

The brief summary of historical population growth and economic activity appearing at the start of the specific sections dealing with Northern British Columbia, the Yukon Territory, and Northwestern Alberta serves the following purposes:

1. As a guide in appraising the possibility that manufacturing industries of various types may form a growing part of economic activity for the needs of local markets. Growth of such industries could change historical population characteristics.

2. As a base for projecting future population and levels of economic activity, if growth in manufacturing operations are not expected to be large enough to cause a shift in population characteristics.

3. Because of the extremely small population base, to illustrate the insensitivity of variations in population forecasts on the need for manufacturing facilities to serve local markets.

4. To illustrate the relative importance of each area, one to one another, and to other areas of North America.

For purposes of this study, the area of Northwestern Canada that is generally accessible to the Alaska Highway is defined as:

1. Northern British Columbia is that region lying north of 55°N latitude, or north of a line running from the mouth of the Nass River on the west through McLeod Lake and east to the Alberta border. Its area is about 180,000 square miles, or about 50 percent of the provincial total.

2. The Yukon Territory covers an area of about 205,000 square miles.

3. Northwestern Alberta is Census Division No. 15, a land area of about 93,000 square miles, making up about 37 percent of Alberta's total land area.

In 1961, the population of these areas were as follows:

Area	Population
Northern British Columbia	34,476
Yukon Territory	14,628
Northwestern Alberta	76,884
Total	125,988

The total population for these three areas, therefore, only amounted to approximately 55 percent of the total population of Alaska in that same year.

The following discussion of these three areas will follow the same general sequence: (1) historical population trends and economic growth; (2) expected growth of those industries in Northwestern Canada that may have some significance as far as the Alaska Highway is concerned; (3) future population growth and economic activity; and (4) possible significance of population growth and economic activity to the Alaska Highway.

Northern British Columbia

Past Population and Economic Growth

Table 9 shows the changes in population of Northeastern and Northwestern British Columbia between 1931 and 1961. For comparative purposes, the change in population for the province as a whole is also shown. During this period, the population of Northern British Columbia ranged from a low of 1.5 percent (1951) to a high of 2.1 percent (1961) of the total population in the province. Figure 1, which shows the population distribution of British Columbia, illustrates very vividly the sparsely populated nature of Northern relative to Southern British Columbia. In addition, it illustrates the concentration of Northern B.C. population in the vicinity of Dawson Creek and Fort St. John at the southern end of the Alaska Highway.

Between 1931-61 the average annual growth rate in population in Northern British Columbia has increased substantially, as shown in the tabulation below:

	Average Annual Growth Rates	
Years	Northern B.C.	All British Columbia
1931-41	0.5 of 1%	1.7%
1941-51	3.5	3.6
1951-61	6.8	3.4

Table 9

POPULATION OF NORTHERN BRITISH COLUMBIA
BY REGION
1931-1961

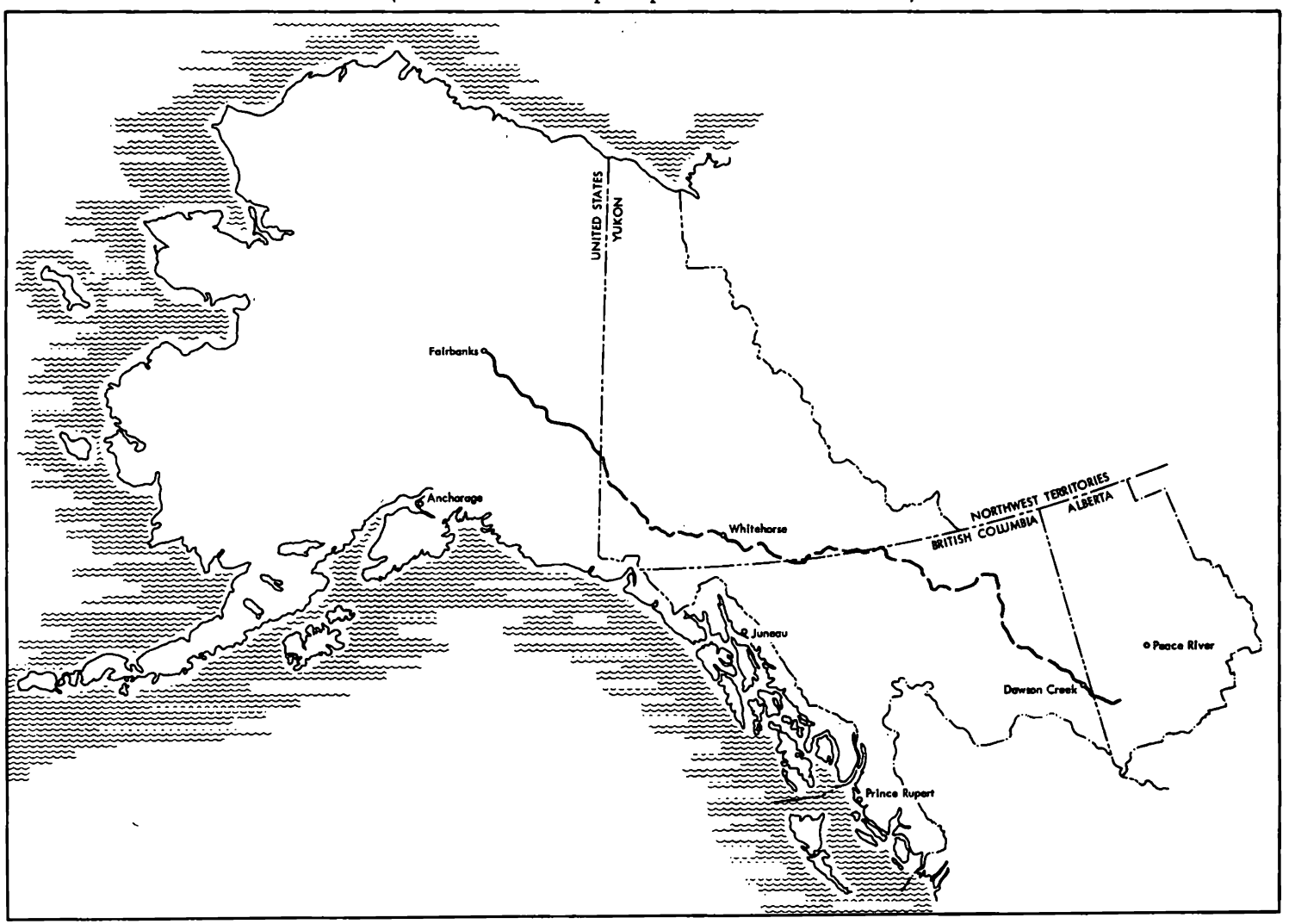
Year	Northwestern Subregion*	Northeastern Subregion†	Total Northern Region	Total British Columbia
1931	4,953	7,013	11,966	694,263
1941	4,097	8,481	12,578	817,861
1951	3,396	14,395	17,791	1,165,210
1961	3,415	31,061	34,476	1,629,082

* Census subdivisions 9A, 9B, and 9C.
† Census subdivisions 10A, 10B, 10C, and 10D.

Sources: Census of Canada. B.C. Bureau of Economics and Statistics, "Industrial and Economic Development in Northern British Columbia," submitted to the Alaska-B.C.-Yukon Conference, Whitehorse, September 14-16, 1964.

Figure 3

THE ALASKA HIGHWAY
(See detailed map in pocket on back cover)



The faster rate of growth in Northern British Columbia during the 1951 to 1961 period reflects the impact of mineral exploration and development activity in the area. Between 1931 and 1961, virtually all of the population growth in Northern B.C. occurred in the northeastern subregion, which is much more significant than the northwestern subregion to the development of the Alaska Highway. By 1961, the population of the northeastern subregion was about ten times that of the northwestern subregion.

Large scale economic development of Northern British Columbia has been hampered by many of the handicaps that faced development of Alaska, including isolation from the more dynamic centers of international development; susceptibility to influence of events over which it has no control; its relatively high cost structure; its primary dependence on export markets for its resource-oriented production; and greater inaccessibility, in terms of transportation distances than certain other regions which compete with it. Northeastern British Columbia, because of its greater distance from Tidewater, faces a more severe transportation handicap than Alaska or Northwestern British Columbia in marketing certain of its products.

Economic development in Northern British Columbia between 1951 to 1961 might be considered as "staple" in the sense that it has been used in the previous discussion of Alaska. In other words, staple products or commodities--mainly in the categories of agriculture, and oil and gas, and to a lesser extent in the categories of forestry, mining, fishing and trapping--currently provide the main economic base of Northern British Columbia. In 1961, however, the combined labor force employed in these industries was less than the combined labor force employed in construction, the service industries, trade, and public administration. The 1951 and 1961 labor force in Northern British Columbia is shown in Table 10 by industry category, in absolute terms, and in Table 11 in relative terms.*

In 1961, Northern British Columbia (including census subregions 9D, 9E, and 9F) accounted for only 4 percent of British Columbia total labor force, despite the fact that between 1951 and 1961, the total labor force in Northeastern British Columbia nearly doubled. During this period, the portion of the Northeastern B.C. labor force involved in agriculture, forestry, and fishing declined (see Table 10). This decline in absolute

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* The labor force for Northwestern British Columbia is distorted in comparison with its population figures shown in Table 9 in view of the fact that the labor force figures include census subdivisions 9D, 9E, and 9F (including Prince Rupert, Kitimat, and the Queen Charlotte Islands), which are relatively heavily involved in pulp and paper manufacturing, aluminum smelting, and logging, respectively. Subdivisions 9D, 9E, and 9F are outside our defined area of Northern British Columbia. Published labor force data are not available for subdivisions 9A, 9B, and 9C, which fall inside our definition of Northern British Columbia.

Table 10

LABOR FORCE IN NORTHERN BRITISH COLUMBIA, BY INDUSTRY
1951 and 1961

	Northwestern Subregion*		Northeastern Subregion		Total Northern Region*	
	1951	1961	1951	1961	1951	1961
Agriculture	56	68	1,939	1,608	1,995	1,676
Forestry	848	1,357	104	128	952	1,485
Fishing and trapping	846	723	79	17	925	740
Mines, quarries, oil wells	634	571	83	522	717	1,093
Manufacturing†	2,221†	4,537†	470	650	2,691	5,187
Construction	610	624	339	1,026	949	1,650
Transportation, communications, utilities	697	1,492	440	1,581	1,137	3,073
Trade	697	1,384	453	1,713	1,150	3,097
Finance, insurance, real estate	75	193	57	198	132	391
Service	1,182	2,292	1,192	1,814	2,374	4,106
Public administration and defense		722		659		1,381
Unspecified or undefined	79	398	72	317	151	715
Total	7,945	14,361	5,228	10,233	13,173	24,594

* Includes Census subdivisions 9D, 9E, and 9F (Prince Rupert, Kitimat, and Queen Charlotte Islands) which are outside our definition of Northern British Columbia.

† The fact that the 1961 labor force engaged in manufacturing is greater than the total 1961 population of Northwestern B.C. suggests that the bulk of this labor force is located in the subdivisions 9D, 9E, and/or 9F, which are located outside Northern B.C., as we have defined it. The same would apply to the bulk of the Northwestern B.C. labor force shown above. It would be surprising if the Northwestern B.C. labor force within our defined borders exceeded 1,000 in 1961 since total population was only 3,400.

Source: B.C. Bureau of Economics and Statistics, "Industrial and Economic Development in Northern British Columbia," submitted to the Alaska-B.C.-Yukon Conference, Whitehorse, September 14-16, 1964.

Table 11

PERCENTAGE DISTRIBUTION OF LABOR FORCE IN
NORTHERN BRITISH COLUMBIA
BY INDUSTRY AND REGION
1951 and 1961

	Northwestern Subregion*		Northeastern Subregion		Total Northern Region *	
	1951	1961	1951	1961	1951	1961
Agriculture	0.7%	0.5%	37.0%	15.7%	15.1%	6.8%
Forestry	10.7	9.4	2.0	1.3	7.2	6.0
Fishing and trapping	10.6	5.0	1.5	0.2	7.0	3.0
Mines, quarries, oil wells	8.0	4.0	1.6	5.1	5.5	4.5
Manufacturing	28.0	31.7	9.0	6.4	20.5	21.1
Construction	7.7	4.3	6.5	10.0	7.2	6.7
Transportation, communications, utilities	8.8	10.4	8.4	15.5	8.6	12.5
Trade	8.8	9.6	8.7	16.6	8.7	12.6
Finance, insurance, and real estate	0.9	1.3	1.1	1.9	1.0	1.6
Services	14.8	16.0	22.8	17.7	18.0	16.7
Public administration and defense		5.0		6.5		5.6
Unspecified or undefined	1.0	2.8	1.4	3.1	1.2	2.9
Total	100 %	100 %	100 %	100 %	100 %	100 %

* Includes Census subdivivions 9D, 9E, and 9F (Prince Rupert, Kitimat, and Queen Charlotte Islands) which are outside our definition of Northern British Columbia.

Source: B.C. Bureau of Economics and Statistics, "Industrial and Economic Development in Northern British Columbia," submitted to the Alaska-B.C.-Yukon Conference, Whitehorse, September 14-16, 1964.

numbers was more than offset by the increase in labor force engaged in mines, quarries, and oil wells (mainly oil and gas exploration and development) in the Fort St. John and Fort Nelson areas. Construction also increased substantially during this period, possibly reflecting preliminary activity on the Peace River power project. However, in absolute numbers, the largest increases occurred in the transportation-communication-utilities, trade, service, and public administration categories.

The limited data available on wage earnings suggest that, in 1961, aggregate payrolls in Northern British Columbia amounted to about $60 million, or only 3.5 percent of aggregate payrolls for the province.

In 1961, retail sales in Northern British Columbia amounted to about $52 million (only 3.3 percent of total retail sales in the province), and the gross value of factory shipments from Northern British Columbia* amounted to about $134 million (only 6.8 percent of the provincial total) of which only $13 million represent Northeastern B.C. factory shipments.

Trade Between British Columbia and Alaska. The last recorded data, which pertain to 1958, indicate that there were virtually no imports from Alaska into the province of British Columbia; these limited imports consisted primarily of fresh fish. The value of exports of British Columbia-produced commodities to Alaska in 1958 totaled about $625,000, of which 60 percent consisted of fish and fish products and 20 percent of chemical and allied products. No published information is available on the origin and destination of these inbound and outbound shipments, nor on the extent to which they were transported via the Alaska Highway.†

Growth of Selected Industries in Northern British Columbia

Future development of Northern British Columbia, particularly development that will have some significance to the Alaska Highway, will likely take the form of an export economy geared to production of various minerals (including oil and gas), forest products, and possibly some agriculture commodities. The following discussion of the growth of these industries should help to judge the validity of published forecasts of population growth in Northern British Columbia and the extent to which the Alaska Highway, paved or unpaved, will play a role in transportation of these products or commodities to ultimate markets. The possible importance of the tourist industry of Northwestern Canada will be discussed in a later section of this report.

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* Includes Census subdivisions 9D, 9E, and 9F, which are outside of our definition of Northern B.C. (see preceding footnote for detailed explanation).

† The later section dealing with traffic patterns and characteristics will deal more specifically with Alaska Highway Freight transportation.

Mining. The value of total mineral production, including metallic and industrial minerals, plus structural materials, between the 55th and 60th parallels of Northern British Columbia (excluding mineral fuels) is shown in the following tabulation for the years 1951 to 1963 inclusive, in millions of dollars.*

1951	$ 7.3	1957	$19.8
1952	10.6	1958	10.9
1953	11.4	1959	8.5
1954	13.2	1960	10.1
1955	13.0	1961	9.3
1956	17.2	1962	10.8
		1963	11.0†

The value of production increased fairly steadily to a peak of approximately $20 million in 1957, but dropped sharply between 1957 and 1959, apparently as a result of reduced lode metal production. In 1963, Northern British Columbia accounted for less than 2 percent of the total value of mineral production (excluding mineral fuels) in British Columbia. In recent years, these figures are of the same order-of-magnitude as values published by the B.C. Department of Mines and Petroleum Resources,‡ which show total value of production of $11.5 million (1962) and $14.0 million (1963), as set out in the tabulation below, for metallic minerals, industrial minerals, and structural materials in 1962 and 1963 for the Atlin and Liard mining divisions of Northern British Columbia. Mineral fuels are excluded.

	Thousands of Dollars	
	1962	1963
Metallic		
Gold	$ 20	$ 6
Industrial Minerals		
Asbestos	10,297	11,681
Sulfur	863	1,795
Structural		
Rock	2	--
Sand and Gravel	335	550
Total	$11,517	$14,032

* D.B.S. and Provincial Reports prepared by: Statistics Section, Mineral Resources Division Dept. of Mines and Technical Survey, July 1964.

† Preliminary.

‡ Annual Reports - B.C. Minister of Mines and Petroleum Resources.

In 1962 and 1963, value of metallic mineral production was negligible. Asbestos accounted for about 90 percent and 83 percent of total value of production in 1962 and 1963, respectively. Sulfur accounted for 7 percent and 13 percent in these two years, and sand and gravel accounted for the balance. For the three categories--metallic, industrial, and structural--the Northern B.C. (Atlin and Liard) 1962 and 1963 total values of production are only 5.9 percent and 6.5 percent, respectively, of total production values in all of British Columbia.

During recent years, mineral exploration, which has been intensive, has been largely localized along the eastern margin of the Coast Mountains area in Northwestern British Columbia. The northeastern portion (through which the Alaska Highway is routed between Dawson Creek, Fort Nelson, and Watson Lake) is generally recognized as a poor area for prospecting for other than mineral fuels. This poor area can be designated as that area running east of a line drawn between Prince George and Watson Lake.

Major existing or future mining developments in Northern B.C. may be summarized as follows:

1. Metallic Minerals

   a. Gold, Silver, Lead-Zinc - In the Alice Arm area on the north coast, two sizable mining ventures are under way. Dolly Varden Mines Ltd., has completed financial arrangements for its development. Silbak-Premier Mines Ltd. was scheduled to be in production by late 1964 at a level of 100 tons per day.

   b. Copper - Granduc Mines Ltd. has announced arrangements for financing production of its sizable properties (having reserves of 32 million tons) north of Stewart in Northwestern B.C., with production scheduled to start in 1968 at the rate of 7,000 tons per day. The Granisle Mine on Babine Lake is expected to open a 5,000 tons per day operation in 1966. The Kennecott Copper group is exploring its Galore Creek properties near the Stikine River in Northwestern B.C., which are estimated to contain between 100 and 300 million tons of better than 1 percent copper.

   c. Molybdenum - Properties are being explored in the Hazelton and Alice Arm areas of Northwestern B.C. The latter is very close to tidewater; the former about 200 miles from tidewater at Prince Rupert via Highway 16.

2. Industrial Minerals

   a. Asbestos - Currently, Cassiar Asbestos Limited has the only producing asbestos property in British Columbia,

a 1,500 tons-per-day operation at Cassiar. Proved reserves are sufficient for 30-years operations.

A number of asbestos deposits are known in the province, some of which are being examined in detail. A subsidiary of Cassiar Asbestos has been formed to develop deposits near Dease Lake.

The outlook for increased asbestos production and the development of new mines appears encouraging owing to steadily increasing world demand and Canada's leading position in asbestos production. Asbestos will likely continue to be the only industrial mineral of any large scale commercial significance in Northern B.C.

b. Sulfur - Sulfur is a by-product of sour gas production in Northeastern British Columbia. The Jefferson Lake Petrochemical Co. plant at Taylor, B.C. is the only one producing this industrial mineral in Northern B.C. at present.

3. Structural Materials. As indicated previously, sand and gravel were by far the most important structural materials in Northern B.C. in 1962 and 1963, although their value of production was only in the order of 3 percent to 4 percent of the value of total mineral production (excluding mineral fuels) in the area. Apparently no suitable quarry stone or building stone exists in the area east of a line from Prince George to Watson Lake.

Forest Products. The best potential forest reserves in this area of Northwestern Canada are located in the general area of Stewart and Hazelton, near the southwest border of the area as illustrated on the forest resources map, Figure 2. As evident from this map, the bulk of the timber resources in the western part of the area appear relatively poor. Timber reserves are somewhat better in Northeastern B.C. particularly in the Peace River-Fort St. John area and east of the Alaska Highway between Fort St. John and Fort Nelson. However, the Northern B.C. forest reserves cannot equal the potential annual cut of the major forest reserves on the coast or on Vancouver Island.

British Columbia's timber resources apparently are capable of supporting a large number of new pulp mills, a few of which might be located in Northern B.C.--particularly in the 1970s and thereafter. Expansion prior to 1970 will likely occur in Central B.C., using reserves adjacent to Highway 16.

Sustained yield forest management licenses granted by the B.C. Forest Service are expected to extend to all the northern forest areas within the next five to ten years. Current proposals, for various types

Figure 1 is presented in the pocket on the back cover.

of permits, cover reserves extending on a solid front to the 57th parallel. Currently, two sustained yield units are planned for the Fort Nelson area.

Initially, the Peace River, Takla Lake, Skeena and Nass valleys are the areas that will most likely be included in the northward expansion of the forest products industry. Subsequent development is expected to take place in the Stikine and Taku River valleys, in the area of the Stewart-Cassiar road, and near Fort Nelson.

Agriculture. The agricultural economy of Northern British Columbia is concentrated in two regions, the central interior (Region 9), which is traversed by Highway 16, and the Peace River (Region 10), which is traversed by the Alaska Highway as shown in Figure 3. Only a small portion of the central interior region falls within the defined area of Northern B.C.

Basically, the central interior region is oriented toward livestock. In 1960-61 about 85 percent of this region's agriculture cash income came from dairy products, beef, poultry products, swine, and sheep.

In contrast, the Peace River, although more of a mixed farming area, is heavily oriented to grain rather than livestock. About 77 percent of British Columbia's grain production comes from the Peace River region. In 1960-61, only about 35 percent of its cash income from agriculture resulted from the livestock business. The Peace River area is said to have about 2 million acres of potential arable land, of which only 14 percent is under cultivation at present. During the 1954-61 period, the main trends in the Peace River area have been a 160 percent increase in the number of beef cattle and a 186 percent increase in forage crop acreage under cultivation (see Table 12).

Agriculture officials feel that agriculture developments in the Peace River area will center around Fort St. John and Dawson Creek. Evidently less favorable climate and soil conditions present problems for expansion of agriculture in the plains area along the Alaska Highway.

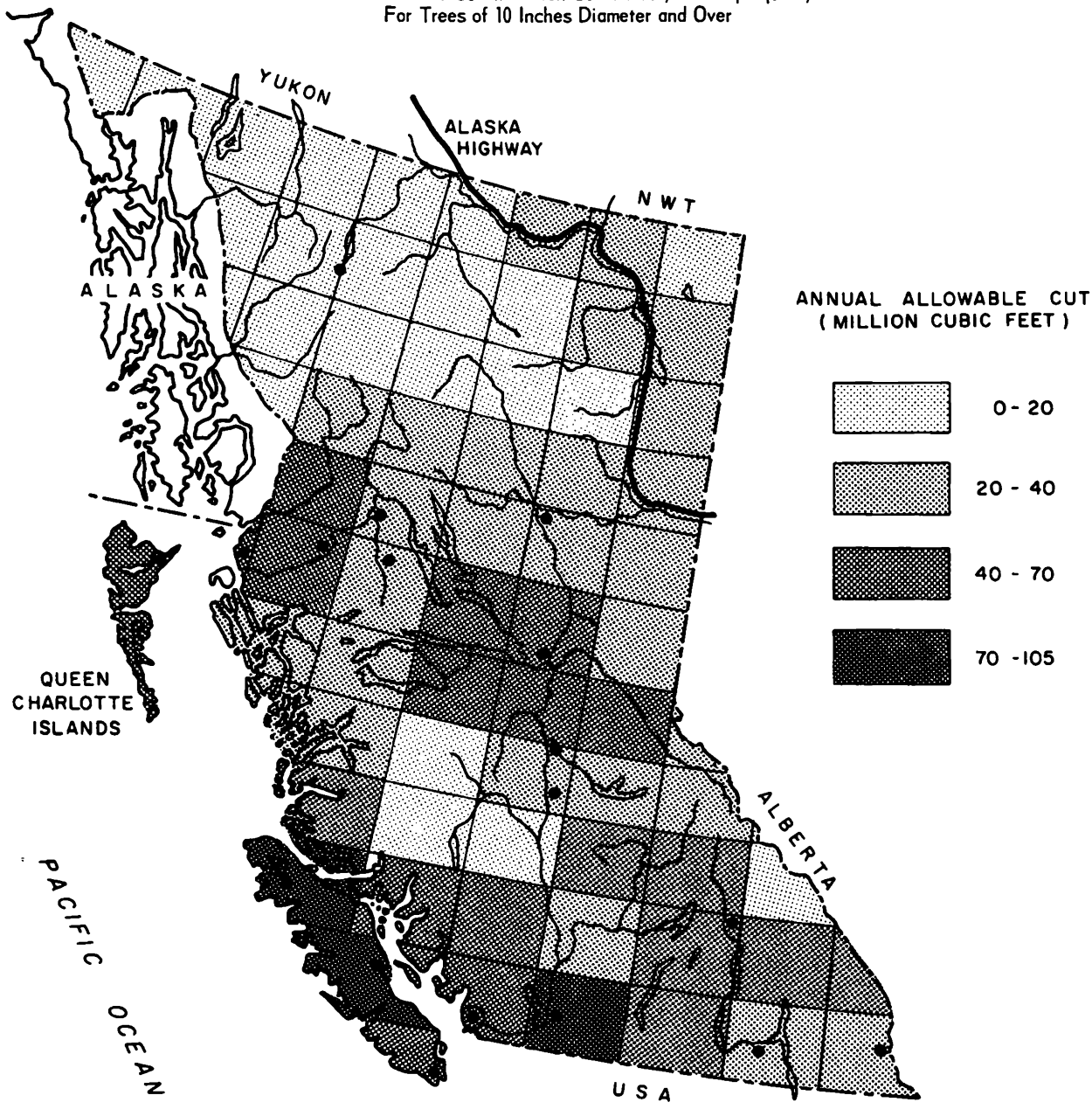
Petroleum Industry. Six sedimentary basins geologically favorable for petroleum and natural gas have been delineated in British Columbia, only two of which are located in Northern B.C., namely the Nass (River) Basin between parallels 56° and 58°, and Northeastern B.C., which is located in the general vicinity of the Alaska Highway. Geological information concerning the Nass Basin is very sketchy and, although a number of exploration permits have been taken out, future development will be slow due to relative inaccessibility.

All of the present B.C. oil and gas reserves are located in the northeastern area that is within the western plains sedimentary basin and encompasses an area of about 61,000 square miles. Because of the high cost of moving equipment, supplies, and personnel from main highways to

Figure 2

FOREST RESOURCES OF BRITISH COLUMBIA

Annual Allowable Cut in Million Cubic Feet, Per Map Square,
For Trees of 10 Inches Diameter and Over



TOTAL ANNUAL ALLOWABLE CUT – 2,260 MILLION CUBIC FEET

SOURCE: Bureau of Economics and Statistics, Victoria

Table 12

AGRICULTURE STATISTICS FOR NORTHERN BRITISH COLUMBIA
1954 and 1961

	Central Interior (Region 9)*		Peace River (Region 10)	
	1954	1961	1954	1961
Number of farms	1,056	907	1,586	1,407
Crop acreage				
Grain	11,050	12,500	174,000	172,000
Forage crops	80,000	83,500	35,000	100,000
Other	3,850	1,600	13,400	17,200
Total	94,900	97,600	222,400	289,200
Livestock				
Dairy	5,208	4,683	2,232	2,569
Beef	10,100	20,300	9,100	23,700
Hens and chickens	4,100	132,300	89,600	112,600
Cash income	$2,042,000	$3,594,000	$5,694,000	$8,750,000

* For comparison only. This area is largely outside the defined area of Northern B.C.

Sources: B.C. Bureau of Economics and Statistics, "Industrial and Economic Development in Northern British Columbia," submitted to the Alaska-B.C.-Yukon Conference, Whitehorse, September 14-16, 1964. B.C. Dept. of Agriculture, "Inventory of Agriculture in B.C."

drilling sites, B.C. oil and gas exploration to date has been concentrated close to existing highways.

Northeastern British Columbia has a plains area of 39,000 square miles and an approximate basin fill of 78,000 cubic miles of sediments.* The density of drilling is one exploratory well per 115 cubic miles of sediments. In Alberta, with approximately 372,000 cubic miles of sediments, the density is one well per 67 cubic miles. Substantial potential for further exploration seems to exist, therefore, in Northern British Columbia.

Crude oil discovered to date amounts to 257,000 barrels per exploratory well in British Columbia as compared with 691,000 barrels per exploratory well in Alberta.

The development of natural gas has been much more intensive than that of crude oil, and this is reflected in the discovery ratio of 10.6 billion cubic feet per exploratory well as compared with 2.8 billion cubic feet per well in Alberta. It is anticipated that this high gas discovery ratio will be maintained for a number of years. Gas reserves discovered to date are 93.6 million cubic feet per cubic mile of sediments in British Columbia and compare with Alberta reserves of 80.8 million cubic feet per cubic mile of sediments.

Based upon historical exploration experience coupled with the comparatively low "intensity of drilling," the chances of further growth in hydrocarbon reserves in British Columbia appear fairly good. Table 13 summarizes historical trends in crude oil and natural gas reserves, production, and also drilling activity in British Columbia. In 1964, British Columbia accounted for only 3 percent of total crude oil reserves, 16 percent of total natural gas reserves, 4 percent of total crude oil production, and 12 percent of total natural gas production in Canada.

Regarding drilling activity, there seems to have been a decline in relative importance of British Columbia to total Western Canadian activity in the past few years. "New field wildcat" drilling† declined from about 11 percent of the Western Canadian total in 1960 to 4 percent in 1964. "Other exploratory" drilling† was 10 to 11 percent of the Western Canadian total in 1961 and 1962, but dropped off to 3 percent in 1964. Although development drilling in B.C. was as high as 15 percent of the Western Canadian total in 1962, normally it has been in the 4 to 8 percent range and was 4 percent in 1964.

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* The foothills belt of 22,000 square miles is relatively sparsely developed and is difficult to appraise because of lack of information.

† Canadian Petroleum Association 1964 Statistical Year Book.

Table 13

PETROLEUM INDUSTRY STATISTICS FOR BRITISH COLUMBIA
1954-1964

Year	Proved Remaining Reserves		Annual Production		Drilling Activity			
	Oil (millions of barrels)	Gas (trillions of cubic feet)	Oil (millions of barrels)	Gas (billions of cubic feet)	New Field Wildcat Wells	Other Exploratory Wells	Development Wells	Total Wells
1954	n.a.	n.a.	n.a.	0.06	14	11	1	26
1955	n.a.	n.a.	--	0.17	34	2	--	36
1956	n.a.	1.59	0.15	0.27	22	5	30	57
1957	2.09	1.80	0.35	8.40	36	25	33	94
1958	8.96	1.69	0.51	62.96	37	11	27	75
1959	19.40	1.83	0.86	68.76	49	12	49	110
1960	44.96	3.10	0.87	84.90	60	11	72	143
1961	80.38	3.62	1.02	103.40	45	28	137	210
1962	136.58	4.93	8.90	128.73	48	33	249	330
1963	136.43	5.77	12.52	133.75	56	27	93	176
1964	204.04	6.93	11.53	145.60	41	12	87	140

Source: Canadian Petroleum Association, Statistical Yearbook.

The future growth of the petroleum industry in Northern British Columbia will undoubtedly depend on (1) future success of exploration activities, and (2) development of distant markets for oil and gas discovered. Regarding developing markets for these fuels, British Columbia reserves are faced with a greater transportation handicap than Alaska reserves owing to their "landlocked" location. Alaska reserves are closer to tidewater, which is an advantage in the case of crude oil and a potential advantage for natural gas.

Crude oil requirements of B.C. refineries are expected to grow at about 4 percent per year during the period to 1980 or 1985.* An increasing share of these requirements should come from B.C. oil reserves. By 1968, it is expected that about 88,000 barrels a day* of B.C. refinery requirements will come from B.C. reserves, as compared with only 24,000 barrels a day in 1962. This expected increase is equivalent to about an 18 percent per year annual growth rate, without taking account of possible shipments into the U.S. Pacific Northwest area. After 1970, when displacement of B.C. oil for Alberta oil has been completed, growth in demand for B.C. crude (over and above the 4 percent annual growth in requirements of B.C. refineries) will depend on the extent to which B.C. oil will penetrate the Pacific Northwest market.

After 1970, demand for natural gas within British Columbia should increase at about 4 to 5 percent per year. Virtually all of this increment should be supplied from Northeastern B.C. reserves. (Prior to 1970, the growth rate will be somewhat higher until the sizable B.C. Hydro Burrard thermal-electric generating load is replaced by Peace River hydroelectricity.) In addition to this domestic market for natural gas, requirements for B.C. gas in certain export markets, such as the Pacific Northwest and Rocky Mountain states, will likely grow at a higher annual growth rate. Export requirements currently exceed domestic requirements for B.C. gas.

Because of this encouraging outlook for Northeastern British Columbia oil and gas, a high degree of exploration activities should continue adjacent to the B.C. portion of the Alaska Highway over the forecast period.

Projected Population and Economic Growth--1965 to 1985

Growth in population and economic activity of Northern British Columbia to 1985, unlike growth projected for Alaska, is not expected to depend on a structural change in the economic base of the region.†

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* "Petroleum and Natural Gas Resources" and "Petroleum Resources and Requirements of B.C." 15th B.C. Natural Resources Conference, 1964.

† A drop in military personnel and civilians employed for military purposes in Alaska is anticipated over the forecast period, requiring such a change. In Northern B.C. military personnel and civilian supporting employees do not make up a significant part of the population.

Since the 1961 population of Northern British Columbia was only about 13 percent of total Alaska population and since it is not concentrated geographically to the same extent as Alaska population, the prospects for abnormally rapid growth in certain manufacturing businesses to support Northern B.C. markets seem even less probable than development of such businesses in Alaska. Relatively high costs of labor and other factors will likely act as further deterrents to significant growth in manufacturing in Northern B.C. Future economic activity, as discussed previously, is likely to be concentrated in the mining, forest products, and oil and gas industries and in agriculture. From the earlier discussion it is evident that growth potential for these industries will be good. Since the employment requirements of these resource industries are not substantial, their growth through 1985 should not result in any abnormal effect on labor force requirements. For these reasons, population growth in Northern British Columbia through 1985, in relative and absolute terms, is not expected to differ materially from that of the recent past.

From 1930-31, the average annual population, by decade, for Northern British Columbia and for Alaska have been as follows:

	Average Annual Growth Rate	
	Northern B.C.	Alaska
1930/31-41	0.5 of 1%	2.0%
1941-51	3.5	5.9
1951-61	6.8	5.9

The Bureau of Economics and Statistics of British Columbia has forecast that Northeastern British Columbia (Census Division 10) population will grow to 81,000 by 1975,* equivalent to a 7.1 percent annual growth rate since 1961, compared with an 8.0 percent per year growth rate between 1951 and 1961. Although such growth rates are conceivable, if they are trended out to 1985, it results in a population for Northeastern B.C. of about 161,000, or 39 percent of Alaska's forecast 1985 population compared with 13 percent in 1961. This population level of 1985 appears high.

The Northwestern B.C. population should grow to about 5,000 by 1975 and 6,500 by 1985 if growth follows the forecast trend for the province as a whole, i.e., 2.6 percent per annum. In summary, therefore, Northern B.C. population would be as follows in 1975 and 1985:

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* "Industrial and Economic Development in Northern British Columbia," Alaska-B.C.-Yukon Conference, Whitehorse, Sept. 14-16, 1964.

	1975	1985
Northwestern B.C.	5,000	6,500
Northeastern B.C.	81,000	161,000
Total Northern B.C.	86,000	167,500

A more conservative but perhaps more realistic population growth results in estimates for 1975 and 1985 as follows:

	1975	1985
Northwestern B.C.	5,000	6,500
Northeastern B.C.	70,000	110,000
Total Northern B.C.	75,000	116,500

Possible Significance of Population Growth and Future Economic Activity to Alaska Highway

In attempting to evaluate the impact of growth of mining, forest products, agriculture, and the petroleum industry in Northern British Columbia on the use of the Alaska Highway, or conversely--to evaluate the net benefits to these industries as a result of paving the Highway--consideration should be given to answers to a number of questions, including:

1. Where will development of the industry be concentrated?

2. In what direction does the product or commodity logically flow to reach its ultimate market?

3. What transportation mode(s) is(are) generally used by the industry?

4. In the case of highway transportation, is a paved highway desirable or necessary?

Mining Industry. As indicated earlier, it seems highly probable that mining developments in Northern B.C. will occur in the northwestern rather than northeastern area. Because the most direct, shortest, and most accessible route to large markets or smelting facilities is via the Alaska Panhandle to tidewater, the Alaska Highway is not likely to be a logical mode of transportation regardless of whether it is paved. The logical flow is in a southwest direction to tidewater. The Cassiar-Stewart Highway appears, therefore, to have greater significance than the Alaska Highway.

The largest mining potential in British Columbia seems to center around copper and other metallic minerals. Because of the location of exploration and production activities in Northwestern B.C., there is virtually no likelihood that these mining developments could utilize the Alaska Highway, regardless of whether it is paved. In fact, in addition to the Cassiar-Stewart Highway, another transportation system for the area is proposed. During a recent trip to Japan, Premier W. A. C. Bennett purportedly announced that B.C. will construct a 100-mile Pacific Great Eastern rail line from Stewart north over Bear Pass, which should facilitate resource development projects to be financed jointly by Japan and British Columbia. The line, to be built by PGE,, eventually will link with an extension from Fort St. James at a point near Dease Lake. It would traverse the mineral-rich region and focus attention on Stewart as the key tidewater ore port.

At present a portion of the top grade asbestos fiber is being shipped from Cassiar via truck on the Alaska Highway to Whitehorse; then by rail to Skagway, Alaska; and by boat to Prince Rupert or Vancouver. With the completion of the Stewart-Cassiar road, tidewater will be only about 300 miles distant, thereby providing the opportunity to cut transportation costs for asbestos substantially if shipments are rerouted away from the Alaska Highway. The reduced transportation costs should permit production of lower grade raw materials. Completion of the Cassiar-Stewart will take three to five years, however, even if the necessary funds become immediately available under the Federal-Provincial "Roads to Resources" program.

A fairly large quantity of fiber is also being shipped from Cassiar to Fort St. John by truck over the Alaska Highway for transshipment by rail. If the rail line were extended north and west from Fort St. James to Dease Lake, asbestos fiber might possibly move all the way via rail to final market destinations. Some rush shipments of asbestos will probably continue to move all the way by truck to Vancouver over the Alaska Highway via Fort St. John. Such rush shipments apparently are small relative to total asbestos shipments.

Industrial minerals and structural materials generally are used locally as they command rather low end-market prices compared with lode minerals and so generally cannot absorb high transportation costs. No large volume traffic over the Alaska Highway is expected from this source.

Forest Products. In the first major round of Northern B.C. forest industry expansion, only the Peace River area development is likely to utilize any portion of the Alaska Highway for delivery of lumber or other forest products to market. Such movements on the Highway per se obviously should be short, i.e., to Dawson Creek or Fort St. John. Shipments from the other areas are likely to move for the most part via rail, e.g., Takla Lake products moving to Fort St. James and south via PGE, or because of their proximity to tidewater via water.

In the second major round of expansion, only developments in the Fort Nelson area would utilize the Alaska Highway, primarily for delivery to eastern Canadian and U.S. markets via Fort St. John and Dawson Creek. Development in the Stikine and Taku and Cassiar-Stewart Highway areas would be transported to markets primarily by water. Developments in this area could also benefit from completion of the Cassiar-Stewart Highway or the proposed Stewart-Bear Pass rail line, not the Alaska Highway. Really to open up the Fort Nelson forest areas, some experts feel that an extension of the PGE railway to Fort Nelson would be necessary, which would reduce or eliminate the need to ship forest products over the Fort Nelson-Fort St. John portion of the Highway.

Agriculture. Since only a small portion of the central interior region falls into Northern B.C., it will have relatively little significance regarding the Alaska Highway as a transportation route, regardless of whether the Highway is paved.

Grain production from the Peace River (northeastern region) is sold primarily as feed grain in the Cariboo and Fraser Valley areas. In addition, the Peace River region has over 90 percent of the provincial acreage devoted to forage seed production. It seems evident, therefore, that the logical movement of grain and forage seed production is in a southwesterly direction either by truck or rail. For these reasons, coupled with the fact that the agriculture activities in the Peace River area are expected to center around the southern end of the Alaska Highway, the Highway is not likely to be a significant transportation factor to the agriculture economy of Northern British Columbia, whether paved or not.

If packing plants are established in the agriculture areas of Northern British Columbia, shipments of meat via the Highway could possibly increase. A paved highway could be an incentive to the transport of meat to Alaska. Currently, some meat is moving from Edmonton and the U.S. Midwest to Alaska by the Highway. Because of the small population forecast for Northern B.C., and because of its expected concentration at Fort St. John and Dawson Creek, meat deliveries to markets north along the B.C. portion of the Alaska Highway will likely remain small.

Oil and Gas. Use of the Alaska Highway by vehicles engaged directly or indirectly in oil and gas exploration work will not likely be influenced by paving of the Highway. Because of the nature of the exploratory work, such vehicles spend a good deal of the time operating in areas with poor roads or virtually no roads at all. Paving of the Alaska Highway might have an adverse effect as a result of road bans or weight limitations that might be imposed during annual spring break-up.

Regarding petroleum products, about 2,000 truckloads of refined products from the Taylor, B.C. refinery, and another 400 truckloads from Edmonton, are moving up the Alaska Highway each year to bulk dealers in Northern B.C. and the Yukon. In addition, B.C. propane is being shipped

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up the Alaska Highway. About 4,000 barrels moved into the Northwest Territories in 1963, plus 12,000 barrels to the Yukon. In addition, an unknown quantity was consumed in Northern B.C. in communities close to the Highway. Paving of the Alaska Highway undoubtedly would benefit the movement of such refined products along the road as a result of lower operating costs. However, because of very small market for petroleum products in these northern areas that are accessible to the Highway, lowered operating costs are not likely to result in any sizable net benefits to the petroleum products or propane industries, or to the consumers of these products. Union Oil Company of Canada Limited announced plans in April 1965 for construction of an oil refinery at Prince George. Although completion of this refinery might result in some shift in movements of petroleum products to Northern British Columbia, the impact of any shift is not likely to be significant because of the relatively small market in this part of Northwestern Canada.

Unlike other commodities, oil and natural gas from Northern B.C. moving to export or to lower B.C. mainland markets, will travel by pipe line rather than by rail or truck. The Alaska Highway, therefore, will not be a factor in moving larger volumes of oil and gas to market. Sulfur production, a by-product of natural gas processing, will continue to move via train to tidewater for shipment to export markets.

Conclusions

In summary, most mining and forest products development in Northern British Columbia should occur in the northwestern rather than northeastern part of the area. The logical flow of production from these industries will be to tidewater and thence to ultimate export markets or domestic markets close to population centers. These industries, therefore, will make little, if any use of the Highway, even it it is paved.

The bulk of agriculture products produced in the Peace River area will move south by rail for consumption within the province.

Paving of the Alaska Highway is not expected to have any significant net benefit to the oil industry. Exploration activities do not require paving. Production of oil, gas, and sulfur will move via pipe line or by rail, not by truck. Movement of refined petroleum products might benefit from paving of the Highway, but the overall net benefit should not be significant.

In order to be competitive in world export markets, and in view of the many handicaps facing resources production in the north, emphasis should be placed on minimizing transportation costs. Because a sizable portion of these resources are located south and/or west of the Alaska Highway, the logical movement is in a southwesterly direction to minimize more costly truck or rail transportation in favor of water transportation. Because of the geographic location of the resources relative to the Alaska Highway, because the general direction of the Highway is at right angles

to the logical flow to tidewater, and because the movement to tidewater over the Highway would generally result in increased land transportation when compared with more direct southwesterly flow, the use of the Alaska Highway is not preferable.

The major exception to this generalization is the two-way movement of local freight and commerce via truck between centers such as Fort Nelson, Fort St. John, and Dawson Creek. Most of the population growth in Northern British Columbia, as mentioned before, is expected to develop in these centers. For purposes of general freight and passenger traffic between these centers, a paved highway would be preferable.

Yukon Territory

Past Population and Economic Growth

Table 14 shows the trend in population in the Yukon Territory between 1931 and 1961. Although the population of the Yukon grew at a somewhat faster rate than the population of Northern B.C. over this 30-year period, in 1961 the Yukon population of 14,628 persons amounted to only 42 percent of the Northern British Columbia population.

Table 14

POPULATION OF THE YUKON TERRITORY
1931-1961

Year	Population
1931	4,230
1941	4,914
1951	9,096
1961	14,628

Source: Canada Year Book.

The average annual growth rate in Yukon population between 1931 and 1961 was:

	Average Annual Growth Rate
1931-41	1.5%
1941-51	6.3
1951-61	4.9

The average annual growth rates in the 1930s and 1940s were significantly higher than those in Northern British Columbia. The average annual growth rate during the 1950s, although higher than the rate for Canada as a whole, was lower than the 6.8 percent average annual rate experienced in Northern British Columbia during this period.

Dawson, Mayo, Elsa, and Carmacks are important communities located along the Whitehorse-Mayo-Dawson Highway. Whitehorse, Watson Lake, Teslin, and Haines Junction are major communities situated along or near the Alaska Highway. Between 1951 and 1961 the population of Whitehorse doubled, from about 2,594 to 5,031. During this same decade, the balance of the Yukon population increased by only 50 percent. In 1961, Whitehorse accounted for 34 percent of the total population of the Yukon.

Of the three regions of Northern Canada under consideration, the Yukon Territory had the lowest population density in 1961, as indicated in the tabulation below. For comparative purposes, the population densities of Alberta, British Columbia, and Canada are shown. These figures illustrate very vividly the sparsely populated nature of the Yukon.

	Area (000's of square miles)	1961 Population	1961 Population Density Persons per Square Mile
Yukon	205	14,628	.07
Northern British Columbia	180	34,476	.19
Northern Alberta	93	76,884	.83
British Columbia	359	1,629,082	4.53
Alberta	249	1,331,944	5.35
Canada	3,560	18,238,247	5.12

Large scale economic development of the Yukon Territory has been faced with many of the handicaps that have hampered development of Alaska and Northern British Columbia, including geographic isolation, inaccessibility to important export markets, vulnerability to uncontrollable external factors, and high cost structures. Whitehorse, the largest city in the Yukon, although further north than many areas of Northeastern British Columbia, had some advantage in being closer to tidewater owing to the proximity of Whitehorse to Skagway via the Whitepass and Yukon Railway.

Economic development of the Yukon, like that of Alaska and Northern British Columbia, has centered primarily around staple products or commodities coming from mining and forest products. In recent years, oil and gas exploration has become an important activity.

Table 15 lists the 1961 labor force of the Yukon Territory by broad categories of occupation. About 38 percent of the 1961 labor force

Table 15

LABOR FORCE IN THE YUKON TERRITORY
BY OCCUPATION AND SEX
1961

	Male	Female
Managerial	412	89
Professional and technical	293	208
Clerical	194	432
Sales	73	88
Service and recreational	690	463
Transportation and communication	643	18
Primary	715	7
Craftsmen, etc.	1,297	23
Laborers	333	8
Not stated	186	70
Total	4,836	1,406

Source: Survey of Markets and Business Year Book, 1964-65. (Data based on 1961 census.)

was employed in Whitehorse. A majority of the men and women employed in managerial, professional, clerical, and sales occupations was located in Whitehorse. The greater portion of the labor force employed in service, recreation, transportation, primary labor, and craftsmen occupations was located outside Whitehorse.

Only limited published information is available on salaries and wages earned in the Yukon. Apparent 1961 wages and salaries earned in the Yukon were estimated at about $26 million, about $9 million of which were earned in Whitehorse. Annual salaries and wages are somewhat higher in the Yukon than in Northern British Columbia.

Apparent total 1961 retail sales in the Yukon Territory have been estimated at about $16 to 22 million. Manufacturing production in Whitehorse in 1961 was valued at only $205,000 based on output of four plants employing 21 persons.

Growth of Selected Industries in the Yukon

Forecast Yukon development through 1985, particularly along the Alaska Highway, will undoubtedly take the form of an export economy geared to production of various minerals (including oil and gas) and forest products. Expected growth of these industries to 1985 and the probable extent to which the Alaska Highway (whether paved or not) will influence the ability of these products to be competitive in ultimate potential markets is discussed below.

Mining. The Yukon, which consists largely of the northern extension of the Cordilleran Region and thus forms a part of one of the two great metal-bearing regions of Canada (the other being the Canadian or Precambrian Shield), is favorable for mineral deposition.

The mining industry has been the Yukon's most important industry for many years. The value of total mineral production (including coal) is shown in the following tabulation for the years 1951 to 1963 inclusive in millions of dollars.*

1951	$ 9.8	1957	$14.1
1952	11.4	1958	12.3
1953	14.7	1959	12.6
1954	16.6	1960	13.3
1955	14.7	1961	12.8
1956	15.7	1962	13.1
		1963†	14.6

* Statistics Section, Mineral Resources Division, Department of Mines and Technical Surveys.
† Preliminary.

With the exception of 1956 and 1957, total value of mineral production in the Yukon has been significantly higher than the value of mineral production in Northern British Columbia. The value of mineral production has been quite stable since 1957. The rise in 1952 reflects the operations of United Keno Hill Mines Limited on Galena and Keno Hills coming into full production. Current levels are significantly below the record of 1900 when the value of gold and silver production was over $22 million.

Six metallic minerals (silver, gold, lead, zinc, cadmium, and copper) account for virtually all of total value of mineral production, as is evident from the following tabulation. Production of industrial minerals and structural minerals has not been significant, although active exploration for certain industrial minerals is presently occurring.

Value of Metallic Mineral Production in the Yukon Territory
(thousands of dollars)

	1960	1961	1962	1963*
Silver	$ 6,417	$ 6,539	$ 7,552	$ 8,464
Gold	2,652	2,371	2,050	2,005
Lead	2,167	1,712	1,616	1,923
Zinc	1,789	1,528	1,439	1,768
Cadmium	207	228	231	337
Copper	--	257	134	--
Tungsten	--	--	2	--
Total	$13,232	$12,635	$13,024	$14,497

Between 1959 and 1960, the number of mineral claims recorded about doubled. By 1963 the number had doubled again, suggesting a new surge in Yukon mineral exploration.

The Yukon Territory is divided into the following mining districts: (1) Dawson, (2) Mayo, (3) Whitehorse, and (4) Watson Lake. Although the Alaska Highway does not traverse either of the two northern districts (Dawson and Mayo), discussion of their present and expected position to the Yukon mining industry seems warranted because of the significance of current mineral production and mineral exploration activities in these two districts. The main population centers are the city of Dawson and the town of Mayo, which are located about 350 to 400 miles north of Whitehorse.

The Whitehorse and Watson Lake mining districts are traversed by the Alaska Highway. Currently the value of mineral production in these

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* Preliminary.

two southern mining districts is small relative to production from the Mayo District.

1. Dawson Mining District. Gold has been mined continuously in this district since the discovery of this metallic mineral in 1896. Currently, most production comes from the dredging operations of Yukon Consolidated Gold Corporation. These operations are expected to phase out about 1966 unless additional reserves are located.

   Regarding current exploration activities for metallic minerals, Silver City Mines is investigating silver-lead-zinc prospects north of Dawson. Three major asbestos companies are mapping and surveying the extent of asbestos showings northwest of Dawson in the Clinton and Cassiar Creek areas. The results of the 1964 drilling program coupled with those of earlier programs (which outlined in excess of 5 million tons of ore-grade fiber) is considered more than encouraging. A rough estimate would place these 5 million ton reserves at about 30 percent of the proved reserves of Cassiar asbestos in Northern British Columbia where mining operations are sizable.

2. Mayo Mining District. This district, which is situated east of the Dawson District and north of the Whitehorse and Watson Lake mining districts, accounts for the bulk of mineral production in the Yukon. The value of 1963 mineral production from United Keno Hill Mines Limited (the major producer in the Mayo District in 1963) amounted to about $10 million, or 69 percent of the total 1963 Yukon value of mineral production.

   United Keno Hill Mines Limited, Canada's foremost silver producer and major producing company in the Yukon, directly or indirectly reportedly supports much of the economy of the Yukon. United Keno and several other mining companies are actively conducting exploration work. Apparently little exploration work has been undertaken in the western part of the district; the eastern part is better mapped. It has been suggested that under present improved market conditions and improved metal prices the district should have a potential for silver, lead, zinc, cadmium, and antimony production well over the billion dollar gross value range, or about four times the value of silver, lead, zinc, and cadmium production in the district to date. Possibilities of economic lode deposits of gold, tungsten, and tin also exist in the Mayo District.

   Discussion of the Mayo Mining District would not be complete without some reference to the iron-bearing deposits discovered by The California Standard Company (Crest Exploration

Limited) in the Snake River area near the Yukon-Northwest Territories border, some 320 miles north of Whitehorse. Reserves are estimated in the range of 10 to 45 billion tons with a grade of 45 percent to 50 percent iron, of which a sizable portion would be suitable for open pit mining.

Major problems will have to be overcome before a mining operation can begin, including: (a) developing long term export markets for 5 million to 10 million tons of ore per year. (Possible market development currently is hampered by a worldwide iron ore oversupply situation that is not expected to be eliminated before the 1970s.) The Japanese, who apparently prefer to buy iron ore requirements on short term contracts from a number of sources, have expressed interest in long term development of the Crest deposits. However, high-grade Australian iron deposits, which are located close to tidewater and are closer to the Japanese market by sea, are a serious threat to Crest. In fact, contracts between Japan and Australia purportedly have already been signed that could delay early production from the Crest property. (b) The devising of an economic concentration process to raise iron content* and to lower the silica and phosphorous content; and (c) overcoming the transportation problems resulting from the remote location of the reserves, which would necessitate the construction of a 500 to 600 mile railroad or slurry pipe line to tidewater.

3. Whitehorse Mining District. In 1963, metal mine operations were limited to four gold placer mines. Exploration leading to the development of a 125-ton per day gold mine is being carried out by Discovery Mines west of Carmacks. This mine may be the only lode gold mine in operation in the near future.

New Imperial Mines Ltd. apparently has discovered copper-iron ore reserves estimated between 1.6 and 5.5 million tons about 4 miles south of Whitehorse. Open-pit mining is feasible. This property, in the Whitehorse copper belt, could become a major producer in the near future. A 1,300-2,000 ton per day concentrating plant may be constructed near Whitehorse. New Imperial Mines also holds claims south of Carcross.

Kerr Addison Mines Ltd. is exploring the possibility of beneficiation of 9.5 million tons of lead-zinc-copper ore east of Carmacks (about 100 miles north of Whitehorse).

Potential copper properties about 18 miles south of Haines Junction are being studied by another company.

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* The grade of ore is not high enough for direct shipping.

The Tantalus Butte coal mine (the only producing mine in the Whitehorse District in 1963) located at Carmacks produced 8,584 tons for local consumption and for use by United Keno Hill mines.

4. Watson Lake Mining District. Canada Tungsten Mining Corporation Limited's tungsten mine and two gold-silver placer mines were the only ones in production in 1964. The Canada Tungsten mine (located north of Watson Lake near the Yukon-Northwest Territories border) which has an adjoining 300 tons per day concentrator, had suspended operations in 1963 because of depressed prices in the world tungsten market but resumed operations in 1964. The ore body is estimated to contain about 1.5 million tons, or about 15 years supply at proposed production rates.

   Several companies are exploring in the Watson Lake Mining District for barite, tungsten, nickel, silver, or lead and zinc.

Forest Products. The forest products industry makes up a very small part of total value of production in the Yukon. For example, the value of Yukon mineral production in 1963 was about $15 million whereas the apparent value of forest products production was under one-quarter of a million dollars.

Productive forest resources of the Yukon, which cover an area in the range of 42,000 to 45,000 square miles (20-22 percent of the Yukon's total land area), consist primarily of white spruce and balsam poplar. The reserves are situated in three general areas: (1) the Carmacks-Mayo-Dawson area and west towards the Alaska border; (2) the Whitehorse area; and (3) the Watson Lake area, particularly in the Upper Liard, Beaver, Hyland, Frances, and Rancheria river valleys. Some reserves are located in the Shakwak Valley in Southwest Yukon.

The accessible productive forest area covers about one-third of the total forested area; the remaining two-thirds is considered potentially accessible. Salable timber inventory of accessible and potentially accessible timber is estimated at about 9 billion cubic feet and current annual production is about 5 million cubic feet. (The low ratio of annual production to salable reserves suggests a limited market to date for Yukon forest reserves.) Utilization in the past has been limited primarily to building logs, fuel wood, and mine timbers. Current utilization is by six small sawmills for local consumption. These mills operate on an intermittent basis.

Although the lumber production has been the principal part of the Yukon forest industry to date, and should grow as a result of increasing mining activity in the future, primary emphasis in the future may be on pulp production. A pulp mill might possibly be built in the Yukon by

1985. Yukon forest reserves may also be used in the future for production of flake board.

Agriculture. Less than 1 percent of the total land area of the Yukon (most of which is located in the vicinity of the Alaska Highway west of Whitehorse, and in certain parts of the Yukon River and its tributaries) is suitable for agriculture. At present only 600 acres out of a total farm acreage of 9,000 acres are under cultivation. In 1963-64 the relative importance of principal crops was:

	Acreage under Cultivation
Hay	200
Oats	100
Barley	20
Wheat	10
Potatoes	10
Vegetables	10

The market garden production was consumed locally in communities such as Whitehorse, Dawson, and Mayo.

The agriculture area supported less than 1,000 head of livestock in 1963, primarily beef cattle, horses, and chickens. Apparent total cash income of the Yukon agricultural economy is estimated at between $85,000 to $140,000 per year, an insignificant amount in comparison to the $15 million contribution by the mining industry (excluding oil and gas).

In terms of number of farms, acreage under cultivation, livestock inventory, and cash income from farm production, the Yukon agriculture business seems to be only about 1 percent of the size of the agriculture industry in Northern British Columbia.

The lack of agricultural potential perhaps can best be expressed by the following excerpts from the report on Territorial Land Administration, November 1, 1964 by the Department of Northern Affairs and National Resources:

> . . . farming on a full time commercial basis has limited possibilities at the present time, and settlement on this basis should be discouraged, if not prevented. . . . Any public policy to encourage or assist the formation of farming units that would be clearly submarginal is not consistent with the present concern of the government for marginal farms and for depressed rural areas and with the whole philosophy of the Agricultural Rehabilitation and Development Act. Establishment of successful farms would require large amounts of public assistance, rigid control and supervision on a sustained basis.

The Department of Northern Affairs and National Resources has asked the Prairie Farm Rehabilitation Administration to study the feasibility of developing a grazing industry in the Yukon. The findings of the study presumably will be used as the basis for formulating policy affecting any development of a grazing industry in the north.

There will probably continue to be a place in the agricultural economy of the Yukon for the growing of limited amounts of market garden crops for consumption in the nearby communities plus cultivation of forage crops for feed for livestock raised in the area. The agricultural experimental station located on the Alaska Highway near Haines Junction apparently has been quite successful in growing vegetables and forage crops but, of course, under ideal experimental conditions.

Petroleum Industry. The Western Canadian Sedimentary Basin covers about 21 percent of the Yukon, primarily in the northern part of the Territory. The Yukon, however, contains only 4 percent of the volume of sediments in Western Canada (versus 41 percent in the Arctic, 21 percent in Alberta, 17 percent in the Northwest Territories, 10 percent in Manitoba and Saskatchewan, and 7 percent in British Columbia).

The area of greatest potential lies some 400 to 500 miles north of Whitehorse. Existing unpaved roads extend about 300 miles north of Whitehorse, and a road is being constructed from Dawson to Fort McPherson, Northwest Territories north of the Arctic Circle. The areas currently under permit lie on either side of the Richardson Mountains in Eagle Plain and the Peel Plateau in the vicinity of the Arctic Circle. Some oil and gas potential may exist in the southeast portion of the Yukon.

In 1959, oil and gas were discovered at the Chance No. 1 well south of the Arctic Circle, but to date no oil and gas has been produced in commercial quantities in the Yukon. It has been estimated that the 64,500 cubic miles of sediments located in the Yukon may contain about 3 billion barrels of crude oil and 19 trillion cubic feet of natural gas. By comparison, Alberta has been estimated to have an ultimate potential of 15 billion barrels of oil (excluding the tar sands) and 100 trillion cubic feet of natural gas.

Despite problems associated with exploration activities in the Yukon, oil and gas exploratory expenditures have increased significantly in recent years. These expenditures average $1 million annually in 1956 and 1957 and increased to about $2 million per year through 1961, and close to $3.5 million per year in 1962 and 1963. By comparison, about $185 million was spent on exploration in Alberta and $42 million in British Columbia in 1963.

Assuming sizable oil and gas reserves are found in the Northern Yukon, their economic development will likely be hampered for reasons mentioned earlier, namely: (1) lack of a large domestic market for crude oil and natural gas in Northern Canada (excluding the remote possibility

that the Crest iron ore development, which would utilize large quantities of fuel and energy, would occur prior to 1985); (2) existence of a relatively high-cost structure; and (3) remoteness from potential export markets. Although offshore markets might be developed for crude oil, further technological improvements in liquifying and transporting liquified natural gas will be necessary before offshore markets for natural gas will be developed.

Projected Population and Economic Growth--1965 to 1985

The preceding discussion suggests that the population and economic growth of the Yukon Territory through 1985 will depend primarily on growth in exploration and producing activities of the mining and petroleum industries. Agriculture and forest products are not expected to make significant contributions to this growth. For these reasons, population and economic growth to 1985, in both relative and absolute terms, are likely to be similar to growth trends in the recent past (1951-61). Because of its extremely small and scattered population, no prospects seem to exist for any important manufacturing operations that would result in above-average growth in population and economic activity. Possible growth in the tourist industry will be discussed in a later portion of this study.

It is reasonable to assume that the population might reach between 40,000 to 50,000 people by 1985 (or approximately equal to the 1961 population of Northern British Columbia). By 1985, the population of Whitehorse will likely be in the range of 16,000 to 25,000 depending on whether growth in population and economic activity is spread over several centers or continues to be concentrated in Whitehorse.

Possible Significance of Population Growth and Future Economic Activity to Alaska Highway

One major difference between Northern British Columbia and the Yukon Territory as far as significance of the Alaska Highway is concerned is that virtually all of the resource development and agriculture in Northern British Columbia occurs south of the Highway. The logical flow of products or commodities to market (with the exception of asbestos from Cassiar) therefore, is in a direction away from the Highway.

In the case of the Yukon Territory, however, because resource development is taking place on both sides of the Alaska Highway, seemingly more potential exists for use of the Highway as a commercial transportation route.

Mining Industry. The two northern mining districts, especially Mayo, currently account for virtually all of total mineral production in the Yukon. It is impossible to predict the specific location and timing of future developments that are likely to occur during the forecast period.

This is particularly true in view of the fact that the total ore potential of the Yukon is not presently known. Regardless of the location and timing of such developments, the mode of transportation and direction of flow of mineral production to market will be governed by location of economic producing ore bodies in relation to location of markets. Success of exploration activity in locating such bodies, not the existence of a paved Alaska Highway, will likely be the primary factor in determining this flow to market, for the following reasons:

1. Looking at the probable flow of mineral production from each district to logical markets, it seems evident that the Alaska Highway is not a significant medium.

   a. Dawson and Mayo Mining Districts - Mineral concentrates will likely move down the present Dawson-Mayo-Whitehorse Highway, meeting the Alaska Highway near Whitehorse. Since export markets should form the bulk of outlet for such minerals, production will continue the present pattern of moving from Whitehorse to tidewater by rail. In this way, relatively low cost water transportation will account for the greater portion of the distance to market.

   b. Whitehorse Mining District - Generally speaking, and depending on the location of producing ore bodies, mineral production will move either (i) east or west to the Mayo-Whitehorse Highway, or (ii) north or south to the Alaska Highway, and from there to Whitehorse. Highway transportation would be expected to cease at Whitehorse in favor of the short rail haul to tidewater at Skagway. Mineral production from certain areas, particularly in the vicinity of or west of Haines Junction, may move to Haines Junction and from there to tidewater via the Haines Highway (e.g., production from the copper properties near Haines Junction).

   c. Watson Lake Mining District - Generally speaking, the movement will be south or north to the Alaska Highway and from there to Whitehorse.

2. In either b or c above, paving of the Alaska Highway would not likely result in increased use of the Alaska Highway over expected use if it remains unpaved. In fact, the reverse might be true. Companies shipping mineral production over unpaved highways such as the Mayo-Whitehorse route or the Alaska Highway are not seriously hampered by dust or other unpleasantness normally associated with unpaved conditions. Evidently, large trucking companies do not favor paving because of possible increased per ton-mile costs resulting from reduced load limits on paved as opposed to unpaved highways. In the case of materials coming into

Whitehorse from the Mayo Highway, only a 7-mile stretch of the Alaska Highway would be affected, which would necessitate leaving this part unpaved or building a separate 7-mile road for ore movement.

3. Since the United Keno Hill Mines production alone is responsible for 69 percent of the total value of mineral production of the Yukon and, therefore, is a major supporter of the Yukon economy, the possible adverse effect that paving would have on their per ton-mile costs must be considered.

4. Asbestos from Cassiar, B.C., does move some distance over the Alaska Highway either to Whitehorse or to Fort St. John. Presumably some of the future asbestos production from the Dawson area of the Yukon might move by truck to Fort St. John. If the Alaska Highway were paved, such movement might be curtailed owing to reduced weight limits and, therefore, increased hauling costs.*

5. It is significant that, if the Crest Exploration iron ore development materializes (regardless of whether it occurs within the forecast period to 1985 or not), production will move by rail or possibly pipe line via the shortest route to tidewater, or approximately at right angles to the direction of the Highway.

6. The main advantage to the mining industry of paving the Alaska Highway (and this would appear to be relatively minor) would be in facilitating the movement of men and certain supplies relating to exploration or producing activities near the Highway.

Forest Products Industry. Generally speaking, most lumber, mine timbers, and fuel wood currently produced in the Yukon are used locally, with the result that highway transportation is short. This situation is expected to continue through the forecast period.

More specifically, however, the possible significance of paving of the Alaska Highway to the forest products industry may be summarized by studying the logical flows of production from major timber reserve areas to market.

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* Because alternative routes for asbestos shipments in Northern B.C. may open up in the future, Yukon asbestos might follow one of several flow patterns depending on final market destination. For brief discussion of these alternatives, see preceding section dealing with Northern B.C.

1. Regarding production from timber reserves located in the Carmacks-Mayo-Dawson area, the bulk of this production presently is consumed locally for construction or mining purposes.

   Assuming a major export market developed for such production, whether lumber and/or pulp (which appears unlikely), the logical flow would seem to be the same as the flow of mineral production from this area, i.e., movement by truck down the Mayo-Whitehorse Highway to Whitehorse and from there to tidewater by rail. Such movement would utilize the Alaska Highway for only one seven-mile stretch near Whitehorse. The economics of such movements would not benefit significantly, therefore, from paving of the Highway and might be adversely affected if load limits, below those presently enforced on the Mayo-Whitehorse road, were introduced.

2. Regarding production from timber reserves in the Whitehorse area, these reserves appear to be concentrated quite close to Whitehorse. Since Whitehorse is the largest community in the Yukon and because of its strategic position as a rail center, production of forest products from these reserves will likely be consumed in, or transported through, local Whitehorse markets. Any export movement would logically flow to Whitehorse by truck and from there to tidewater by rail. It seems reasonable to conclude, therefore, that shipments of production from these reserves would not benefit materially from paving of the Alaska Highway because of the small quantities concerned and the short stretch of the Highway utilized.

3. Evidently forest reserves of the Southeast Yukon may be large enough to support a pulp mill that would be located in the Watson Lake area. Production from such a mill would likely move to Whitehorse for transshipment to rail, or south to rail facilities at Fort St. John or possibly Fort Nelson. Paving of the Alaska Highway would be expected to result in a benefit to truck transportation of pulp production, assuming there were no severe weight restrictions which would offset lower operating costs to be expected under paved conditions.

   The main question to be answered in this case, therefore, concerns the timing of construction of a pulp mill in the Southeast Yukon. The only way to assess this probability is to review the expected development of the forest products industry in the adjacent area of Northern British Columbia.

   Because of closer proximity to export markets and presumably higher-volume acreages in Northern British Columbia, the Southeast Yukon reserves are not likely to be developed on

an economic basis ahead of Northern British Columbia reserves. Sustained yield forest management is expected to extend to all of Northern British Columbia by 1970 or 1975. Whether extensive pulp operations on a sustained yield basis would be underway in Northern British Columbia by 1975 is indeterminate at present. It seems reasonable to conclude, however, that on the basis of the logical development of Northern British Columbia forest reserves, a Yukon pulp mill is unlikely to become a reality until 1975 to 1980, at the earliest. The total benefit of paving the Alaska Highway to the transportation economics of such a Yukon pulp mill are not expected to be large, therefore, over the forecast period.

In the event that the mill is located at Whitehorse, which is considered a possibility, there would be no benefit accruing from paving of the Highway.

Agriculture. Because the agriculture potential of the Yukon Territory seems limited primarily to growth of livestock, market garden, and forage crops for local consumption, paving of the Alaska Highway should not have any net benefit to this part of the area's economy. Farm produce and livestock raised in the Yukon River and its tributaries will likely continue to be consumed in the Dawson, Keno Hill, and Mayo areas, which are so far off the Alaska Highway that paving of the Highway would have no significance. Agriculture production from the Little Atlin, Tagish Lakes, and Takhani and Dezadeash Valleys will likely be consumed in Whitehorse and thus will move to market over the Alaska Highway. Because of the small quantity of such production, the net benefits from paving the Highway should be insignificant.

It is not expected that paving of the Alaska Highway will stimulate the agriculture economy in the Yukon owing to the fact that limitations on potential arable land rather than limitations on transportation costs of farm commodities to market is the most significant factor.

Petroleum. As pointed out in the previous discussion of the petroleum industry in Northern British Columbia, paving of the Alaska Highway would not likely result per se in an increase in use of the Highway by vehicles engaged directly or indirectly in oil and gas exploration work. Such vehicles normally are equipped to operate over poor roads to remote drilling sites. Paving might result in reduced oil and gas equipment movements on the Alaska Highway if more restrictive weight limits were imposed. Exploration equipment and supplies moving to the Yukon oil and gas area from Fort Nelson, B.C. would involve a truck haul of up to 1,000 miles, including about 400 to 500 miles on the "leg" north of Whitehorse (via the Whitehorse-Dawson Highway and the Chapman Lake road). Even if the Alaska Highway were paved, therefore, between 40 percent and 50 percent of the trip would be over unpaved highways. Two other logical routes

would by-pass the Alaska Highway, that is, (1) via water to Skagway, rail to Whitehorse, and truck to the Northern Yukon, or (2) via the MacKenzie and Peel Rivers to Fort McPherson, N.W.T., in summer months, and by truck to the exploration area.

Oil or gas production would move to market by pipe line, and thus would not be influenced by paving of the Alaska Highway. This would be true also of any production from Southeast Yukon which would logically flow via pipe line to Northeastern British Columbia to tie in with pipe line facilities in that area.

Because of the fact that the potential oil and gas reserves of the Yukon are small relative to other parts of the Western Canadian Sedimentary Basin, and because of their general remoteness relative to British Columbia and Alberta producing areas, exploration activities in the Yukon will likely continue to be comparatively small at least through the forecast period. In other words, there is not likely to be a sudden and sizable increase in exploration which might have an unusual effect on the Yukon economy.

In summary, the most important aspects of the Yukon economy through 1985 should be further development of the mining and petroleum industries; the growth of these industries will not be influenced significantly by paving of the Highway.

Northwestern Alberta

Past Population and Economic Growth

Table 16 shows the trend in population in Northwestern Alberta. In 1961, the population in this region amounted to only 5.8 percent of the total of Alberta. However, the population in Northwestern Alberta was about double the 1961 population of Northern British Columbia, and more than five times the 1961 population of the Yukon. Between 1941 and 1961, the average annual population growth rates (shown below) for Northwestern Alberta were substantially lower than for these other two areas.

	Northwestern Alberta Average Annual Growth Rates
1931-41	1.9%
1941-51	1.4
1951-61	2.2

In the 1930s, the annual average growth rate for Northwestern Alberta was approximately double the average rate for the province of Alberta as a whole. Since 1941, the average annual growth rate for the province as a whole has been higher than the growth of the Northwestern area.

Table 16

HISTORICAL POPULATION TRENDS IN NORTHWESTERN ALBERTA
1931-1961

Year	Northwestern Alberta*
1931	44,447
1941	53,491
1951	61,800
1961	76,884

* Census Division 15.

Source: Alberta Bureau of Statistics.

During the 30-year period ending in 1961, the population of Northwestern Alberta remained in the range of 6 percent of total Alberta population. Considering that the area is equivalent to about 37 percent of Alberta's total land area, its sparsely-populated nature is clearly evident: 0.83 persons per square mile. However, the population density of Northern British Columbia and the Yukon was only 0.19 and 0.7, respectively in 1961.

The shift of population from farm to nonfarm rural and urban between 1951 and 1961 in Northwestern Alberta is shown below:

	1951	1961
Urban population (in centers over 1,000)	6,551	17,407
Rural		
Farm	34,873	32,520
Nonfarm	20,376	26,957
Total	61,800	76,884

In 1951, Northwestern Alberta urban population accounted for only 10.6 percent of total population; by 1961 it accounted for 22.6 percent. During this period, over half of this urban growth occurred in Grande Prairie, as is evident from the following tabulation:

	Urban Population (in centers over 1,000 population)	
	1951	1961
Grande Prairie	2,664	8,352
Peace River	1,672	2,543
High Prairie	1,141	1,756
Fairview	--	1,506
Grimshaw	--	1,095
McLennan	1,074	1,078
Valleyview	--	1,077
Total	6,551	17,407

Grande Prairie and Valleyview are situated on the main highway system leading from Edmonton to Dawson Creek, the southern terminus of the Alaska Highway.

Economic development of Northwestern Alberta has been hampered by the same handicaps encountered in the development of the Yukon and Northern British Columbia. Economic activity has centered around agriculture, oil and gas exploration, and to a lesser extent, forest products and mining.

Labor force in Northwestern Alberta (Census Region 15) and in Alberta in 1951 and 1961 is shown in Table 17, by major category of occupation. Between 1951 and 1961, the relative importance of Northwestern Alberta to total Alberta labor force declined from 5.8 percent to 5.1 percent. In 1961, the total number of workers in the labor force in Northwestern Alberta who were engaged as farmers, loggers, fishermen, trappers and hunters, and as miners, quarrymen, etc. were about equal to the total number of workers employed in the remaining categories; i.e., service industries, trade and commerce, management, transportation and communications, etc. Between 1951 and 1961, there was about a 7 percent drop in the number of farmers and farm workers in Northwestern Alberta. As illustrated in Table 17, farmers and farm workers accounted for about 41 percent of the 1961 total labor force in the area; for the province as a whole in 1961, farmers and farm workers made up only 21 percent of the total labor force. Northwestern Alberta is much more highly oriented to the agriculture industry than are either Northern British Columbia or the Yukon.

Personal income apparently is considerably lower in Northwestern Alberta than it is for the province as a whole. In 1963, the area contained about 5.7 percent of the province's population, but only 4.5 percent of its disposable income. The following is a comparison of the average yearly earnings for the labor force in Northwestern Alberta and for other areas:

	1961 Average Annual Earnings	
	Male	Female
Northwestern Alberta (Census Div. 15)	$2,846	$1,815
Alberta	3,733	2,001
Northern B.C. (Census Div. 10)	3,875	1,944
Yukon (Whitehorse)	4,683	2,555

Retail sales in Northwestern Alberta amounted to approximately $55 million in 1961, substantially higher than apparent retail sales in the Yukon and about equal to retail sales in Northern British Columbia* in the same year.

Gross value of shipments from Northwestern Alberta in 1961 amounted to about $19 million, as compared with only $13 million for Northern British Columbia (Census Division 10) and substantially less than $1 million for the Yukon.

Growth of Selected Industries in Northwestern Alberta

Mining. With the exception of a small area of Precambrian rock in the northeast area, and the Cordilleran Range in the southwest, the province of Alberta is covered by the Western Canadian Sedimentary Basin. As a result, mineral resources are made up primarily of mineral fuels and some nonmetallics. Only the northeastern area of Alberta around Lake Athabasca would appear to hold some prospect for production of metals. Peace River area iron is an exception.

Past production of metallic minerals in Alberta as a whole has been negligible. Value of metal production for selected years was limited to recovery of gold valued at only $4,000 in 1951, $14,000 in 1957, and $7,000 in 1962. It is apparent, therefore, that metallic mineral production has not been significant to the economy of Alberta, let alone to the economy of Northwestern Alberta. However, large deposits of iron ore do exist in Northwestern Alberta, in two main areas: (1) near Worsley in the Clear Hills area north of Peace River, where proven reserves have been estimated at 250 million tons and possible reserves at 1 billion tons; and (2) south of the Peace River between Gordondale and Spirit River, where the magnitude of reserves has not been determined. The ore at Worsley is of rather low grade (35-40 percent iron, and of relatively high silica and low lime content) and is uneconomical to develop with conventional processes. Pilot plant operations, which are presently underway will not be completed until 1966 or 1967. Some authorities feel that commercial development of the Worsley reserves may occur by 1970.

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* $52 million in Census Divisions 9 and 10, excluding Prince Rupert.

Table 17

LABOR FORCE IN NORTHWESTERN ALBERTA,* BY OCCUPATION
1951 and 1961

	1951†	1961	1951	1961
Managerial	1,225	1,674	5.9%	6.7%
Professional and technical	1,282	1,636	6.2	6.5
Clerical	495	1,100	2.4	4.4
Commercial and financial	655	n.a.	3.2	--
Sales	n.a.	1,024	--	4.1
Service and recreational	1,267	1,903	6.1	7.6
Transportation and communication	1,310	1,167	6.3	4.7
Farmers and farm workers	11,059	10,275	53.4	41.0
Other primary	1,266	n.a.	6.1	--
Loggers, fishermen, trappers and hunters	n.a.	1,202	--	4.8
Miners, quarrymen, and related	n.a.	355	--	1.4
Manufacturing and mechanical	871	n.a.	4.2	--
Craftsmen	n.a.	3,129	--	12.5
Construction	441	n.a.	2.1	--
Laborers	783	926	3.8	3.7
Other	45	659	0.3	2.6
Total	20,699	25,050	100 %	100 %

* Census division 15.

† 93 percent of the figures for old Census divisions 15, 16, and 17 was taken as an approximation of the new Census division 15 in an attempt to make 1951 figures comparable to 1961. The data classifications for 1951 are not strictly comparable to those for 1961, but on the whole the relationship is reasonable.

n.a. : denotes not available

Source: Alberta Bureau of Statistics.

Three possible types of operation for iron processing plant at Worsley seem to exist: (1) high-priced iron powder could be produced for small volume shipments, (2) pig iron could be produced for possible shipment to Japanese markets, and (3) pig iron and more refined iron could be produced for North American markets. No shipments of unrefined ore can occur owing to its low iron content.

In 1962, industrial minerals in Alberta were limited to salt valued at about $1.4 million and sulphur at $8.3 million. No breakdown is available showing the value of production of these industrial minerals in Northwestern Alberta. Industrial minerals and structural minerals such as bentonite, pumicite, gypsum, sand and gravel, salt, and sulphur hold some potential for further development in Northwestern Alberta.

A bentonite* deposit has been found in the Kleskun Hills in the Grande Prairie region. Increasing oil and gas activity plus possible iron ore development in Northwestern Alberta may hasten development of these reserves although large reserves of bentonite also exist in Central Alberta.

Pumicite, a material used in the production of cement, was discovered at Marten Mountain east of Lesser Slave Lake and at Asplund, southwest of Lesser Slave Lake. The deposits are presently undeveloped, and development does not seem imminent.

Gypsum has been discovered at Mowitch Creek in Jasper National Park and at Featherstonhaugh Creek (north and west of Mowitch Creek but outside Park limits).

Undeveloped sand and gravel are found near Peace River, where the high-silica-content sand is very pure. High transportation costs will probably prevent shipment to adjacent provinces. Markets may also be limited by competition from production of high-silica-content sand from Athabasca Tar Sands operations.

Salt deposits in Northwestern Alberta will not likely be developed because of the availability of more attractive deposits, particularly between Edmonton and the Saskatchewan border.

Sulphur is produced at Windfall near Whitecourt in Northwestern Alberta. The plant has a capacity of 1,250 long tons per day which is equivalent to 19 percent of total Canadian elemental sulphur plant capacity. Historical production trends for Windfall and for the province are evident from the following tabulation:

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* A type of clay used in drilling mud and for pelletizing ores in iron processing.

	Elemental Sulphur Production (thousand long tons)						
	1956	1958	1960	1961	1962	1963	1964
Northwestern Alberta (Windfall)	--	--	--	--	127.2	219.5	226.6
Total Alberta	29.9	109.2	348.1	434.4	972.4	1,227.7	1,414.2
Northwestern Alberta to percent Total Alberta	--	--	--	--	13.1	17.9	16.0

Probable future plants in Northwestern Alberta may be located at Simonette, Berland River west of Whitecourt (with daily capacities of 250 and 175 long tons respectively), and one at Waiporous Creek east of Fort St. John (daily capacity is 10 long tons).

Nearly 75 percent of 1964 Alberta sulphur deliveries (which exceeded 1963 deliveries of 1,044.2 thousand long tons) was exported, as shown below:

Market Destination	Deliveries (thousand long tons)	Percent
Alberta	67.7	4.5%
Other Canada	319.9	21.0
United States	534.0	35.1
"Offshore"	598.9	39.4
Total	1,520.5	100.0%

Northwestern Alberta's major sulphur reserves, which are tabulated below, should undergo future expansion:

	Remaining Recoverable Sulphur Reserves Dec. 31, 1964 (thousand long tons)	Percent of Alberta Total
Northwestern Alberta		
Berland River	2,084	2.8%
Simonette	1,439	1.9
Pine Creek	6,345	8.4
Windfall	3,868	5.1
Total	13,736	18.2%
Total Alberta	75,380	100.0%

The Province of Alberta holds about 48 percent of total Canadian coal reserves, yet in 1961 accounted for only 19.5 percent of total Canadian production. As shown below, reserves and production in Northwestern Alberta make up a very small portion of total Alberta figures:

	1945 Reserves Estimates (million tons)	Percent of Alberta Total	1963 Production (tons)	Percent of Alberta Total
Northwestern Alberta				
Smoky River	3,300	7.1%	--	--
Halcourt	300	0.7	280	0.01 of 1%
Valhalla	30	0.1	--	--
High Prairie	9	--	--	--
Sexsmith	10	--	--	--
Slave	9	--	--	--
Total	3,658	7.9%	280	.01% of 1%
Total Alberta	46,562	100.0%	2,289,943	100.0%

The six areas shown in the tabulation contain various types of coal: (1) Smoky River, high grade bituminous coal; (2) Halcourt, lower grade bituminous coal; and (3) Valhalla, Sexsmith, High Prairie, and Slave, subbituminous coal. Smoky River coal is located north and east of Jasper National Park. The remaining areas are located in a region extending from the British Columbia border near Dawson Creek, across to the east side of Lesser Slave Lake. This region encompasses Grande Prairie, but is south of the town of Peace River.

Coking coal from the Smoky River coal area may find a market in Japan, or in the United States, which has apparently run out of indigenous coking coal supplies.

Significant volumes of coal production from reserves in the Grande Prairie to Lesser Slave Lake area are unlikely in the near future.

Forestry. Most of Northwestern Alberta (except for land around Peace River, Grande Prairie, and north along the Peace River to Fort Vermilion) is open to forestry and closed to agricultural settlement. Three forestry divisions, i.e., Grande Prairie, Slave Lake, and Peace River* lie entirely within Northwestern Alberta.† In addition, a portion

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* Now subdivided into the Peace River and Footner Lake Divisions.
† Census Division 15.

of the Edson and Whitecourt divisions also lie within Northwestern Alberta.* While production presently takes place in all divisions, the least concentrated activity is in the Peace River division.

A 1961 report of the Alberta Department of Lands and Forests indicates that about 75 percent of the apparently productive forested Crown lands was situated in Northwestern Alberta (Census Divisions 14 and 15), the greatest portion of which was located in the Peace River forestry region. A further 26 million acres of inventoried Crown land was classed as potentially productive, a sizable portion of which is located in the Peace River division of Northwestern Alberta.

Coniferous reserves (consisting primarily of spruce and pine) were somewhat more important than deciduous reserves both in Northwestern Alberta and the province as a whole. Examination of Table 18 points out the relative importance of coniferous and deciduous species in each forestry region.

Lumber has been the main product in Northwestern Alberta as shown in Table 19. These data indicate the relative magnitude of forest output by end-product from each forestry division. This summary points out that:

1. Northwestern Alberta accounted for an average 68.5 percent of total Alberta production over this period.

2. Lumber, pulpwood, and railway ties in total accounted for over 95 percent of total forest production both in Northwestern Alberta and the province as a whole. In each area, these three products were of about the same relative importance.

3. Edson was the most important forestry division over the period in terms of volumes of wood produced, primarily due to the large pulpwood operations of Northwestern Pulp & Power Ltd. at Hinton.

4. The Edson division accounted for virtually all of the pulpwood production and the greatest portion of railway ties production in Northwestern Alberta and in the province as a whole. The remaining four divisions were restricted primarily to lumber production.

5. Northwestern Alberta supplied all the plywood production in the province, which came mainly from the Grande Prairie and Slave Lake division.

Coniferous production in 1964-65 amounted to 67.9 million cubic feet compared with total average annual production for the 1954-1959 period

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* Census Division 15.

Table 18

CURRENT ESTIMATED PRODUCTIVE FORESTED AREA IN NORTHWESTERN ALBERTA* AND TOTAL ALBERTA

Forestry Division	Presently Forested Area† (millions of acres)	Timber Reserves‡ (billions of cubic feet) Coniferous	Deciduous	Total
Edson	4.02	5.05	1.03	6.09
Grande Prairie	3.68	3.12	2.48	5.59
Peace River	10.88	5.02	6.58	11.60
Slave Lake	5.39	4.06	5.60	9.66
Whitecourt	3.14	3.44	2.45	5.89
Total Northwestern*	27.11	20.69	18.14	38.83
Total Alberta	36.98	25.66	23.07	48.73

* Includes Census districts 14 and 15 which are somewhat larger than our definition of Northwestern Alberta (for purposes of this study) which has been Census district 15 only. Refers to inventoried Crown Land, but excludes the three Metis colonies in this region.

† More recent data from the same source shows a slightly different breakdown (as given below). Differences are reportedly attributable to (1) changes in productive forest areas due to forest fires and new surveying activity, and (2) slight changes in boundaries of forestry divisions.

	Productive Forested Area (millions of acres) Present	Potential
Edson	3.43	0.17
Grande Prairie	3.29	0.61
Peace River (including Footner Lake)	10.57	8.92
Slave Lake	4.84	2.08
Whitecourt	3.04	0.54
Metis colonies	0.41	0.23
Total	25.58	12.55

‡ Trees 4" or dbh (4" or more in diameter at breast height).

Sources: Alberta Department of Lands and Forests, Alberta Forestry Industry, November 1961, plus more recent data.

Table 19

ESTIMATED AVERAGE ANNUAL FOREST PRODUCTION ON CROWN LANDS
BY FOREST DIVISION AND MAJOR PRODUCT CATEGORY*
(Millions of Cubic Feet)

Products	Northwestern Alberta						Alberta	Northwestern as a Percent of Alberta
	Edson	Grande Prairie	Peace River	Slave Lake	White-court	Total		
Lumber	5.90	9.30	7.93	13.40	10.38	46.91	71.85	65.2%
Pulpwood	10.30	0.01	--	0.15	0.04	10.50	12.89	81.5
Railway ties	6.12	--	--	0.41	1.09	7.62	8.65	88.1
Plywood	--	0.59	--	0.77	0.12	1.48	1.48	100.0
Poles and piling	0.10	--	0.02	--	--	0.12	0.29	41.4
Round timber	0.03	--	--	--	--	0.03	1.48	2.0
Miscellaneous	0.06	--	0.01	0.01	0.03	0.11	0.91	12.1
Total	22.51	9.90	7.96	14.74	11.66	66.77	97.55	68.5%

* Based on the period August 1, 1954, to July 31, 1959.

Includes building logs, mine ties, fuel wood, slabs, lath, and plug wood.

Source: Estimated by Foster Associates Ltd. from Alberta Department of Lands and Forests data.

of 66.8 million cubic feet. The figures are not entirely comparable since the 1964-65 figures exclude 2.4 million cubic feet of poplar plywood logs produced in the Slave Lake, Grande Prairie, and Whitecourt areas. Based on 1954-1959 data, when coniferous production amounted to about 98 percent of total production and assuming this relationship is still valid, the figures are likely to be quite comparable. From a comparison of these figures, it would seem that there has been a shift in the importance of production by division over the period as indicated below:

Forestry Division	1954-1959 Average Annual Forest Production (million cubic feet)	1964-1965 Coniferous Production (million cubic feet)
Edson	22.5	12.9
Grande Prairie	9.9	11.3
Peace River (including Footner Lake)	8.0	9.3
Slave Lake	14.9	16.0
Whitecourt	11.6	18.4
Total Northwestern Alberta	66.9	67.9

Production fell substantially in the Edson forestry division in 1964-65, apparently as a result of inclement weather conditions. For this reason, it is not likely to be a permanent drop. Offsetting this decline was a substantial increase in the production in the Whitecourt division.

The estimated value of coniferous production was $14 million in 1964-65 from 166 sawmills and deciduous production, $354,000. Expanded activity in forestry in Northwestern Alberta is expected to be sizable, and one likely area of expansion is in pulpwood production. Most of the timber in the Edson and Whitecourt forestry divisions is already under pulpwood lease or reserve. There is also a large area south and a somewhat smaller area north, of Grande Prairie which are proposed pulpwood reserve areas. A pulp mill is reported to be planned for Whitecourt in 1965. It has been reported that a pulp mill may be constructed at Grande Prairie in the near future.

Manufacture of plywood in Northwestern Alberta, which contains large volumes of deciduous timber (particularly poplar) should increase over the forecast period. Currently, production from the only plywood manufacturing establishment presently operating in Northwestern Alberta, located at Grande Prairie, is shipped south to major Canadian and U.S. markets and as far as Europe. Future production may come from coniferous as well as deciduous reserves.

Lumber production is also expected to continue to be large in Northwestern Alberta, and future expansion may tend towards increasing size and integration of operations.

Data prepared by the Alberta Department of Lands and Forests in 1961 indicate that potential annual yields of forest products from Northwestern Alberta greatly exceed 1964-65 production, suggesting a lack of local Northwestern Alberta market for production, and/or inability of northern production to compete in more distant markets within and outside the province.

Agriculture. Agricultural activity is concentrated around Fort Vermilion, Grande Prairie, High Prairie, and Peace River. The land is of two basic types: the "degraded black" soil variety and the "gray wooded" type, which deteriorates rather quickly under steady use. The 1961 total occupied land area of 4.3 million acres represents an increase of 24 percent over 1951. Northwestern Alberta is still a rapidly growing agriculture area, as indicated by the trend in land under crops, and value of principal agricultural products sold (see Table 20). Improved land acreage (i.e., on which the occupant has done some work) increased by 38 percent over this same period, whereas the number of farms dropped, resulting in an increase in the size of farms. The average size of farms in 1961 was 485 acres compared with 645 acres for Alberta as a whole.

In 1961, about 71 percent of the improved land in Northwestern Alberta was utilized for growing crops, particularly wheat, oats, barley, and tame hay. The amount of land under crops increased by 33 percent between 1951 and 1961.

In 1961, Northwestern Alberta also accounted for about 31 percent of the total Alberta value of production of fur-bearing animals and 38 percent of the total Alberta (market) value of fish production. The fur farms are located almost exclusively along the south shore of Lesser Slave Lake, close to supplies of rough fish for animal feed. The fishing industry revenue in Northwestern Alberta derived from animal feed sales to the fur-farming industry often has exceeded revenue from sales for human consumption.

It was recently reported that there are still about 13 million acres available for agricultural development in Northwestern Alberta (about 3 times the 1961 total for occupied land). Efforts are being made to develop a variety of barley--the earliest maturing cereal crop--that can overcome the climatic handicaps existing north of the 55th parallel. Purportedly, agriculture activity would be stabilized if development of such a variety of barley could be realized. Barley production has already increased considerably in relation to other grain crops in Northwestern Alberta.

Table 20

AGRICULTURE STATISTICS FOR NORTHWESTERN ALBERTA

1951 and 1961

	1951	1961
Total no. of farms	9,492	8,955
Total occupied land (thousand acres)	3,500	4,341
Improved land (thousand acres)	1,837	2,533
Land under crops (thousand acres)	1,361	1,811
Wheat	461	388
Oats	434	270
Barley	166	447
Tame hay and seed crops	229	415
Other*	71	291
Livestock and poultry (thousands)		
Cattle		
Beef	55	103
Dairy		13
Hogs	49	114
Sheep	7	20
Poultry	470	546
Fur-bearing	n.a.	102
Grain production (thousand bushels)		
Wheat	10,246	10,321
Oats	19,591	11,379
Barley	5,167	15,243
Value of principal agricultural products sold (thousands of dollars)		
Wheat	$ n.a.**	$ 6,161
All grain and oil seeds	7,262 **	15,191
Hay and forage crops	2,003 **	1,747
Cattle	2,456 **	4,091
Swine	1,387 **	3,130
Dairy and poultry	670 **	1,029
Fur-bearing animals	486 **	587
Fish	n.a.**	650

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* Mainly forage crops and seeds.

1964 data.

Data for 1951 included old Census divisions 15, 16, and 17.

June 1, 1960, to May 31, 1961.

** 1950 data.

Market value, not landed value.

n.a. denotes not available.

Sources: Census of Canada. Dominion Bureau of Statistics.
Alberta Department of Agriculture (Farm Economics Branch).

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Continued growth of agriculture including forage crops, livestock, and grain crops in Northwestern Alberta is expected through the forecast period. Northwestern Alberta has sizable undeveloped homesteading areas for which demand is high, particularly in the (1) Peace River and Grande Prairie areas, (2) north of these lands along the Peace River Valley, (3) around Fort Vermilion, and (4) west of High Level to Zama Lake.

In absolute terms, agriculture has been far more important in Northwestern Alberta than in Northern British Columbia. As indicated in the previous section, farming is of little significance in the Yukon Territory.

Petroleum Industry. Initial major oil discoveries were made in Northwestern Alberta in the 1950s near Swan Hills and Sturgeon Lake. Swan Hills, the second largest field in Canada, now has remaining recoverable reserves in excess of 1 billion barrels. In 1964, remaining recoverable oil reserves in Northwestern Alberta were equivalent to 38.5 percent of total Alberta reserves and virtually all of these Northwestern Alberta reserves are located in the Sturgeon Lake-Lesser Slave Lake area. Six oil fields accounted for about 90 percent of remaining recoverable crude oil reserves in Northwestern Alberta at the end of 1964 as tabulated below:

Field	Remaining Recoverable Crude Oil Reserves at Dec. 31, 1964 (million barrels)	Relative Importance to Total Northwestern Alberta
Swan Hills	1,034	46%
Judy Creek	455	20
Virginia Hills	162	7
Sturgeon Lake South	118	5
Kaybob	110	5
Carson Creek North	108	5
Other smaller fields	261	12
Total Northwestern Alberta	2,248	100%

Although natural gas was first discovered in Northwestern Alberta in 1923 at the Pouce Coupe field, other significant discoveries were not made until the late 1950s. Currently, Northwestern Alberta gas reserves are equivalent to about 14.3 percent of total Alberta gas reserves. About 83 percent are located in the Sturgeon Lake-Lesser Slave Lake area, the remaining 17 percent in the Peace River-Grande Prairie area.

Fourteen gas fields accounted for about 80 percent of total remaining marketable gas reserves in Northwestern Alberta at the end of 1964, as tabulated below:

Field	Remaining Marketable Natural Gas Reserves at Dec. 31, 1964 (billion cubic feet)*	Relative Importance (percent)
Martin Hills	654	13%
Windfall	474	9
Kaybob	446	9
Swan Hills	395	8
Pine Creek	390	8
Berland River	300	6
Judy Creek	245	5
Carson Creek	230	4
Worsley	191	4
Simonette	165	3
Kaybob South	149	3
Carson Creek North	138	3
Tangent	109	2
Sturgeon Lake South	108	2
Other smaller fields	1,082	21
Total	5,076	100%

Crude oil and natural gas production in Northwestern Alberta has accounted for an increasing share of total Alberta production since 1956, as shown below:

Crude Oil Production† (thousand barrels)

	Northwestern Alberta	Total Alberta	Northwestern Alberta as Percent of Total Alberta
1956	2,443.9	143,707.3	1.7%
1960	13,305.2	130,491.6	10.2
1964	41,463.3	175,441.6	23.6

* At variable Btu content.

† These figures exclude condensate. Although sizable condensate reserves exist in Northwestern Alberta and in the province as a whole, condensate production has been quite small relative to crude oil production.

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Raw Natural Gas Production
(billion cubic feet)

	Northwestern Alberta			Northwestern Alberta as Percent of Total Alberta	
	Peace River-Grande Prairie	Sturgeon Lake-Lesser Slave Lake	Total Alberta	Peace River-Grande Prairie	Sturgeon Lake-Lesser Slave Lake
1956	1.9	2.3	200.2	1.0%	1.1%
1960	31.4	16.4	443.4	7.1	3.7
1964	32.7	179.3	1,184.8	2.8	15.1

Natural gas liquids reserves and production in Northwestern Alberta compared with Alberta as a whole are shown below:

	Production (thousand barrels)			Reserves (million barrels)		
	Propane	Butane	Pentanes	Propane	Butane	Pentanes
Northwestern Alberta	96.1	100.1	5,662.1	55.9	35.5	88.0
Total Alberta	6,724.3	4,828.1	23,298.9	329.2	211.1	549.7
Northwestern Alberta as Percent of Total Alberta	1.4%	2.1%	24.3%	17.0%	16.8%	16.0%

The future growth of the petroleum industry in Northwestern Alberta will likely depend on (1) future success of exploration activities, and (2) future development of domestic and export markets for crude oil and natural gas. Although marketing of Northwestern Alberta reserves face the same "landlocked" transportation problem as does the marketing of both Northern British Columbia and Yukon reserves, Alberta oil and gas does have the advantage of being connected to, or being located reasonably close to pipe line terminals leading to several large markets.

It seems unlikely that Alberta crude oil will penetrate any sizable new markets, either domestic or export, in the foreseeable future. For this reason, the average annual growth rate for crude oil should follow historical trends. Despite the probable lack of new market outlets, large annual increments (in absolute terms) in demand for Alberta crude oil in existing markets can be expected.

Alberta natural gas, on the other hand, is likely to penetrate new export markets during the forecast period. In addition, if the Peace River iron ore development becomes a reality prior to 1985, a new local

market for Northwestern Alberta gas will develop. The increasing production of natural gas will result in production of increasing quantities of by-product propane and butane which will likely be marketed locally and/or will be exported to other parts of Canada, the United States, and offshore.

It seems obvious, therefore, that the long-term outlook for Northwestern Alberta oil and gas is very encouraging and should be reflected in continuation of a high degree of exploration activity in this area at least through 1985.

Projected Population and Economic Growth--1965 to 1985

Population and economic growth in Northwestern Alberta through 1985 should develop at least as rapidly as growth during the 1951 to 1961 period. The preceding analysis of selected industries suggests that future growth in the economy of Northwestern Alberta will result from expansion of agriculture, petroleum, forest products, and mining (if the Peace River iron ore development reaches fruition). Excluding mining, development of these industries should follow historical trends. A review of historical value of production for each of these resource industries suggests that the economy of Northwestern Alberta is better balanced than that of the Yukon or Northern B.C. On this basis, therefore, population of Northwestern Alberta should increase during the forecast period at an annual growth rate of 2.2 percent which would result in a total population of 130,000 in 1985 compared with 76,884 in 1961.

However, it seems probable that the annual average growth to 1985 might be somewhat higher than the average historical rate. This higher rate could develop for several reasons:

1. The impact of the Peace River iron ore development, if and when, it becomes a commercial operation.

2. A slower movement away from the farm or the area.

3. Even if we assume that the historical growth rate continues in the near future, with such a growth rate the total population could reach sufficient size during the forecast period to represent a sizable market, and therefore might result in an increasing number of small industrial and commercial firms moving into Northwestern Alberta. This could accelerate population growth.

It is not inconceivable, therefore, that the 1985 population in Northwestern Alberta might be in the range of 157,000 to 195,000. This maximum figure of 195,000 is slightly less than the current Alaska population.

Possible Significance of Population Growth and Future Economic Activity to the Alaska Highway

Unlike Northern B.C. or the Yukon, Northwestern Alberta does not have the Alaska Highway routed through it. Thus it is a "gateway" area in close proximity to, and in many ways similar to, Northeastern B.C. However, Northwestern Alberta and Northeastern B.C. appear to be following separate courses of development. While Northeastern B.C. may be dependent to some extent on the Alaska Highway, Northwestern Alberta is apparently placing primary emphasis on a north-south rail-highway system wholly within the Northwestern portion of the province.

While Northwestern Alberta and Northeastern B.C. may make interrelated use of the Alaska Highway and connecting roads in the Dawson Creek-Grande Prairie vicinity for local commerce, no major product movements in either direction will utilize the Alaska Highway. For example:

1. Because of the extremely small population in the area served by the Alaska Highway, shipments from Northwestern Alberta to local markets along the Highway will likely be limited to certain agricultural commodities, petroleum products, and some general freight.

2. Products from points along the Highway will not be competitive in Alberta markets with the same products coming from Northeastern B.C. or Northwestern Alberta. (In addition, because of cost disadvantages of long distance highway transport, it has been pointed out in earlier sections of this study that such movement is small.)

3. Any products from areas along the Highway flowing to export markets or distant domestic markets logically would be transferred to railroad transportation at earliest opportunity, e.g., Fort St. John.

4. Any products from areas in Northwestern Alberta flowing to offshore export markets at present would logically move by rail from Grande Prairie or Peace River to Edmonton and thence out to the west coast. With completion of a new rail line from the CNR transcontinental main line at Solomon to Grande Prairie, a more direct rail routing to Pacific Coast ports will be available.

   This routing will be preferable to the longer, less direct and higher cost per mile truck haul over the Alaska Highway. This illustrates the fact that the Alaska Highway was constructed for strategic military purposes rather than primarily to provide an economic transportation medium.

Northern British Columbia's development independent of the Alaska Highway is typified by the Cassiar-Stewart Highway and the proposed

Stewart - Bear Pass - Dease Lake - Fort St. James railroad. Northwestern Alberta's development independent of the Highway is illustrated by the following:

Mining Industry. Northwestern Alberta may look forward to possible future development of Clear Hills iron ore, Smoky River coking coal, and Featherstonhaugh gypsum. All three minerals will be linked by the new Solomon to Grande Prairie railroad tied in with the Great Slave Lake Railway running from Pine Point. Thus Northwestern Alberta will be traversed by what has been referred to as a "resources railroad" network connected at Solomon with the CNR mainline which branches in B.C. to either Prince Rupert or Vancouver, and also runs to provinces east of Alberta. While the movement of mineral production relies on the economic advantage of long distance rail (vs truck) transport to be competitive in the marketplace, it should be noted that the Northwestern Alberta resources railroad will be paralleled throughout its length by a highway. The Mackenzie Highway already follows closely the route of the Great Slave Lake Railway and the Alberta government intends building a highway beside the new Solomon to Grande Prairie rail line. This highway system will facilitate short truck hauls to various rail transshipment points along it.

Forest Products. The Northwestern Alberta "resources railroad" and highway system will facilitate development of forest reserves south and north of Grande Prairie. Connection with the CNR east-west main line allows improved access to Pacific Coast export ports.

Agriculture. The northward push of agricultural settlement along the Mackenzie Highway is facilitated by the present existence of the Mackenzie Highway and the Great Slave Lake Railway. Agricultural produce can be disseminated throughout Northwestern Alberta and to markets farther afield via CN main line rail connections.*

Oil and Gas. Exploration and development activity is extending north along the Mackenzie Highway in the same manner as agricultural development. The promising finds in the vicinity of Rainbow Lake and Zama Lake west of Meander River on the Mackenzie Highway are a case in point.

Three companies have been granted permits to build pipe lines from the Rainbow Lake-Zama Lake vicinity of Northwestern Alberta to connect to the facilities of Interprovincial Pipe Line, Trans-Mountain Oil Pipe Line and/or Western Pacific Products and Crude Oil Pipeline. If feasible, these lines may carry both oil and gas, in which case the gas would be delivered to Westcoast Transmission or perhaps to the Alberta Gas Trunk Line Company Limited.

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* It should be pointed out that the Northern Alberta Railroad already serves Grande Prairie and Peace River, but the route from Edmonton is circuitous.

The foregoing illustrates a situation comparable to that in Northern B.C.: (1) exploration equipment movement depends to some extent on a main highway (not requiring a paved surface); (2) gas and oil movement to market depends on pipe lines. As the Alaska Highway was found to be reasonably important to exploration equipment movement in Northeastern B.C., so the Mackenzie Highway plays a comparable role in Northwestern Alberta.

Sulphur moves entirely by rail to export market and Northwestern Alberta production is no exception to this rule, i.e., a CN rail line extends from Edmonton to the Windfall plant, the only sulphur plant in Northwestern Alberta at present.

Propane from Northwestern Alberta gas plants offers some possibility for truck shipment into B.C. and up the Highway but it should be noted that Northeastern B.C. propane has a transportation cost advantage.

Conclusion

In summary, resource development in Northwestern Alberta is not expected to have any relation to the Alaska Highway. However, from the standpoint of Northwestern Alberta being a gateway area, Grande Prairie could become a distribution center and transshipment point for goods (farm, oil, and forestry equipment and supplies) manufactured in Alberta, Eastern Canada and the Central and Eastern United States and destined for end-use at locations along the Alaska Highway or the Mackenzie Highway. Dawson Creek or Fort St. John are, of course, the logical distribution points for B.C. or Western U.S. goods.

Some Northwestern Alberta agricultural produce might be shipped to markets along the Alaska Highway but volumes would be relatively small.

V PRESENT TRAFFIC CHARACTERISTICS AND FUTURE TRANSPORT REQUIREMENTS

Transportation Characteristics of Present Economy

Alaska

A study of Alaska's transportation system reveals the predominance of ocean freight business and the importance of airlines for passenger service. This study concentrates on the freight and passenger transportation to and from Alaska and it will not include the intra-Alaska transportation network. Although it is an important line in the overall system, its analysis and study is beyond the scope of this research.

Oceanborne Commerce to and from Alaska

The freight movement to and from Alaska is predominately oceanborne, with long-haul trucks and aircraft accounting for only a small amount of commercial transportation.

Table 21 shows the freight movement to and from Alaska in 1963. It indicates that Canadian oceanborne commerce with Alaska is virtually nonexistent because Canadian traffic passing through Skagway is not primarily international trade between Alaska and Canada, but it consists largely of intra-Canadian trade passing via Skagway to Whitehorse, Yukon. For example, the 194,303 short tons of petroleum products, gasoline, and other commodities of Canadian origin that appear as imports from Canada are in reality traffic to Whitehorse that travels via Skagway. Also through Skagway pass 84,202 tons of lead, zinc, and other ores of Yukon origin which are then transported to Canada, and 68,386 tons of gasoline, gas-oil, and fuel oil from non-Alaskan U.S. sources.

If the commercial flows of petroleum crude and products are excluded from the 1963 total of 2.92 million short tons of oceanborne commerce, the resulting flows reveal the backhaul problem that Alaska transportation costs must bear. Shipments to the remainder of the states are then approximately one-third of the total tonnage.

The imbalance between regional inflows and outflows is even greater when we compare the actual value of the flows. The majority of the commodities imported from the United States by the state are high-value products, but Alaskan exports to the United States are generally low-value products. The backhaul problem is also intensified by the seasonality of the Alaskan exports of pulp, fish, etc.

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Table 21

ALASKAN WATERBORNE FREIGHT TRAFFIC
(Short Tons)
1963

Ports	Foreign Trade				Coastal Trade			
	Imports		Exports		Receipts from		Shipments to	
	From Canada	From Others	To Canada	To Others	Other U.S.	Rest of Alaska	Other U.S.	Alaska
Ketchekan	6,372	7,935	54,000	32,590	196,251	1,960	6,014	24,414
Wrangell	--	36	--	84,163	5,360	4,000	1,341	6,234
Petersburg	--	120	--	--	6,611	213	6,492	34,882
Sitka	--	428	--	161,875	96,493	587,255	2,188	5,004
Juneau	--	148	--	33	51,800	1,970	1,452	6,428
Skagway	37,931	--	84,188	--	66,476	7	--	29
Cordova	--	--	--	--	9,958	14,478	8,521	1,190
Valdez	--	--	--	--	13,281	28,565	--	176
Seward	--	--	--	--	509,364	--	3,429	101,700
Anchorage	--	102,982	--	9,153	247,918	65	330	18,664
Whittier	--	310	--	--	111,785	4,195	41	4,525
Kodiak	--	1,085	--	10	24,070	27,213	6,583	1,370
Iliuluk	--	--	--	--	100,012	19	227	25,930
Nome	--	--	--	--	18,927	--	29	4,209
Southern side of Alaskan peninsula	--	--	--	--	--	380,510	1,261,965*	3,559
All other ports	--	--	--	--	44,222	227,628	117,969	--
Total	44,303	113,044	84,242	287,824	1,502,528	1,278,078	1,416,581	296,006

* Includes the shipment of crude petroleum to the rest of the states.

Source: U.S. Army Corps of Engineers, "Waterborne Commerce of the United States," Calendar Yearbook, Part IV, 1963.

There is a high level of activity at the Port of Seward because it is the terminal point of the Alaska Railroad connecting Fairbanks, Anchorage, and Seward. Since the earthquake in 1964, a large portion of this traffic is now diverted to the Port of Anchorage which has been opened for year-round navigation. The figures for oceanborne commerce contrast with the freight and express traffic between Alaskan and U.S. airports which are less than 30,000 short tons a year. For example, in 1962 and 1963, the freight traffic to the remainder of the states originating at Alaskan airports was 5,564 and 6,926 short tons, respectively. There is almost no airfreight traffic between Alaska and Canada.

The freight traffic commerce to Alaska carried by trucks is quite small in comparison with the waterborne commerce. For example, in 1964, less than 50,000 short tons were received by Alaska from the United States and Canada via the Alaska highway; the shipments by truck from Alaska to continental United States were less than 20,000 short tons. This truck traffic therefore amounts to less than 4 percent of the waterborne tonnage commerce with the rest of the United States.

Passenger Transport

At the present time, the airlines are the chief means of transportation for passenger traffic between the continental United States and Alaska; however, highway transportation is still very important for tourism purposes. During 1963, for example, the total outbound traffic on Alaska highways was 77,000 persons, whereas 137,000 persons traveled on airlines. From May 1 to August 31 of the same year, however, the ratio of air-to-highway travelers was almost 1:1--48,878 on highways and 54,114 on airlines. These figures are significant because a much larger proportion of highway travelers are tourists. Table 22 shows the magnitudes of outbound travel from Alaska.

In 1962, approximately 10 percent of the outbound highway passengers were Canadians; the remainder came from the United States and Alaska. The portion of Canadian ferry travelers was 4 percent in 1963 and 1964, and 5 percent of the cruise ship travelers were also Canadians. Nearly 6 percent of the outbound airline traffic from Alaska goes to Canada (Yukon, etc.), and of this portion, 6 percent were Canadians who were returning to their country. Of the White Pass and Yukon Railroad passengers outbound from Alaska, only 7 to 12 percent were Canadians, and the remainder were Americans.

From 1958 to 1964, the growth rate of summer passenger travel has been 8.9 percent and 6.4 percent for highway and airline travel, respectively. Although the majority of U.S. highway tourist travelers came from the Midwest, most of the airline tourists arrived from the Northwest and Pacific regions. It is significant, however, that at present only a small proportion of airline travelers to and from Alaska are tourists. The Midwest region and the Northwest and Pacific regions accounted for 40 percent each of the summer tourist ferry travel. The Canadian summer passenger travel to Alaska was mainly on highways.

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Table 22

TOTAL OUTBOUND PASSENGER TRAFFIC FROM ALASKA
1952-1963

	1952	1958	1959	1960	1961	1963	Rates of Growth in Travel (percent) 1952-63	1958-63
Highway	21,499	46,569	58,224	54,167	59,377	77,000	12.3%	10.6%
Ferry	--	--	--	--	--	18,488	--	18.8*
Railroad	n.a.	8,487	11,856	12,413	14,144	15,230	--	5.0
Cruise ship	16,868	11,608	14,343	10,341	10,228	7,396	--	--
Airlines	74,118	90,112	104,766	127,873	106,489	137,500	5.8	8.8

* Covers the period 1963-64.

Sources:
1952--W. T. Stanton, Alaska Recreation Survey, Government Printing Office, 1953.
1958, 1959, 1960--State of Alaska Department of Commerce, Alaska Passenger Traffic Survey, 1958, 1959, and 1960.
1961--U.S. Department of Commerce, Area Redevelopment Administration, Investment Opportunities in Southeastern Alaska, January 1965.
1963--State of Alaska, Department of Economic Development and Planning, Traveler Profiles, Juneau, 1964.

Information presented in Tables 23 to 26 shows the seasonal characteristics of passenger travel to Alaska, and it indicates that airline travel is the least sensitive to seasonal fluctuations. In the above description, highway traffic was discussed briefly, however, this subject will be examined more thoroughly in the following chapters of this report.

Table 23

PERCENT OF TRAVELERS BY MODE OF TRANSPORTATION
1964

	All Summer Travelers	All Summer Visitors	All Summer Vacationers
Highway	35%	46.9%	42.5%
Ferry	12	13.9	15.9
Railroad	2	2.3	5.4
Cruise ship	5	0.2	15.2
Airline	46	36.7	20.9
Total	100%	100.0%	100.0%

Source: State of Alaska Department of Economic Development and Planning, "Traveler Profiles." Juneau, December, 1964.

Commercial Freight Transportation on the Alaska Highway

Introduction

In the preliminary evaluation of potential benefits that might be derived from paving of the gravel section of the Alaska Highway, it was readily apparent that commercial motor transport operators could conceivably benefit to some considerable degree from the paving program. To determine the nature and extent of benefits that might accrue to such operators, the research program has attempted to construct an "economic model" of highway transport operations in the study area for the purpose of evaluating the impact of the paving program on future operating costs, rate structure, and traffic volumes. The specific objectives of this phase of the study can be summarized as follows:

1. To determine present commercial utilization of the graveled portion of the Alaska Highway in terms of volumes of truck traffic moving in a typical year.

Table 24

PASSENGER TRAFFIC OUTBOUND FROM ALASKA
1961

Mode	Canadian Citizens	U.S. Citizens
Highway*	5,938	53,439
Railroad	1,684	12,460
Steamship†	511	9,717
Airlines‡		
To United States	n.a.	98,720
To Canada	304	7,458

* The Highway traffic was allocated in accordance with the proportion of automobiles and buses with Canadian and U.S. registration.

† The Marine Highway Ferry System was not in operation until 1963 and therefore does not appear in the above table. However, in 1963 the proportion of Canadians among that traffic was approximately 4 percent.

‡ All the travel to Canada originating from Alaska was assumed to enter Canada through the Yukon Territory. No Canadian passengers were assumed to be in the passenger traffic to the United States from Alaska sources.

Sources: Canada Dominion Bureau of Statistics, Travel Between Canada and Other Countries 1962, Ottawa, March 1964. U.S. Department of Commerce, Investment Opportunities in Southeastern Alaska, Washington, 1965.

Table 25

OUTBOUND SUMMER PASSENGER TRAVEL FROM ALASKA
May 1 to August 31
1952-1964

	1952	1958	1959	1960	1963	1964	Rates of Growth in Summer (percent) 1952-64	1958-64
Highway	11,217	27,782	38,384	35,841	48,878	46,252	12.6%	8.9%
Ferry	--	--	--	--	13,771	15,202	--	--
Railroad	n.a.	n.a.	n.a.	n.a.	3,105	3,360	--	--
Steamship	11,106	8,658	12,231	8,686	7,396	6,296	--	--
Airlines	33,216	41,745	49,524	57,428	54,114	60,404	5.1	6.4

Sources: 1964--State of Alaska, Department of Economic Development and Planning, Travel Profiles, Juneau, 1964. For the other years, the sources are the same as those given in Table 23.

Table 26

PERCENT DISTRIBUTION OF OUTBOUND SUMMER PASSENGER TRAVEL FROM ALASKA, BY RESIDENCE OF TRAVELER
May 1 to August 31
1952, 1963, and 1964

Transport Mode and Residence of Traveler	1952	1963	1964
Highway			
Alaska	16.1%	n.a.%	27.3%
United States	82.6	n.a.	60.7
Canada	1.3	n.a.	12.0
Total	100 %		100 %
Ferry			
Alaska	--	30.4	22.5
United States	--	62.3	73.3
Canada	--	7.3	4.2
Total		100 %	100 %
Railroad			
Alaska	n.a.	n.a.	1.7
United States	n.a.	n.a.	70.3
Canada	n.a.	n.a.	28.0
Total			100. %
Steamship			
Alaska	2.5	n.a.	0.0
United States	88.1	n.a.	95.0
Canada	9.4	n.a.	5.0
Total	100 %		100 %
Airlines			
Alaska	27.0	n.a.	48.7
United States	72.0	n.a.	50.3
Canada	1.0	n.a.	1.0
Total	100 %		100 %

Sources: 1952--same as shown on Table 22.
1963--same as shown on Table 22.
1964--Stanford Research Institute.

2. To estimate potential savings in terms of reduced operating costs that could be expected to accrue to commercial transport operators as a direct result of the paving program.

3. To examine the outlook for commercial truck transport operations over the Alaska Highway as related solely to the paving program. Although paving of the Highway may encourage economic growth in other sectors of the economy, which, in turn, could affect the volumes of truck transportation, the primary objective to analyze the impact of the paving program on truck volumes solely as a function of potential rate reductions and improvements in service.

In planning the research program required to achieve these objectives it was soon evident that extensive field work would be required to obtain the necessary data. This was partly because there is no statistical data on motor carrier operations in the project area collected or published by any government agency and partly because of structure of the trucking industry in northern Canada and Alaska where there are a relatively small number of large carriers and a large number of small carriers.

The first step in the program was to contact regulatory agencies and trucking associations to identify those trucking companies that are regular users of the Highway. Primary sources of this data were the Commissioner of the Northwest Territories, Whitehorse; the British Columbia Public Utilities Commission, Vancouver; the Alaska Carriers Association, Anchorage; and the Alaska Public Service Commission, Anchorage. From a combination of these sources, it was possible to obtain a complete listing of carriers regularly using the Highway and to segregate the larger operators from those that use the Highway occasionally.

Because of the large number of small carriers indicated in the listings, it was reasonable to expect that in many cases only limited operating data would be available. Characteristically, small-fleet operators do not maintain complete records of volumes, costs, or traffic carried. As a result, it was decided to avoid asking for operating data dating back several years. For this reason, the research program used 1964 as a a base year and attempted to test it for validity as a typical year. For the most part, trucking operators considered 1964 as a typical year, particularly in the Yukon. However, following the earthquake in Alaska in March 1964, when port facilities were severely damaged, there was a short term upsurge in traffic. The estimates contained in the following have been adjusted for this abnormality.

The basic data from which final estimates were prepared consist mainly of field interviews and questionnaires. A complete questionnaire was submitted to all operators of major carriers. In almost every case, this form was completed during an interview with the carrier concerned. An abbreviated questionnaire was also sent to the smaller carriers. In all, a total of 61 questionnaires were submitted to the various motor vehicle operators. When a truck line did not respond to an interview or to a questionnaire, other means of estimating its volume were employed, as described on the following page.

1. The Alaska Public Service Commission operates a scale at Tok. Data compiled at Tok shows the date the vehicle entered Alaska, the name of the company, and its destination point. Through comparison with reported scale information and data on specific companies responding to the interviews, it was possible to prepare a valid estimate of total volumes for specific companies as a function of volumes reported at the scale. This was further verified through a comparison with total vehicle counts reported at U.S. Customs. The relationship developed from the scale data was used to estimate volumes for a number of smaller U.S. carriers and for U.S. operators using the Highway on an occasional basis.

2. The Commissioner of the Yukon, in granting licenses, requires information from the carrier as to the number of tractor units that he will operate over the highway. Based on utilization data reported by other carriers, it was possible to estimate traffic for a number of nonreporting Canadian carriers.

3. During a three-week period of 1964, a 24-hour sample was taken of all vehicles moving through Watson Lake, Yukon. By a process of elimination it was possible to estimate the volume of Highway traffic by operators who are not licensed in the Yukon for regular use of the Highway.

As a result of the interviews and cross-checking of their contents, along with the data used to estimate the volumes for nonreporting carriers, it is considered that the total volume estimates are very reliable. Of the data shown for major carriers, that is, frequent users of the Highway, 90 percent is on a reported basis and only 10 percent on an estimated basis. For all carriers, 78 percent is on a reported basis and only 22 percent on an estimated basis.

In examining the results of the survey, it should be noted that they include only motor vehicle carriers using tractor and semitrailer or full-trailer equipment, and excludes small truck operators. In addition, with one exception, they exclude private contract operators; that is, carriers hauling for their own account.

Present Commercial Utilization

Estimates of present utilization of the Highway have been expressed in terms of vehicle miles, and they have been segregated by carriers' national origin and by direction of traffic flow. For the purpose of the study, vehicle miles are considered to be the most appropriate measure of utilization, since the potential benefits that might be derived from paving will be primarily in terms of operating costs. In motor vehicle operation, these costs are principally a function of vehicle miles. Moreover, direct operating costs are essentially the same for both a loaded and an empty vehicle, which invalidates the use of net-ton-mile data as a base for the allocation of cost benefits.

Table 27

ANNUAL VEHICLE MILES TRAVELED OVER GRAVELED PORTION OF THE ALASKA HIGHWAY BY ALL MOTOR COMMON CARRIERS 1964

	Thousands of Vehicle Miles		
	Canadian Carriers	U.S. Carriers	Total
Loaded			
Northbound	2,745	1,951	4,696
Southbound	814	1,139	1,953
Subtotal	3,559	3,090	6,649
Empty			
Northbound	285	1	286
Southbound	2,216	813	3,029
Subtotal	2,501	814	3,315
Total	6,060	3,904	9,964

Table 28

ANNUAL NUMBER OF TRIPS OVER THE GRAVELED PORTION OF THE ALASKA HIGHWAY BY ALL MOTOR COMMON CARRIERS 1964

	Number of Trips		
	Canadian Carriers	U.S. Carriers	Total
Loaded			
Northbound	5,769	1,802	7,571
Southbound	1,987	1,054	3,041
Subtotal	7,756	2,856	10,612
Empty			
Northbound	876	6	882
Southbound	4,658	754	5,412
Subtotal	5,534	760	6,294
Total	13,290	3,616	16,609

These data include only vehicle miles traveled over the gravel portion of the Highway; they do not include prior to subsequent haul on a paved surface. Appendix A shows mileages between principal points along the Highway. Aside from lack of available data, it would have been a monumental undertaking to attempt to trace every trip to its precise point of origin. Carriers were therefore requested to provide origin-destination data relative to significant geographic regions rather than to specific cities.

The carriers holding annual Public Service vehicle licenses in the Yukon Territory are also listed in Appendix A. An attempt was made to contact all of these carriers through interview, mailed questionnaire, or long-distance telephone calls. Of the 24 major carriers, only nine did not respond to contacts. In several cases, the operations could be identified from other sources or it was known that they had only limited operations on the Alaska Highway. For the three major U.S. carriers that did not reply, excellent data were available from the scale records at Tok. Other checks were available through the Alaska Carriers Association. It was established that two of the smaller major Canadian carriers that did not respond, use the Alaska Highway on an infrequent basis. For example, it was established that one of the carriers operates primarily between Whitehorse and Dawson City and each trip would therefore cover only seven miles of the Highway. Similarly, the other carrier operates north of Watson Lake to the Canadian Tungsten Mine. Details of the method of estimating for each of the nonrespondent carriers are shown in Appendix A.

Table 27 contains a summary of the total vehicle miles incurred on the gravel portion of the Highway segregated by direction, loaded or empty movement, and according to the country of the carriers concerned. Table 28 contains similar information in terms of the number of trips. Further details are shown in Appendix A.

Of the 9,964,000 total vehicle miles operated over the gravel portion of the Highway, 60 percent were incurred by Canadian carriers and 40 percent by U.S. carriers. In terms of the number of trips, 80 percent were operated by Canadian carriers and 20 percent by U.S. carriers. This points up a sharp difference in the average distance per trip operated by Canadian vs U.S. carriers. In the case of the former, the average trip was 456 miles and in the latter, 1,080 miles. In other words, the average trip by a Canadian carrier was less than half the distance of the gravel portion while virtually all the U.S. carrier trips traveled the full length of the gravel portion. Only a very small amount of U.S. traffic moved between the Alaska Panhandle and the Anchorage-Fairbanks area.

In determining the potential benefits between Canadian and U.S. users, it is significant that a relatively small amount of traffic was carried by a carrier of one country to a destination in another country. The amount of traffic that originated with U.S. carriers and terminated in Canada was so small as to be insignificant, and it was therefore not identified separately in the analysis. The total amount of vehicle miles Canadian carriers traveled to or from the state of Alaska amounted to

636,000 vehicle miles. A substantial portion of this was by a wholly owned subsidiary of one of the large U.S. carriers. Other significant movements originating in Canada and terminating in Alaska included a regular shipment of meat from Edmonton to Anchorage and propane gas products moving from the refinery at Taylor, B.C., to Anchorage and Fairbanks. In addition there was some movement of house trailers between the two countries.

Table 1 shows that there was a marked contrast between loaded and empty movements for Canadian and U.S. carriers. Approximately 60 percent of total vehicle miles incurred by Canadian carriers were loaded vehicle miles, while almost 80 percent of U.S. carrier vehicle miles were loaded. For purposes of this study, a loaded vehicle mile is defined as one in which the unit was carrying any amount of revenue freight. The major reason for the difference between the loaded characteristics of the carriers of the two countries was that the U.S. mail was carried by Highway on a scheduled basis and virtually all units moved south by the mail contractor contained at least a partial load. The only northbound empty vehicle miles incurred by U.S. carriers were in respect to vehicles returning empty to the Anchorage or Fairbanks areas from the Alaska Panhandle.

Table 29 illustrates the principal origin-destination areas for Alaska Highway traffic flows and points out a somewhat balanced distribution of loaded vehicle miles between U.S. and Canadian carriers.

Table 29

ORIGIN AND DESTINATION AREAS
OF MOTOR COMMON CARRIER LOADED VEHICLE MILES
OVER THE GRAVELED PORTION OF THE ALASKA HIGHWAY
1964

Between	And		
	Canadian Alaska Highway Communities	State of Alaska	Total
Vancouver area	502,000	72,000	574,000
Calgary-Edmonton area	1,201,000	113,000	1,314,000
Other Prairie points	81,000	48,000	129,000
Canadian Alaska Highway communities	1,472,000	88,000	1,560,000
U.S. Pacific Northwest	--	2,309,000	2,309,000
Other U.S. points	--	753,000	753,000
State of Alaska	--	10,000	10,000
Total	3,256,000	3,393,000	6,649,000

As stated previously, almost all the U.S. carrier traffic moved over the full length of the Canadian portion of the Alaska Highway. Approximately 3,072,000 loaded vehicle miles were operated over this route by U.S. carriers, and this constituted 90 percent of all loaded vehicle miles to and from the state of Alaska.

The Pacific Northwest Gateway from Seattle was used most frequently by American carriers moving to and from Alaska, generating 66 percent of the northbound loaded vehicle miles and 91 percent of the southbound loaded vehicle miles. Most of the remaining commercial Highway traffic between the U.S. mainland and Alaska moved through the Midwest Gateway at Coutts, Alberta. The flow of U.S. traffic between the Panhandle and Alaska proper was negligible, amounting to only 10,000 miles per year over the Canadian portion of the Alaska Highway.

The four major originating areas for Canadian traffic to the state of Alaska are Calgary-Edmonton, which generated 113,000 loaded vehicle miles; Vancouver, which generated 72,000 loaded vehicle miles; the Taylor Refinery at Fort St. John, which generated 88,000 loaded vehicle miles; and the Canadian Prairies, which accounted for about 48,000 loaded vehicle miles of traffic. Of this total Canadian movement, 99 percent returned empty. It is significant to note that the Canada-Alaska traffic constitutes only 10 percent of the total loaded vehicle miles of traffic into and out of Alaska.

One of the main flows of Canadian common carrier traffic on the Alaska Highway is from the Calgary-Edmonton area up to Dawson Creek and then on to the Highway communities of Fort St. John, Fort Nelson, Watson Lake, Whitehorse, and Alaska. Approximately 1,244,000 northbound loaded vehicle miles, or 45 percent of total northbound Canadian traffic, are operated in this service in a typical year.

The second heaviest northbound movement, or 39 percent of northbound traffic, is between Dawson Creek-Fort St. John and the numerous small highway communities as far north as Alaska. Approximately 1,069,000 loaded vehicle miles are generated in this service, 75 percent of which is between Taylor Refinery at Fort St. John and Watson Lake.

The remaining 16 percent of northbound traffic originates in Vancouver and the Canadian Prairies: 12 percent in Vancounver and 4 percent in the Canadian Prairies.

Fifty-eight percent of the southbound traffic, or approximately 491,000 loaded vehicle miles, represents traffic that both originates and terminates at points on the unpaved portion of the highway. Of the remaining 42 percent, 30 percent goes on to Vancouver, 8 percent to Calgary-Edmonton, and 4 percent to other points on the Canadian Prairies. Approximately 53 percent of the southbound traffic local to the Alaska Highway is between Cassiar (Watson Lake) and Fort St. John.

To summarize, 40 percent of the traffic handled by Canadian carriers over the Alaska Highway moves between Canadian communities on or near the Highway, and 34 percent moves between the Calgary-Edmonton area and the Canadian Alaska Highway communities. It is also significant to note that three-quarters of the northbound traffic returns southbound empty. Appendix A gives detailed information on vehicle miles and percentages of total traffic handled over the various routes by both the Canadian and U.S. carriers.

Table 30 summarizes commercial vehicle traffic density along selected segments of the Alaska Highway. Appendix A gives details of traffic densities classified into loaded and empty movements.

Table 30

MOTOR COMMON CARRIER TRAFFIC DENSITY,* BY GEOGRAPHIC SEGMENT OF THE CANADIAN PORTION OF THE ALASKA HIGHWAY 1964

	Canadian Carriers	U.S. Carriers	Total
Dawson Creek-Fort St. John	8,686	3,392	12,078
Fort St. John-Mile #80	10,097	3,392	13,489
Mile # 80-Fort Nelson	9,933	3,392	13,325
Fort Nelson-Watson Lake	6,068	3,392	9,460
Watson Lake-Whitehorse	4,874	3,392	8,366
Whitehorse-Yukon border	1,648	3,514	5,162
Average	5,578	3,422	9,000

* Vehicle miles per mile of highway.

Basically, utilization of the Highway by Canadian carriers becomes progressively lower from south to north. On the other hand, Highway utilization by U.S. carriers is relatively uniform, reflecting in part the licensing restrictions that do not permit pickup and delivery within Canada. Traffic density by U.S. carriers increases slightly at the northern end of the Highway as a result of shipments to and from the Panhandle.

The heaviest use of the Highway by Canadian carriers is between Fort St. John and Fort Nelson, where traffic density is almost twice that for the Highway as a whole. The average empty return movement of Canadian

carrier traffic along the entire Highway is 75 percent, with the highest ratio, 100 percent, occurring between Fort Nelson and Watson Lake. Table 31 contains a comparison of the vehicle mile densities along different segments of the Alaska Highway with the most highly utilized section lying between Fort St. John and Mile #80.

Table 31

COMPARATIVE TRAFFIC DENSITIES OF
SELECTED SEGMENTS OF THE ALASKA HIGHWAY WITH THE
FORT ST. JOHN-MILE #80 SEGMENT
1964

Highway Segment	Loaded (percent)	Empty (percent)	Total (percent)
Fort St. John-Mile #80	100.0%	100.0%	100.0%
Dawson Creek-Fort St. John	84.9	97.0	89.5
Mile #80-Fort Nelson	100.0	96.1	98.8
Fort Nelson-Watson Lake	76.8	59.4	70.1
Watson Lake-Whitehorse	67.5	53.2	62.0
Whitehorse-Alaska border	43.2	30.3	38.3
Average	71.3%	59.2%	66.7%

In establishing the most appropriate method for determining the type of commodities that move by motor common carriers over the Alaska Highway, it was considered that the required information would be available only in limited detail. Once again, it was expected that a large number of carriers, particularly the smaller ones, would not maintain suitable records. As a result, it was decided to classify vehicle mile data according to the type of carrier reporting the traffic data.

In many cases, specialized equipment is required to handle particular commodities and this factor was used as a guide for the classification of individual reporting operators. In addition to the information developed through this method of classification, attempts were made to secure more specific information when interviewing the various truck operators. Examination of the carrier lists indicated five significant categories that broadly indicated the type of commodities handled.

General Freight

As would be expected, this is the largest group and a reporting carrier was included in this classification where it was clear that he was

not committed to the movement of any single or closely related group of products. Carriers in this category would normally have only general-use equipment such as closed vans, flatbed semitrailers, and stake and rack semitrailers. They carry a broad range of commodities, including meat, produce, building products, heavy machinery, oilfield equipment, lumber, pipe, cement, and asbestos fiber. In addition, they could also carry commodities that might normally be handled by a more specialized carrier, e.g., individual tourist automobiles and crated household effects.

Bulk Petroleum

Traffic reported by an operator was included in this category when it was established that he operated only semitrailer or full-trailer tank vehicles. Commodities included in this category are refined petroleum products ranging from gasoline to liquid propane. It should be noted that while some of the general freight carriers would move petroleum products in barrels there was no evidence that any of these operators used tank trucks in addition to their regular fleet of general-service vehicles.

House Trailers

A carrier was included in this category when it was indicated that all of his traffic consisted of the movement of mobile structures on wheels, such as house trailers, kitchens, dormitory units, etc., for private, industrial, or commercial use. In no case did a carrier moving mobile homes indicate the handling of any other type of freight.

Household Effects

Reporting carriers falling in this category include those using only specialized furniture moving vans and those carrying used furniture and other household goods.

Automobile Haulers

This group included only those carriers reporting the movement of automobiles or trucks in special equipment. It did not include the ferrying of individual units between two points.

The tabulation on the following page illustrates the loaded vehicle miles operated over the unpaved portion of the Alaska Highway by each type of carrier defined in the preceding paragraphs. Appendix A provides more complete date with respect to loaded, empty, and total vehicle miles by type of carrier.

Type of Carrier	Thousands of Loaded Vehicle Miles: Canadian Carriers	U.S. Carriers	Total
General freight	2,532	2,635	5,167
Bulk petroleum	905	--	905
House trailers	51	155	206
Household effects	71	91	162
Automobile haulers	--	209	209
Total	3,559	3,090	6,649

As shown in the foregoing tabulation, it is apparent that general freight haulers account for 71 percent of Canadian loaded vehicle miles and 85 percent of U.S. loaded vehicle miles, or a total of 78 percent of all loaded vehicle miles traveled on the unpaved portion of the Alaska Highway.

Because of the importance of the general freight classification, attempts were made during field interviews to secure additional information respecting specific commodities handled, points of origin and destination of traffic, and details on volumes. Generally, the carriers were not prepared to release cargo manifests or waybills, but they did provide extensive estimates of data. Where possible, these data were cross-checked with other independent sources. The findings with respect to movement of general freight are described in the paragraphs that follow.

The Canadian northbound general freight movement accounts for 1,775,000, or 70 percent, of the loaded vehicle miles operated in Canadian general freight service. Approximately 1,027,000, or 58 percent, of these vehicle miles originate in the Calgary-Edmonton area, 20 percent in the Vancouver area, 4 percent in the Canadian Prairies, and the remaining 18 percent are local movements among communities along the Alaska Highway. The general distribution pattern for the traffic from Calgary-Edmonton, Vancouver, and the Canadian Prairies is given in the tabulation below. It should be noted that approximately 440 trailer-loads per year reach the Yukon and Alaska from Vancouver via Skagway-White Pass and Yukon Route and are trucked from Whitehorse. Of these loads, 40 percent move north to the U.S. border and 60 percent south towards Watson Lake.

Origination	Destination (percent of total trips): Fort St. John	Fort Nelson	Watson Lake	Whitehorse	Alaska
Calgary-Edmonton	6%	6%	33%	44%	11%
Vancouver	8	9	16	51	16
Canadian Prairies	12	12	--	41	35

The largest single movement of local general freight is the mail traffic which moves between Dawson Creek and Whitehorse. This traffic accounts for approximately 30 percent of the 304,000 vehicle miles operated in local service; the remaining 70 percent consists of local movements from community to community along the Highway.

Principal commodities handled by the Canadian general freight handlers in their northbound trips are meat and packing-house products, fresh and frozen produce, culvert and drilling pipe, heavy machinery and oilfield equipment, miscellaneous manufactured items, and building materials. In addition, approximately 350 loads of asbestos fiber are handled by common carrier from Cassiar to Whitehorse and thence to Vancouver via a White Pass and Yukon route. Small quantities of beer and lumber are also moved into the north. The culvert pipe, heavy machinery, and oilfield equipment are distributed primarily in the Fort Nelson-Watson Lake area, whereas the other commodities are distributed to communities along the full length of the Highway.

The Canadian southbound general freight movement accounts for 756,000, or 30 percent, of the loaded vehicle miles operated by Canadian general freight haulers. Almost all of this traffic originates on the Canadian portion of the Alaska Highway, with only 3,800 loaded vehicle miles, or one-half of 1 percent, originating in Alaska.

Approximately 660,000, or 87 percent, of the total southbound vehicle miles are operated in local Alaska Highway service. The major movement, which accounts for 63 percent of the local southbound loaded vehicle miles, is the movement of asbestos fiber from Cassiar (Watson Lake) to Fort St. John. The remaining 37 percent of local southbound traffic moves fairly uniformly between communities from Whitehorse to Dawson Creek.

Nonlocal southbound traffic accounts for 13 percent, or 100,000, of the total southbound loaded vehicle miles. Almost 80 percent of this nonlocal traffic originates in the Whitehorse area and approximately 20 percent originates in the Watson Lake-Fort St. John region. Of these vehicle miles, 57 percent terminate in Vancouver, 40 percent in the Calgary-Edmonton area, and 3 percent in the Canadian Prairies.

The principal commodities, other than the asbestos fiber and mail, handled by the Canadian general freight haulers in their southbound trips are used machinery and equipment; empty beer bottles; used pipe; household effects; and, to a lesser degree, lumber and tourist automobiles. The empty beer bottles, lumber, and tourist automobiles usually terminate in Fort St. John or Dawson Creek, whereas the machinery and equipment, used pipe, and household effects are handled through to Calgary-Edmonton and Vancouver.

The U.S. northbound general freight movement accounts for 1,648,000, or 63 percent, of the loaded vehicle miles operated in U.S. general freight service on the Alaska Highway. Approximately 1,160,000, or 70 percent, of these vehicle miles originate in the Seattle or U.S. Pacific Northwest

area and over 29 percent originate in the U.S. Midwest or beyond. The Panhandle traffic from Haines Junction to the Alaska area is negligible, amounting to less than 1 percent of loaded vehicle miles. Both the traffic from the Pacific Northwest and from the Midwest is distributed 25 percent to the Fairbanks area and 75 percent to the Anchorage area.

The principal commodities hauled by the U.S. general freight carriers from the Pacific Northwest area are mail; meat, milk, produce, and other perishable foodstuffs; building products, notably plywood; explosives for military use; machinery, and miscellaneous manufactured items. The principal commodities moving from the Midwest to Alaska are meat; new furniture; machinery, notably oilfield equipment; and miscellaneous manufactured items.

The U.S. southbound general freight movement accounts for 987,000, or 37 percent, of the loaded vehicle miles operated by U.S. general freight haulers. Of these vehicle miles, 75 percent originate in Anchorage, 25 percent in Fairbanks, and a negligible amount are operated in Panhandle service. The U.S. Pacific Northwest is the destination for 930,000, or 95 percent, of the southbound loaded vehicle miles and the U.S. Midwest is the destination for the remaining 5 percent.

The principal commodities handled southbound by the U.S. general freight haulers are mail, scrap and surplus, household effects, and oilfield equipment. The scrap and surplus tend to be distributed to the Pacific Northwest area, whereas the household effects and oilfield equipment move to the U.S. Midwest. The commodities that are moved in the very limited Panhandle service are principally retrograde machinery, military stores, and equipment.

Canadian bulk petroleum carriers operate 905,000 loaded vehicle miles on the unpaved portion of the Alaska Highway. This accounts for 25 percent of the total Canadian loaded mileage. All of this traffic is northbound, with 16 percent of it originating in Edmonton and the remaining 84 percent at the Taylor Refinery in Fort St. John. The Edmonton traffic and 86 percent of the Taylor Refinery traffic, which constitutes 90 percent of the total bulk petroleum traffic, terminates between Fort St. John and Whitehorse, with 75 percent of it being delivered to communities in the Fort Nelson area, 18 percent in the Watson Lake area, and 7 percent in the Whitehorse area. The remaining 10 percent of the total petroleum traffic, which is liquid petroleum gas, originates at Taylor Refinery and terminates in Alaska, with 82 percent going to Fairbanks and 18 percent to Anchorage. All bulk petroleum movements experience a 100 percent empty return movement on their southbound trips. It is worthy of note that there was no evidence of U.S. carriers moving petroleum products to Canadian destinations.

House trailer carriers account for 206,000 loaded vehicle miles, or 3.1 percent of the total loaded vehicle mileage on the unpaved portion of the Highway. One-quarter of this mileage, or 51,000 loaded vehicle miles, is operated by Canadian carriers and three-quarters, or 155,000 loaded

vehicle miles, is operated by U.S. carriers. The Canadian movement, which consists for the most part of industrial and catering trailer equipment, originates in Calgary, with 71 percent terminating in the Fort Nelson area, 8 percent in the Watson Lake area, 10 percent in the Whitehorse area, and 11 percent going on to Alaska. These carriers invariably are empty when they return southbound.

The U.S. house trailer movement is made up predominantly of mobile homes for residential use, with 76 percent originating in the U.S. Midwest; 20 percent in the U.S. Pacific Northwest; and a negligible 4 percent or four trips per year, originating in northern British Columbia and the Yukon. All of this movement terminates in Alaska, and 96 percent of the southbound trips are empty.

Household effects carriers account for 162,000 loaded vehicle miles, or 2.5 percent of the total loaded vehicle mileage on the unpaved portion of the Alaska Highway. Forty-four percent of this mileage is operated by Canadian carriers and 56 percent by U.S. carriers. Only 24 percent of the Canadian northbound trips are loaded, the remaining 76 percent being empty trips to Whitehorse to bring back loads. Of the northbound traffic, 47 percent originates in the Calgary-Edmonton area, 47 percent at other Canadian Prairie points, and 6 percent in Vancouver, with 82 percent terminating at Watson Lake and 18 percent in Whitehorse. The southbound movement, which is 100 percent fully loaded, accounts for 80 percent of the total Canadian loaded vehicle miles. Eighty-three percent originates at Whitehorse and 17 percent at Watson Lake, with half going to Calgary-Edmonton and half to other Canadian Prairie points.

Household effects move in two distinct sectors of the Alaska Highway. The major movement, which accounts for 97 percent of the total vehicle miles, is the traffic from the U.S. Midwest, South, and East to Alaska. The rather insignificant movement, which accounts for 2,900 vehicle miles, is the Panhandle movement that operates from the Alaska Border to Haines Junction in a loaded southbound and empty northbound traffic pattern.

The major U.S. household effects movement, which accounts for 90,000 loaded vehicle miles per year, is loaded in both directions. Of the northbound movement, 40 percent originates in the U.S. Midwest and 60 percent in the U.S. South and East; with 40 percent terminating in the Fairbanks area and 60 percent in the Anchorage area. Of the southbound movement 60 percent originates in the Anchorage area and 40 percent in the Fairbanks area, with 60 percent terminating in the U.S. South and East and 40 percent in the U.S. Midwest. It is significant to note that household effects moving between the U.S. Pacific Northwest and Alaska are not handled over the Alaska Highway.

U.S. automobile haulers operate 209,000 loaded vehicle miles on the unpaved portion of the Alaska Highway. This accounts for 6.7 percent of the total U.S. loaded vehicle miles. All northbound automobile traffic originates in the Seattle area, with 65 percent of it terminating in Anchorage and 35 percent in Fairbanks. The southbound movement of automobiles is also fully loaded and termiantes in Seattle, with 65 percent

originating in the Anchorage area and 35 percent in the Fairbanks area. The southbound movement is comprised of tourist and "changing-resident" automobiles and used vehicles for sale in the Seattle market.

As stated at the outset, this study was concerned primarily with the cost benefits to common carriers using the unpaved portion of the Alaska Highway. This, by definition, excluded consideration of private carrier traffic on the highway. However, because of the extremely heavy use that is made of the Watson Lake-Whitehorse segment of the highway by one larger private carrier, its operations form an appropriate part of this study.

The major private carrier operates between Cassiar and Whitehorse, which means that it is using 272 miles of the unpaved portion of the Alaska Highway. This carrier uses the highway seven days per week, year-round, and operates 715,000 loaded vehicle miles northbound and 715,000 loaded vehicle miles southbound per year. Asbestos fiber is moved northbound, and, in the southbound direction, this carrier hauls fuel oil and general supplies for the mine at Cassiar.

This private carrier also uses a seven-mile portion of the Alaska Highway immediately north of Whitehorse to haul copper ore from United Keno Hill Mine. In this operation, however, the vehicle miles operated on the Alaska Highway amount to approximately 8,000 northbound and 8,000 southbound per year, or only about 10 percent of the mileage generated by the Cassiar development.

While other U.S. and Canadian private carriers are using the Highway on a year-round basis, their combined mileage is insignificant in comparison with the one large ore carrier and the common carrier operators.

Potential Cost Savings

Potential cost reductions that could be realized by truck operators as a direct result of paving the gravel portion of the Alaska Highway fall into two principal categories, i e., reductions in direct operating expenses and reductions in capital costs. Savings in direct operating costs can be more readily and clearly associated with the paving program than is the case with capital costs. It is readily apparent that there are fewer determining variables to consider in estimating changes in operating expenses, for example, basic route patterns are relatively fixed, as are equipment specifications. On the other hand, capital expenses, primarily those relating to equipment, can vary materially over the long term depending on the operator's traffic expectations, route patterns, and maintenance practices. In addition, it is extremely difficult to associate changes in equipment specifications (and their consequent impact on capital expense) with considerations arising solely as a result of paving. Many other factors govern the selection of equipment, some of which are the distance between service facilities, mountain grades, road curvature, and average length per trip.

In this case, under conditions where the paving program was undertaken simultaneously with grade elimination, curvature reduction, and increase in economical service facilities, reductions in capital expense could be determined reliably. However, it would be highly unrealistic to associate major reductions in capital expense directly with paving of the present Highway.

This section concentrates primarily on an analysis of probable changes in typical direct operating costs as related to the present level of operating expenses and present volumes of traffic. For study purposes, direct operating costs include only those expenses directly related to line-haul operations, that is, they do not include terminal expense, traffic, or general expense. It is readily apparent that line-haul costs are the most sensitive indicator of potential savings from highway paving.

During the field work, all carriers were requested to provide information on their cost experience during 1964 and to estimate those reductions in costs that they would expect to realize from operations over the gravel section of the Highway, assuming it were paved. In other words, they were not asked to estimate average direct expenses for their operations assuming the Alaska Highway were fully paved, but rather were asked to indicate differences in expenses that would arise from operations on paved instead of gravel surface in that area.

In all, 29 carriers supplied the requested data on a partial or complete basis. In a number of cases, the smaller carriers obviously had unusual labor arrangements and would not reveal this information. In other instances, carriers would provide only a total direct cost figure. However, sufficient data was secured to allow the preparation of meaningful estimates of direct per mile operating costs as well as anticipated savings resulting from the paving program. The data constitute a typical cost and would reflect experience of the operator regularly using the Alaska Highway. Cost peculiarities of smaller carriers would not be taken into account.

In preparing these estimates, various tests were made to establish the validity of each component. For each series the mean, mode, median, and weighted average were calculated, and the appropriate cost component selected in the light of the operating characteristics of the principal carriers concerned. In a few instances, obviously unrealistic data were submitted and, in such cases, the material was excluded entirely from the estimates.

Table 32 summarizes the typical direct operating expenses by significant category for Canadian carriers operating in Alaska Highway service.

This average cost is considerably above that for Canadian carriers as a whole, reflecting primarily higher equipment maintenance costs; tires and tubes expense; and, to a lesser extent, drivers' wages and fuel.

Table 32

TYPICAL DIRECT LINE HAUL OPERATING EXPENSES OF CANADIAN MOTOR COMMON CARRIERS OPERATING OVER THE ALASKA HIGHWAY
1964

Expense	Cost per Vehicle Mile (cents)
Drivers wages (including allowances)	14.0¢
Fuel and oil	7.5
Insurance	4.0
Equipment maintenance	9.5
Tires and tubes	6.0
Licenses	2.0
Other	1.5
Total	44.5¢

Similar data for U.S. carriers using the Alaska Highway are shown in Table 33. The data were originally reported in terms of U.S. dollars and in order to make a direct comparison with Canadian experience, the results have been converted to Canadian equivalents.

As can be seen, U.S. operating expenses are substantially above those of Canadian carriers. Notable differences are in drivers' wages, fuel and oil expense, and equipment maintenance. While no detailed analysis of comparative cost levels has been made, it is suggested that the principal reason for the difference is the extremely high price levels that exist in the state of Alaska. In addition, it would take into account the relatively higher level of wages that generally exist in the United States.

During the field work, all carriers interviewed were asked to provide information respecting equipment failures or any special problems that arise during operation over the gravel portion of the Highway. It is significant to note that in only two cases did the carriers indicate that equipment failure during operation over the gravel portion of the highway was sufficiently frequent to affect their dependability of service. This included both short-haul and long-haul carriers. In most cases, however, truck operators stated that equipment failure did occur more frequently during operation over gravel surface. The principal causes of equipment failure and the number of carriers indicating each cause as a significant type of equipment failure are listed on the following page.

Equipment Failure	Number of Responding Carriers
Tire failures (flying rocks, grader blade slivers)	25
Brakes and airlines (dust and flying rocks)	7
Undercarriage gas tank and radiator (flying rocks, dust)	7
Suspension (rough road, dust)	6
Windshields and mirrors (flying rocks)	5
Rear end (rough road, dust)	3
Engine (rough road, dust)	3
Accidents (dust, road condition)	3

Table 33

TYPICAL DIRECT LINE HAUL OPERATING EXPENSES OF U.S. MOTOR COMMON CARRIERS OPERATING OVER THE ALASKA HIGHWAY
1964*

Expense	Cost per Vehicle Mile	
	U.S. Cents	Canadian Cents*
Drivers wages (including allowances)	18.5¢	20.2¢
Fuel and oil	11.5	12.5
Insurance	1.0	1.1
Equipment maintenance	11.5	12.5
Tires and tubes	6.5	7.1
Licenses	3.0	3.3
Other	1.5	1.6
Total	53.5¢	58.3¢

* Costs expressed in terms of Canadian dollar equivalents rounded to the nearest one-tenth cent. Rate of exchange applied at 91.75 U.S. = 100 Canadian.

From the foregoing, it is evident that any anticipated savings from paving of the Highway would be focused on equipment maintenance costs and tires and tubes expense. This is borne out by the responses of the carriers, which are summarized in Tables 34 and 35. As was the case with direct operating costs, estimated U.S. savings have been converted to Canadian dollar equivalents for comparative purposes.

Table 34

ESTIMATED SAVINGS PER VEHICLE MILE IN DIRECT LINE HAUL OPERATING EXPENSE ON GRAVEL SURFACE RESULTING FROM PAVING OF THE ALASKA HIGHWAY (Canadian Carriers)

	Savings per Vehicle Mile
Drivers wages (including allowances)	--
Fuel and oil	0.5¢
Insurance	--
Equipment maintenance	2.0
Tires and tubes	2.1
Licenses	--
Other	--
Direct Savings per Vehicle Mile	4.6¢

Table 35

ESTIMATED SAVINGS PER VEHICLE MILE IN DIRECT LINE HAUL OPERATING EXPENSE ON GRAVEL SURFACE RESULTING FROM PAVING OF THE ALASKA HIGHWAY (U.S. Carriers)

	Savings per Vehicle Mile	
	U.S. Cents	Canadian Cents
Drivers wages (including allowances)	--	--
Fuel and oil	0.5¢	0.6¢
Insurance	--	--
Equipment maintenance	2.5	2.7
Tires and tubes	1.0	1.1
Licenses	--	--
Other	--	--
Direct Savings per Vehicle Mile	4.0¢	4.4¢

In only one case did a carrier indicate that there might be a slight saving in drivers' wages. In all other instances, the indication was that these would stay at the same level. The estimated decrease in fuel and oil expense was listed as a possibility rather than a certainty by the responding carriers. The bulk of the savings estimated by both Canadian and U.S. operators centered around equipment maintenance costs and tire and tube expense.

Because of the almost identical saving expectations by carriers of the two countries, the estimated cost benefits have been based on an average saving of 4.5 cents per vehicle mile and are expressed in Canadian dollars. As indicated in an earlier section, the cost benefits are most appropriately expressed as a function of vehicle miles.

It should be noted that this benefit relates only to common carriers operating more than one heavy duty tractor-trailer unit. It does not include any potential benefits to the very small local trucking concerns operating from Alaska Highway communities such as Whitehorse, Watson Lake, etc.

For the adjusted year 1964, U.S. common carriers operated 3,094,000 miles over the gravel portion of the Alaska Highway, and Canadian carriers operated 6,060,000 miles. As indicated earlier, there was a negligible amount of traffic moved by U.S. carriers to Canadian destinations. However, Canadian carriers operated a total of 722,000 vehicle miles between Canada and Alaskan points.

It has also been pointed out that, while the study centered around operations of motor common carriers, there was an instance of two major traffic movements by private carriers, i.e., the movement of asbestos fiber and supplies between Cassiar, B.C., and Whitehorse, Yukon, and the movement of ore concentrates and supplies between Dawson City and Whitehorse. Allowance should be made for these movements, which totaled 1,446,000 vehicle miles, in estimating cost benefits that might accrue as a result of the paving program.

In a number of cases, major common carriers indicated that because of operation over the Alaska Highway, their original equipment costs were somewhat higher than might otherwise be the case. They estimated that because of heavier undercarriages, more powerful engines, and high-quality tires, original costs for a tractor and trailer unit would be increased by approximately $4,500. However, as noted earlier, it is extremely difficult to conclude that this premium cost can be directly associated with operation over a gravel surface. Most carriers in Alaska Highway service are operating very long-haul routes in an area where servicing facilities are extremely limited. Moreover, in reaching this area, it is necessary to pass through varied terrain that includes highways having heavy grades and many curves. Thus, it could be expected that because of considerations other than paving, truck operators would specify heavy-duty equipment. Therefore, it would appear that while the gravel section may have a major impact on maintenance costs, it alone does not have a major impact

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on capital costs. For purposes of this study, it is concluded that there will be no cost benefit in terms of capital cost arising from paving of the gravel section of the Highway

The potential savings concerning direct operating costs should be considered in conjunction with potential diseconomies that could occur as a result of paving both on a permanent basis and during the construction period. In a number of cases, motor carriers were opposed to the paving program because of concern over possible increases in license fees and road closures and restrictions during spring break-up. All major carriers were categorically opposed to paving if the resulting gross vehicle weight limit would be below 72,000 pounds. The possible objections to the paving program are aptly summed up in the following quotation taken from a letter submitted by one of the major carriers:

> With respect to the whole project of paving the road, we are also going under the assumption that any contemplated improvements would consist of a highway that would be properly engineered, rebuilt and paved to standards of at least a 72,000 pound year-around highway. Anything less than this would substantially increase operating costs. As an estimate, I would think that operating costs would be increased 10-15% on a year-around basis if the unpaved portion of the highway were paved only to standards which would call for 75% restrictions each spring. If greater restrictions were imposed, operating costs would increase proportionately. In fact, if substantial restrictions were imposed in the usual "spring breakup" period, it's entirely possible that the tonnage available during the time of year when the restrictions were not imposed would drop substantially. This is because it has taken years in time and much effort to convince shippers that the highway service is available the year around and if it were unavailable because it was impractical to operate even a few weeks out of the year, it would make our and other people's selling job much, much more difficult.
>
> I would also like to point out that during the years it would take to rebuild and pave the highway, operating costs would be increased substantially, as well as substantial delays being encountered. These factors would tend to reduce the traffic available during the period of construction and would, of course, call for increased sales efforts to regain lost traffic once the road was open on a year-around basis.
>
> One other factor which you might take into consideration is that our figures indicate the gravelled portion of the highway is the nearest to an accident-free area as any which we operate. In fact the gravelled portion has, over the years, produced less than half the accident ratio that similar paved portions of our routes have produced. If by paving the highway it would tend to attract more traffic of any kind, I would expect a substantial increase in both the number and severity of accidents with the resulting costs to every one concerned.

In addition to the savings in operating expense at present volumes of traffic that may be realized from paving the Alaska Highway, there are two other principal potential cost benefits. The first is associated with changes in traffic volumes. As these increase in the future, the lower level of operating expense could conceivably result in substantial future savings to Highway operators. The second major potential benefit is related to mileage reductions (rerouting, etc.) of the Highway, which may occur either as a part of, or separate from, the paving program.

The total savings that could be realized by the commercial truck transportation industry as a direct result of shortening the Highway arise from three major determinants. These are:

1. Avoidable vehicle operating costs per mile.
2. Traffic density in the area receiving the mileage reduction.
3. Total number of miles saved.

Appendix A estimates the segregation of typical line-haul operating costs between those items of expense that will vary with mileage and those that will not. For example, it is estimated that a portion of equipment maintenance expense and tire expense are related more to time than to distance. Similarly, it is considered that license and insurance costs will not vary significantly with a reduction in average miles per trip. For purposes of this analysis, it has therefore been estimated that the avoidable expense (in Canadian funds) associated with mileage on the Alaska Highway is 49.7 cents per vehicle mile for U.S. carriers and 34.5 cents per vehicle mile for Canadian carriers.

Traffic density is a major determinant of total realizable savings. For example, the saving to the trucking industry from a one-mile reduction in the Highway in the St. John area is more than double that that can be realized by shortening of the Highway by one mile near the Alaska border.

It is particularly noteworthy that very substantial net benefits can be realized by shortening the Highway as a part of, or separate from, the paving program. Moreover, to realize such savings, it is not necessary to make major investments in paving surface, nor are they accompanied by major annual Highway maintenance expenditures. It should be further noted that the estimated savings associated with increases in traffic are considered to be highly optimistic.

Outlook for Highway Transportation

On the basis of results of interviews with motor carriers, the outlook for motor transportation on the Alaska Highway cannot be regarded as favorable. Generally, the U.S. carriers were highly pessimistic and were very much concerned about the impact of any disruption of service on their competitive position. In some cases, Canadian carriers were cautiously optimistic, and primarily based on ancitipated increase in traffic around the demand for construction materials and general supplies related to a possible rise in tourism.

U.S. carriers operating from the Pacific Northwest face a distinctly different situation from their Canadian counterparts. Basically, the trucking industry operating from this area to Alaska has built up its business on the competitive advantage provided by its ability to give more frequent service on a more reliable basis than other types of carriers. Historically, the all-highway movement has been priced above water transportation and substantially below air transportation. However, for a number of reasons, the truckers' advantageous competitive position is facing serious erosion, which will continue in the future regardless of the paving program, for the reasons described below.

1. More frequent service is being provided by the water carriers. During the past two years, Sealand Inc., introduced a new container ship service direct from Seattle to Anchorage, which has had a major impact on the operation of other water carriers in the area. At the present time, it operates three ships in high-speed service direct to Anchorage. Sealand can offer the shipper fifth morning delivery, which is fully competitive with the service offered by trucking companies. Other water carriers have largely followed suit.

   Sealand also introduced the use of heavier ships to the Alaska service with the result it has been able to operate with complete reliability direct into Anchorage over the past year and a half. As a result, Sealand's business has increased to the point where it has more than doubled facilities, since its original opening and plans a further substantial increase during 1965.

   The major traditional carrier, Alaska Steamship Company, now operates four ships all of which can handle containers. In addition, Alaska Steamship Company operates the Alaska Train Ship, which carries rail cars from Delta, B.D., to Whittier, Alaska, for subsequent move by rail to Alaska. The Puget Sound Navigation Company operates the Hydro Train, which is a roll-on, roll-off barge operation carrying 32 rail cars. There are also a number of other smaller carriers providing barge service during the summer months.

2. Because of the nature of overhead expense, water carriers have a major incentive to use rates as a means of attracting traffic. By virtue of the rate structure now in effect for shipments between Seattle and Anchorage, shippers have an incentive to hold traffic until they can ship in high volumes. The tabulation on the following page illustrates some typical rate examples that encourage volume shipments. The rates in the tabulation are based on the present Sealand tariffs, but in general they conform with the other major water carriers.

Commodity (pounds)	Water Rate (dollars per hundred pounds)
Fresh meat	
10,000	$6.39
60,000	3.41
100,000	2.93
Canned goods and dry groceries	
10,000	3.22
60,000	2.43
Roofing and siding	
36,000	3.12
100,000	1.77

In addition to the use of incentive rates, the water carriers have turned to the truck operators as a source of traffic and in some cases have arrangements for joint motor carrier-water carrier shipments. At the present time, Sealand provides a joint through service with Lynden Transfer Inc.; Alaska Steamship Company provides a through service with Consolidated Freightways Inc.; and Puget Sound Navigation Company provides a through service with Weaver Brothers. Sealand has been particularly aggressive in this area and will provide all Lynden's customers with a closed van for loading, which is subsequently hauled to the wharf facility by Lynden and delivered in Anchorage or Fairbanks by Lynden's Alaska division.

3. Rates for all highway movement are generally higher than for the comparable water movement. The following comparison of Sealand rates with all highway drivers for movement from Seattle to Anchorage is pertinent:

	Dollars per Hundred Pounds	
	Sealand	All Highway
Meat, 10,000 pounds	$6.39	$8.50
Dairy products, general, 30,000 pounds	5.25	8.25
Butter, 38,000 pounds	5.25	8.00

4. The rates for air cargo are approaching those for all highway movement. The all highway LTL rate is $13.00 per hundred in the northbound direction, dropping to $8.50 per hundred for shipments in excess of 38,000 pounds. In comparison Alaska Airlines has recently introduced a rate of $13.00 per hundred pounds for shipments of 10,000 pounds or over. This airline anticipates a

gradual expansion of its air cargo activities and recently has ordered Lockheed Hercules aircraft. While these will be used within the state of Alaska initially, it is reasonable to conclude that they could lead to an expansion of air cargo service between Seattle and Anchorage.

All of the above factors bring very heavy competitive pressure to bear on the U.S. Pacific Coast motor carrier. On the basis of an average cost per vehicle mile of 54.5 cents and the content load weight characteristics per trip (18.4 tons northbound, 3.3 tons southbound), the average line haul cost per net ton-mile is estimated at approximately 5 cents. Average revenue from present operations is estimated at 6.5 cents per net ton-mile, which, when considering terminal and overhead costs, leaves virtually no room for rate reductions for all-highway movement between Seattle and Alaska. The potential savings from paving would represent a cost reduction of less than 5 percent for the entire trip. As a result it is likely that, despite paving of the Highway, truck transportation from the Pacific Northwest to Alaska will decrease.

As noted earlier, the outlook for American carriers is substantially different from that of their Canadian counterparts. From cost and load characteristics, it is apparent that the present operations of Canadian carriers are substantially more profitable. Moreover, the possibility of major competition from some other form of carrier is considered to be remote. As a result the Canadian carriers have little incentive to reduce rates, and it is not likely that a major portion of any benefits from paving the Highway would lead to a reduction in rates. Moreover, it is unlikely that a reduction in rates would be sufficient incentive to generate any significant amount of additional traffic.

Analysis of Total Traffic on the Alaska Highway

Passenger traffic on the Alaska Highway is mainly passenger car traffic, with buses carrying less than 5 percent of the total number of passengers leaving Alaska and entering Yukon Territory.

Table 36, which is based on official Canadian statistics, shows the growth of passenger traffic at the Alaska border. It is apparent from the data that significant growth rates of through passenger traffic, of the order of 10 percent per year, have occurred on the highway in spite of considerable year-to-year variation in traffic volume and the unpaved condition of the Highway.

The seasonality of highway passenger traffic to and from Alaska is shown in Table 37. Almost 68 percent of total passenger travel to and from Alaska on the Alaska Highway occurs during the summer, and as the tourist traffic has grown, so has the seasonality of traffic on the Highway. Since 1958, the percentage of summer travelers has increased from 58 percent to the 68 percent referred to above.

Table 36

PASSENGER TRAVEL ON THE ALASKA HIGHWAY ENTERING CANADA THROUGH THE YUKON*†
1952-1963

	Number of Automobiles				Number of Bus Passengers	
	Canadian‡		U.S.‡			
	Local	Nonlocal	Local	Nonlocal	Canadian	U.S.
1952	212	167	2,263	7,253	110	495
1953	405	212	1,520	8,255	120	272
1954	1,332	200	1,536	8,017	35	57
1955	1,069	381	626	7,756	56	246
1956	1,495	387	995	9,191	126	432
1957	2,445	609	847	10,424	n.a.	n.a.
1958	1,385	386	337	9,476	23	915
1959	1,271	475	402	n.a.	n.a.	1,368
1960	437	607	225	13,507	156	1,624
1961	535	678	297	14,481	213	2,237
1962	2,374	952	1,049	17,623	143	2,238
1963	1,481	1,132	1,752	20,252	195	2,805
Growth rate						
1952-63		19.0%		9.8%	5.4%	17.1%
1960-63		23.1		14.5	7.7	20.0

* This traffic is practically all to and from Alaska.

† These counts coincide with our figures of highway passengers outbound from Alaska. For example, take the 1963 figures on highway passengers outbound from Alaska, which amount to 77,000, divide them by the average party size, 3.2 persons, the result is 24,062 passenger car vehicles, which corresponds quite closely to the total number of autos entering Yukon from Alaska given above.

‡ Local traffic includes traffic with a length of stay of 24 hours or less, while nonlocal includes traffic with lengths of stay of over 24 hours.

Source: Dominion Bureau of Statistics, Travel between Canada and Other Countries, 1959, 1960, 1961, 1962, and 1963 issues.

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Table 37

PASSENGER TRAFFIC INBOUND AND OUTBOUND FROM ALASKA BY THE ALASKA HIGHWAY, BY MONTH OF TRAVEL 1958-1960

	Number of Passengers								
	1958*			1959†			1960†		
	Inbound	Outbound	Total	Inbound	Outbound	Total	Inbound	Outbound	Total
January	1,250	1,091	2,341	1,361	841	2,202	1,198	797	1,995
February	1,128	1,014	2,142	2,025	1,509	3,534	1,284	645	1,929
March	1,690	985	2,675	3,104	1,884	4,988	2,066	1,037	3,103
April	2,456	1,166	3,622	3,510	1,742	5,258	2,783	1,082	3,865
May	2,589	2,723	5,312	4,320	4,316	8,636	3,734	2,805	6,539
June	5,158	4,149	9,307	8,898	5,222	14,120	8,788	5,800	14,588
July	6,616	5,843	12,459	10,042	9,016	19,058	12,101	10,736	22,837
August	6,899	6,449	13,348	6,644	8,447	15,091	8,031	8,957	16,988
September	3,199	4,121	7,320	3,297	2,960	6,257	3,150	4,331	7,481
October	1,809	3,167	4,976	1,128	2,121	3,249	1,702	2,906	4,608
November	1,425	1,917	3,342	909	1,511	2,420	1,183	1,839	3,022
December	945	1,527	2,472	590	1,418	2,008	953	2,242	3,195
Total	35,164	34,152	69,316	45,828	40,993	86,821	46,973	43,177	90,150
Summer travel as a percent of total passenger travel (May-August)			58.3%			65.5%			67.6%

* Source: Alaska Department of Natural Resources, Alaska Passenger Traffic Survey, 1958, Juneau, August 1959.

† Sources: Alaska Department of Commerce, Alaska Passenger Traffic Survey, 1959, and 1960, Juneau, 1960 and 1961.

The daily and weekly traffic counts on different sections of the Highway, which are shown in Tables 38 and 39, were provided by the Federal Department of Public Works in Ottawa. These figures are based on counts taken during one day of the year, with the date selected varying all through the time series. While these data may be deficient as true samples, they give a rough indication of the extent of local traffic on the highway and the comparative growth rates of local and nonlocal passenger traffic.

These figures show importance of local traffic on the Highway. The places where passenger traffic is heaviest, such as from the beginning of the Highway up to Fort Nelson and in the vicinity of Whitehorse from Carcross Road to Mile 925, coincide with the sections of the Highway where local traffic predominates. For example, 53 percent of the passenger traffic from the beginning of the Highway to Fort Nelson is made up of local traffic on the Highway. The proportion of local traffic jumps to 64 percent from Carcross Road to Whitehorse and to 86 percent from Whitehorse to Mile 925.

Although the data are far from complete they do provide information on relative traffic growth along the Highway and therefore are of help in projecting passenger traffic for 1975 and 1985.

The overall composition of the average daily traffic on the Alaska Highway is shown in Table 40. In this table, the data on through traffic by tourists and Alaskan residents were taken from the Traveler Profiles of 1964 and the Dominion Bureau of Statistics Travel between Canada and the United States. For each section of the Highway, the differences between this through traffic and the daily passenger car traffic counts on the Highway were imputed to be made up of local Canadian traffic. In this way, the average daily passenger car traffic used in the projections was matched with the actual traffic counts on the road.

A similar approach was taken to balance the traffic counts of commercial vehicles with the established estimates of through commercial traffic by imputing the differences between them to be local truck traffic. The notes to Table 40 describe the adjustments made to account for local truck traffic.

It is noteworthy that except for the sections around Whitehorse and between Fort Nelson and the beginning of the Highway, through traffic from Alaska to the United States accounts for 60 percent of the daily traffic counts of passenger cars.

Table 40 shows the great importance of local truck traffic on the Highway. On only two segments of the road--the sections from Fort Nelson to Watson Lake and from Mile 1016 to the Alaskan border--does the through truck traffic exceed the local traffic. These sections are also the ones that have experienced comparatively slower rates of traffic growth.

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Table 38

DAILY TRAFFIC COUNTS ON THE ALASKA HIGHWAY
(Includes both Passenger Car and Commercial Vehicles)
May-October 1957-1964

	1957	1960	1961	1962	1964	Traffic Growth Period	Traffic Growth Rate
Mile 163--Beginning of Alaska Highway	n.a.	n.a.	353	375	470	1961-64	10 %
Mile 278--Before Fort Nelson	n.a.	260	164	359	250	1960-62	17
Mile 325--After Fort Nelson and before Watson Lake	n.a.	218	83	225	250	1962-64	5.4
						1960-64	3.5
Mile 733--Outside Watson Lake	253	n.a.	n.a.	243	250		None
Mile 897--Before Carcross Rd.	n.a.	476	302	345	322	1961-62	14.2
						1961-64	2.2
Mile 915--Before Whitehorse	n.a.	852	794	680	775		None
Mile 919--After Whitehorse	n.a.	n.a.	1,643	1,454	1,733	1962-64	9.2
						1961-64	2.0
Mile 946--Before Haines Road	n.a.	403	259	387	232		None
Mile 1202--At end of Alaska Highway	134	n.a.	129	134	166	1961-64	8.8
						1957-64	3.8

Source: Department of Public Works, Canada.

Table 39

AVERAGE WEEKLY TRAFFIC COUNTS ON THE ALASKA HIGHWAY
(Includes both Passenger Cars and Commercial Vehicles)
1959-1962

	1959	1962	Traffic Growth Rate 1959-62
Mile 163--Beginning of Alaska Highway	1,650	2,600	16.4%
Mile 278--Before Fort Nelson	1,600	2,500	16.4
Mile 324--After Fort Nelson	1,550	1,600	1.1
Mile 733--After Watson Lake	1,450	1,700	5.5
Mile 897--Before Carcross Rd.	1,700	2,400	12.2
Mile 915--Before Whitehorse	4,200	4,700	3.8
Mile 919--After Whitehorse	3,300	10,150	45.5
Mile 946--Before Haines Junction	1,800	2,700	14.5
Mile 1202--At end of Alaska Highway	950	1,000	2.0

Source: Department of Public Works, Canada, November 17, 1964.

Table 40

AVERAGE DAILY PASSENGER CAR AND TRUCK TRAFFIC
ON THE ALASKA HIGHWAY
1964

	Mile 163/ Fort Nelson	Fort Nelson/ Watson Lake	Watson Lake/ Carcross Rd.	Carcross Rd./ Whitehorse	Whitehorse/ Mile 925	Mile 925/ Haines Jct.	Haines Jct./ Alaska Border
Passenger car traffic							
U.S.-Alaska tourist traffic							
Via Midwest Gateway	33	33	33	33	33	33	33
Via Pacific Gateway	18	18	18	18	18	18	18
U.S.-Alaska traffic by Alaska residents	81	81	81	81	81	81	81
Canada-Alaska tourist traffic	14	14	14	14	18	18	18
Local traffic							
Dawson Creek-Fort Nelson	114						
Dawson Creek-Whitehorse	52	52	52	52			
Watson Lake-Whitehorse			17	17			
Carcross Rd.-Whitehorse				190			
Whitehorse-Mile 925					940		
Subtotal	312	198	215	405	1,090	150	150
Truck traffic							
U.S.-Alaska	21	21	21	21	21	21	24
Through Canadian	38	26	17	17	4	4	4
Local Canadian	102	23	92	410	590	58	4
Subtotal	161	70	130	448	615	83	32
Total	473	268	345	853	1,705	233	182

Note: The through truck traffic data were taken from the investigation of traffic on the Alaska Highway performed in "Analysis of Present Alaska Highway Traffic." The discrepancy between this count and the daily truck traffic data furnished by the Canadian Department of Public Works was assumed to correspond to local highway traffic. Therefore, the following adjustments for local annual traffic were made: (1) increase by 4,000 the number of trucks traveling between Fort St. John and Fort Nelson, (2) increase by 4,000 the traffic between Dawson Creek and Fort Nelson, (3) add 600 to traffic between Fort Nelson and Watson Lake, (4) add 7,200 to the traffic between Whitehorse and Watson Lake, (5) increase by 50,800 the number of trucks on the Carcross Rd.-Whitehorse section, (6) increase by 85,000 the traffic between Whitehorse and Mile 925, (7) add 9,000 to the traffic from Haines Jct. to Whitehorse, (8) increase by 400 the traffic from the Panhandle to Tok Jct., (9) increase by 72 the the local Canada-Alaska border traffic.

Sources: Dominion Bureau of Statistics, Travel between Canada and Other Countries, 1964, monthly issues from January to December 1964. Letter from Canadian Department of Public Works, dated Nov. 17, 1964. Charles E. Hinkson, Traveler Profiles: A Study of Summer Travel to Alaska during 1963 and 1964, Department of Economic Development and Planning, Juneau, December 1964.

Future Transportation Requirements of the North-Northwest Area

It is impossible to project or to forecast the precise pattern of economic development that is likely to occur during the next 20 years or so in the area served by the Alaska Highway. This inability does not mean that nothing can be said about the transportation requirements necessitated by a given pattern of growth. Transportation requirements are generally known because they arise largely from the nature of the industries that are potentially involved in the economic development process. For instance, pulp mills or iron ore mines--no matter where they are located--tend to have certain transportation requirements that are implicit in the nature of the economic opportunities involved. The precise location of these activities simply determines the focal point of the requirements and it does not give the essential characteristics.

Transportation facilities are not only provided for by existing industries or operations that are about to be begun, they are often considered stimuli for further economic development and growth. This stimulating function is not equally applicable to all industries, particularly those that may contribute to the further development of the area.

Since the projections made earlier indicate that the future economic structure of the area served by the Alaska Highway is assumed to be "mixed," it is worthwhile to examine the transportation requirements that would be implicit in their industrial economic development of certain industries. In view of their associated transport requirements, the three most significant industries are mining, oil and gas production and associated refining industries, and tourism. These three industries have considerable requirements for overland transportation facilities. Although the future economic growth of the area probably will involve further development of fisheries and forest products, these two industries actually have few special overland transportation requirements.

Transport Requirements for Mineral Development

Mining development in Northern Canada and Alaska is characterized by high transportation costs, particularly for overland transportation. This high cost is a significant deterrent to mining development in the area, and it affects not only the production costs but exploration costs as well, by increasing the outlays needed to maintain the work crews in the field. The total effect is that mineral finds in Northern Canada and Alaska must have some advantage over finds in other areas of the world, such as ore richness or low direct mining costs, to overcome transportation cost disadvantages.

For this reason, a definite transportation pattern has developed in the mining industry of the area. For minerals with a high specific value, such as gold, uranium concentrate, etc., the preferred method of shipping is by air. At the other extreme, mining operations involving low-value materials, such as iron ore, utilize water or rail transportation when it

is available. Although truck transportation does play a limited role in moving mineral ores and concentrates in Northern Canada, these movements generally involve short distances and the materials are of medium to high value per ton.

The specific transportation requirements of a mining operation can only be met after the ore body has been discovered and a decision as to its development has been made. For this reason, transportation facilities cannot be provided in advance of mining development, except in a very general sense. Even mineral exploration is no longer greatly dependent on overland transportation, because in recent years, the airplane has become the primary means for geophysical and geological explorations.

The inability to provide transportation facilities in advance of needs does not mean that the provision of transport facilities may not be used as an important stimulant for mining development. On the contrary, the heavy impact of transportation on total mining costs indicates that government assistance is often necessary in this field. However, an effective policy of support in this area would tend to concentrate on the provision of transport facilities after a find has been made rather than beforehand. A primary example of such a policy would by the Great Slave Lake Railway now under construction in Northern Canada which is being built to permit the development of Pine Point lead-zinc deposits.

Given the requirements for transportation facilities incidental to mining developments, the following conclusions on the importance of the Alaska Highway and any improvements to it in regard to future mining developments can be made:

1. From the point of view of promoting and stimulating planning development, the Alaska Highway either as it exists today or any improvements to it would only be of minimal significance, mainly because exploration activities are currently conducted by aircraft, and the problem of accessibility is no longer a significant handicap.

2. Truck transportation will continue to play only a minor role in mineral development, mainly because of its relatively high cost as compared with shipping by water and rail. Furthermore, for cases in which truck transportation is used to move ores or concentrate, it is always the intent to minimize the haul and to find an outlet to the sea as soon as possible. In this respect, the directional flow of the Alaska Highway--roughly paralleling the coastline--is not suitable for extensive use by future mining developments.

Transport Requirements for Oil and Gas Development

Prospects for continued and rapid growth of the oil and gas industry and associated facilities for the entire area are fairly good. Alaska's more recent oil and gas strikes indicate large increases in reserves, and heavy development continues in Northern British Columbia and Alberta where there is significant production of both oil and gas. Overland transportation of oil and gas is handled primarily by pipeline. Northern Alberta and Northern B.C. are already covered by an extensive field-gathering system that is extended into new adjacent areas whenever significant new strikes are made. As yet there are only a few pipelines in Alaska however, with further finds and development of outlets, additional pipelines will undoubtedly be constructed. Overland transportation facilities also are required for the movement of production equipment, drilling tools, etc., and existing highways are used for the movement of this equipment. Since drilling sites are dictated not by accessibility, but by geological or geophysical data indicating the likelihood of success at certain spots, the accessibility of an area made possible by highway is unlikely to promote a more rapid pace of development in oil and gas exploration.

In many other respects, the transportation requirements for oil and gas development are very similar to those for mining development. As in mining development, geological and geophysical exploration is carried out largely by air or supplied by aircraft. As in mining development, the construction of major transportation facilities, such as pipelines must await the discovery and development of finds.

Again, it can be concluded that the role of the Highway or of any improvements to it will only be a marginal one as far as development of the oil and gas industry in the area is concerned. The use of the improved highway will undoubtedly affect the transportation costs of material incidental to oil and gas development shipped over it. This saving will be summarized later for all types of vehicles. However, the Highway as it exists today or any improvements to it are not likely to have a stimulating or accelerating effect on the oil and gas industry.

Transportation Requirements for Tourism Development

Requirements for transportation facilities to support tourism are quite different from those needed for mining or petroleum development. These differences pertain both to the nature of facilities and to the timing of their construction.

Transportation facilities make an area accessible to tourists. A far greater diversity of transportation facilities for tourists is desirable than would be the case for transportation facilities to support mining development. Transportation costs and efficiency are important in passenger transportation, but since individual choices of transportation mode often involve nonmonetary values, there is no need to restrict transportation facilities to the most efficient means. Variety of available transportation means may indeed be an asset in developing a tourist industry.

Also, the basic role of transportation facilities in tourism--to provide access to the areas to be visited--generally requires that the provision of transportation facilities must lead the generation of traffic by a considerable amount of time. This lead time is important because additional and improved transport facilities are expected not only to accommodate tourist traffic, but to stimulate it as well.

Thus, the paving of the Alaska Highway can be expected not only to improve service for the normal number of travelers, it can also be expected to stimulate tourist traffic and to accelerate its growth rate.

Despite the fact that the paving of the Alaska Highway would greatly enhance the tourism potential of the area and stimulate travel, it must not be assumed that automobile travel will therefore become the predominant choice of tourists who travel from the continental United States. Two factors that argue against this assumption are:

1. There is general agreement among observers that air travel will continue to enlarge its share of intercity passenger transportation in North America, and this relative growth will be greatest for trips of 400 miles or more. The basic reason for this projected growth is that jet aircraft can be expected to reach their full potential within the next ten years, not only with respect to speed but to cost. Air fares may be of particular significance because there are definite indications that these fares may be reduced within the next five to ten years and the participation in air travel may be greatly broadened. These developments can be forecast with a fair degree of certainty because construction of jet planes with a passenger capacity of 250 or more is well advanced, and even larger planes are in the design phase. Given this background of technological advances toward less expensive and faster aircraft, and the concurrent development of lower fares, it must be assumed that within the next 20 years, air passenger transportation will play a proportionately larger role in passenger travel between the continental United States and Alaska.

2. The second factor that would argue against the assumption that automobile travel would be the primary means of traveling to Alaska is related to the promotional program that must be initiated in support of this travel. It is unlikely that tourism would grow very rapidly without a considerable promotional effort. One objective of such a campaign would be to increase both the number of tourists coming to the area as well as length of their stay. Both of these objectives can be served far more successfully by promoting air travel, and this promotion would enlarge the potential market of visitors by making feasible trips of a week's duration or even less. One major handicap of air travel in support of tourism--the "immobilization" of the traveler at the destination--is being overcome by increasing tie-in between airlines and automobile rental agencies.

The above analysis should not be construed as a direct forecast that there will be very few automobile travelers to Alaska and the Yukon Territory by 1985. By a wide margin, automobile travel is at present the primary means of intercity passenger travel on the North American continent, and will probably continue in that role until 1985. The point of the above paragraphs is rather to indicate that growth of passenger automobile travel on the Alaska Highway will have to occur in the face of heavy promotional efforts advocating very efficient competing means of transportation, and a handicap of this magnitude should not be underestimated.

It is apparent from the foregoing that the projected improvement program of the Alaska Highway will have a growth-stimulating effect only in one important area of future industrial growth, namely tourism. In other areas of potential economic development, the improvement is not likely to have a growth-stimulating effect, but it will have cost saving effects to the extent that the various sectors use truck transportation over the Alaska Highway.

Transportation Requirements for Local Supply Traffic

In addition to transportation requirements associated with specific sectors of potential economic development, there exist current and future requirements for transportation facilities to supply the area with general commodities. The significance of these requirements are emphasized by the fact that a majority of the loaded trucks going north on the Highway are for destinations short of Alaska.

One of the basic findings of this investigation is that, while the original purpose of the Highway was primarily to establish an overland route between the continental United States and Alaska, its present purpose is definitely a dual one: (1) to link the continental United States with Alaska and (2) to make the communities at or near the Highway accessible to automobile and truck traffic.

This local supply role of the Alaska Highway may appear obvious and of no great consequence in arriving at a decision concerning the proposed improvement program, but there is one point that must be emphasized strongly. The local supply function of the present highway severly limits the alternatives available for improving the present Highway, particularly with respect to relocating the Highway.

It is far simpler to build highways than to abandon them. One of the alternative improvement programs proposed (Alternate E) envisages the construction of new paved highway from Hazelton, B.C., to Jake's Corner on the Alaska Highway (Mile 872). This relocation would undoubtedly shorten the distance between the continental United States and Alaska and perhaps even provide for a more scenic highway over this stretch, but we seriously doubt that this is an actual alternative to improving the Alaska Highway. It is our belief that if such a decision were made, the

present Alaska Highway from Mile 0 to Mile 872 would still have to be maintained in fairly good condition. In view of this, Alternative E should in reality be viewed as a proposal to build a new road from Hazelton to Mile 872 on the Alaska Highway and not as an alternative to improving the present highway.

VI ECONOMIC EFFECTS OF THE ALASKA HIGHWAY IMPROVEMENT PROGRAM

Definition of Alaska Highway Improvement Program

The Department of Public Works, Federal Government of Canada, is responsible for the development of an improvement program for the Alaska Highway. In line with this responsibility, the Department of Public Works undertook an engineering study concerning this matter. Although the entire study is not as yet complete, the Institute was furnished with a summary of this report which is quoted in full.

3.1 GENERAL

This summary is a brief review of the main report which deals with:

Traffic and Design Standards

Rating of Geometric Elements and Comparison of Routes

Geology, Soils, and Materials

Flexible Pavement Design

Structures

Program of Construction and Estimated Costs

In the report 5 alternates of a land route to Alaska are considered. The distance from Dawson Creek (Mile O) and the Alaska Boundary along the existing road is 1,221 miles. Mile O to Mile 84 has been reconstructed and paved.

Alternatives 'A', 'B' and 'C' follow the same general route as the existing highway. The estimated costs of reconstruction and maintenance contained in the report for alternatives 'A', 'B' and 'C' refer to the section of highway from Mile 84 to the Alaska Boundary. For comparative purposes, alternative 'E' involves the estimated costs of maintenance and construction of an alternate route from Hazelton, British Columbia to Mile 866 on the Alaska Highway and thence along the existing route to the boundary. This route has been included because of the possibility of the Liard River Power Development.

3.2 HIGHWAY DESIGN

The existing highway is not conducive to traffic because of its tortuous alignment and gravel surface which reduces through traffic to a minimum. It may be deduced from the traffic records that the number of American cars using the highway drops off rapidly as they proceed northward beyond the end of pavement. The study has shown that design standards should be those for a Rural Arterial Undivided Highway (C.G.R.A. - R.A.U.60, less than 3,000 vehicles per day). While traffic projections over most of the route show volumes much lower than 3,000 v.p.d., it was agreed, in discussions with officials from the United States, that the arterial nature of the route and potential road user benefits warrants this classification. This standard provides a 24-foot travel surface with 7-foot shoulders and has been used in developing the cost estimates.

3.3 ALTERNATE CONSIDERATIONS FOR A LAND ROUTE TO ALASKA

ALTERNATIVE 'A' - MAINTENANCE OF EXISTING HIGHWAY

The distance involved in this route is 1,137 miles.

If the existing highway is maintained as a gravel road to its present standard, it will be necessary to replace and upgrade inferior bridges at an estimated cost of $12,382,000.

As the traffic increases, the cost of maintenance will increase and it will be necessary to apply some type of dust layer to accommodate the traveling public.

The cost of maintenance and bridge reconstruction for a 20-year period is estimated to be $143,137,000. The table at the end of this section gives the estimated annual cost for a 20-year period.

ALTERNATIVE 'B' - RECONSTRUCTION AND PAVING OF EXISTING ROUTE WITH MINOR DIVERSIONS

The distance involved in this route is 1,127 miles.

This alternative would follow the existing highway with a great many minor revisions in the alignment, up-grading or replacement of inferior bridges and grade reductions to attain the R.A.U. 60 Standard. This alternative has the advantage that it would not disrupt roadside garages and tourist establishments along the existing route nor would it interefer with the servicing of three micro-wave stations which are located on sections of the highway which will be abandoned if alternative 'C' is adopted. By virtue of the minor alignment

revisions, the length of the highway would be reduced by approximately 10 miles.

The disadvantages are the cost of construction and maintenance and the additional length of highway compared to route 'C'. It is also doubtful if some of the sliding silt areas and the section of highway with numerous gravel fans could be completely controlled. The estimated cost of reconstruction is $174,493,000 and the cost of maintenance for 20 years is estimated to be $67,719,000 or a total of $242,212,000. See table at end of summary.

By far, the most heavily traveled section of the highway is in the vicinity of the city of Whitehorse. This is followed by the section from Dawson Creek to Fort Nelson (Mile 300). The Pacific Great Eastern Railway plans to extend the rail to Fort Nelson by 1970 to service proposed pulp and other forest industries. This, in conjunction with the present oil exploration, will, undoubtedly, cause a further upsurge of traffic from Dawson Creek to Fort Nelson. Should alternative 'B' be adopted, it would be accessible to construction at any point and with the exception of the Whitehorse area, the construction program could logically continue north from the end of pavement

ALTERNATIVE 'C' - RECONSTRUCTION AND PAVING OF EXISTING ROUTE WITH MAJOR DIVERSIONS

The distance involved in this route is 1,037 miles.

Should this alternative be adopted, approximately 24 business establishments and access to 3 micro-wave stations will be affected. The Canadian National Telegraph is also serviced from the existing road. It will, therefore, be necessary to give consideration to the relocation of these establishments and facilities or maintaining the existing gravel road.

The revisions shown on Figure 5-6 are not only feasible but economical from construction and maintenance considerations and the highway length would be reduced by approximately 100 miles.

The estimated cost of construction for this route is $167,651,000 and the cost of maintenance for a 20-year period is $64,231,000 for a total cost of $231,882,000. See table at end of summary.

Access for construction would only be available at either end of the long revisions and it would be necessary to revise the construction schedule as shown on Figure 9-1 so that highway construction could be completed in a 10-year period. Costs

of relocation of existing facilities or maintenance of the gravel sections to service these facilities are not included in the estimates.

ALTERNATIVE 'D' - LIARD RIVER HYDRO POWER DEVELOPMENT

Should the Province of British Columbia proceed with the Liard River Development, it will affect the location of the highway from Mile 315 to Mile 680. The proposed highway crossing of the Liard River would probably have to be made in conjunction with the construction of one of the proposed dams and the highway must be located at higher elevations to avoid areas which will be flooded by reservoirs. Engineering studies must be carried out in liaison with the British Columbia agency responsible for the development. Cursory examination indicates the costs of highway relocation may be excessive and an alternative through land route to Alaska may be advisable.

It is impossible at this time to choose the most feasible route to accommodate this development or estimate the cost of construction in this area. Construction scheduling for the time being should be confined to the remainder of the highway as shown in Figure 9-1. It will be noted that the section from Mile 680 to Mile 866 has been reserved for the end of this program in case an alternate route is chosen because of these new developments.

ALTERNATIVE 'E' - WESTERN ROUTE FROM HAZELTON, B.C.

One of the alternative through routes indicated in the Battelle Report is referred to in Section 5.5 of this report. This route leaves the northern Trans-Provincial route at Hazelton, B.C. and proceeds in a northerly direction to join the existing highway at Mile 866 as indicated on Figure 5-8. Should alternative 'E' be adopted, it is estimated that the average distance travelled to reach the Alaska Border would be reduced by 188 miles. The length of highway required to be reconstructed to connect Hazelton on the northern Trans-Provincial Highway to the Alaska Boundary would be 897 miles.

The estimates contained in the Battelle Report indicate that the cost of construction including paving on this route would be approximately 80% of the cost of reconstruction along the existing route and although no detailed examination of the route has been made by this department, a preliminary examination would support this estimate. Applying this percentage to our estimated costs of reconstruction and paving along the existing route, the cost of constructing alternative 'E' would be $139,595,000 and the cost of maintenance for 20 years would be

$77,879,000 for a total cost of $217,474,000. This maintenance cost does not take into consideration any maintenance of the existing highway from Mile 84 to Mile 1,221 after the new route is constructed.

3.4 CONSTRUCTION SCHEDULES

The construction schedules in this report cover a 10-year period with one additional year to complete the pavement. This, in effect, requires that ten grading contracts and five paving contracts be active for most of the period with an average annual expenditure of $17,500,000. The length of the construction period and the sequence of construction may be readily revised to accommodate other considerations.

3.5 COMPARISON OF ALTERNATIVES

ALTERNATIVE 'A' - COST OF MAINTAINING GRAVEL ROAD WITH NECESSARY UPGRADING OF BRIDGES

	20 YEARS	40 YEARS
Maintenance	$130,755,000	$283,113,000
Construction	12,382,000	12,382,000
T o t a l ...	$143,137,000	$295,495,000

ALTERNATIVE 'B' - RECONSTRUCTION WITH MINOR DIVERSIONS DISREGARDING LIARD DEVELOPMENT

	20 YEARS	40 YEARS
Maintenance	$ 67,719,000	$124,069,000
Construction	174,493,000	174,493,000
T o t a l ...	$242,212,000	$298,562,000

ALTERNATIVE 'C' - RECONSTRUCTION WITH MAJOR DIVERSIONS DISREGARDING LIARD DEVELOPMENT

	20 YEARS	40 YEARS
Maintenance	$ 64,231,000	$116,081,000
Construction	167,651,000	167,651,000
T o t a l ...	$231,882,000	$283,732,000

ALTERNATIVE 'D' - LIARD RIVER POWER DEVELOPMENT

It is not possible to develop cost estimates for Alternative 'D' at the present time.

ALTERNATIVE 'E' - WESTERN ROUTE - DISREGARDING MAINTENANCE OF EXISTING HIGHWAY AFTER NEW ROUTE IS COMPLETED

	20 YEARS	40 YEARS
Maintenance	$ 77,879,000	$122,729,000
Construction	139,595,000	139,595,000
T o t a l ...	$217,474,000	$262,324,000

Following the receipt of this report, the summary of comparative costs given in Table 41 was changed to include repair costs for alternatives B, C, and E for years 21-40. These additions, which amounted to $27,480,000, $24,888,000, and $21,528,000, respectively, represent the estimated cost of repairing the Highway after twenty years, should an initial decision be made to pave the Highway.

The summary includes, quite correctly, estimates of capital and maintenance costs for all of the alternatives discussed. They are stated in actual terms, without discounting to present values, which will be done later. However, attention is called to the considerable difference in the level of estimated maintenance costs between paved and unpaved highways. Any failure to achieve the projected savings for maintenance of the paved highway, as against the cost of upkeep for the present gravel highway, would tend to increase the overall cost estimates for the three alternative highway improvement programs.

The first two alternatives for improving the Highway involve varying reductions of total mileage on the Highway, and therefore the choice of one of the alternatives will, to some extent, affect the amount of projected user savings. In general, the greater the mileage reduction achieved, the greater the user savings. The exact amount of savings calculated under these alternatives is shown later.

With respect to Alternative E--the construction of a new highway from Hazelton on the Transprovincial Highway in British Columbia to mile 866 on the Alaska Highway--the potential benefits cannot be estimated at the present time. The summary cost information cited above only includes the cost of constructing a new highway from Hazelton to mile 866 on the Alaska Highway, and for paving and improving the Highway beyond that point to the Alaska border. It contains no estimate of the cost of improving or maintaining the existing Alaska Highway up to mile 866, which would be necessary to provide service to existing communities there. Thus, Alternative E really involves the construction of a new road and is not an alternative to improving the Alaska Highway.

Determination of Cost Saving Effects

Unit Cost Savings

Truck Transportation

As was established in Chapter V, the relevant cost savings attributable to the paving of the Highway will be related to line haul expenses, and within such expenses, the principal savings will be in equipment maintenance and expenditure for tires and tubes. It was found, based upon interviews and written questionnaires, that the estimated saving per vehicle mile will be approximately 4.5 cents, or about 10 percent of the direct operating costs for such trucks. U.S. owned trucks were found to have slightly higher operating costs than Canadian trucks, primarily due to

Table 41

SUMMARY OF COMPARATIVE COSTS FOR ALASKA HIGHWAY IMPROVEMENT
ALTERNATIVES A, B, C, AND E

	A Existing Gravel Road 1,137 Miles			B Reconstruction with Minor Diversions 1,127 Miles			C Reconstruction with Major Diversions 1,037 Miles			E Western Route from Hazleton B.C. 897 Miles		
Year	Maintenance	Construction	Total	Maintenance	Construction	Total	Maintenance	Construction	Total	Maintenance	Construction	Total
1	$ 5,457,600	$ 1,500,000	$ 6,957,600	$ 5,091,300	$ 8,937,000	$ 14,028,300	$ 5,068,800	$ 8,252,400	$ 13,321,200	$ 5,457,600	$ 7,149,600	$ 12,607,200
2	5,571,300	1,500,000	7,071,300	4,838,600	15,350,000	20,188,600	4,793,600	14,665,400	19,459,000	5,571,300	12,280,000	17,851,300
3	5,685,000	1,500,000	7,185,000	4,586,000	22,223,000	26,809,000	4,518,500	21,538,400	26,056,900	5,685,000	17,778,400	23,463,400
4	5,798,700	1,500,000	7,298,700	4,333,300	21,789,000	26,122,300	4,243,300	21,104,400	25,347,700	5,798,700	17,431,200	23,229,900
5	5,912,400	1,500,000	7,412,400	4,080,700	18,947,000	23,027,700	3,968,200	18,262,400	22,230,600	5,912,400	15,157,600	21,070,000
6	6,026,100	1,500,000	7,526,100	3,828,100	20,003,000	23,831,100	3,693,100	19,312,400	23,011,500	6,026,100	16,002,400	22,028,500
7	6,139,800	1,500,000	7,639,800	3,575,400	19,985,000	23,560,400	3,417,900	19,300,400	22,718,300	6,139,800	15,988,000	22,127,800
8	6,253,500	1,500,000	7,753,500	3,322,800	20,378,000	23,700,800	3,142,800	19,693,400	22,836,200	6,253,500	16,302,400	22,555,900
9	6,367,200	382,000	6,749,200	3,070,100	16,542,000	19,612,000	2,867,600	15,857,400	18,725,000	6,367,200	13,233,600	19,600,800
10	6,480,900		6,480,900	2,817,500	8,437,000	11,254,500	2,592,500	7,756,400	10,348,900	2,242,500	6,749,800	8,992,300
11	6,594,600		6,594,600	2,817,500	1,902,000	4,719,500	2,592,500	1,902,000	4,494,500	2,242,500	1,521,600	3,764,100
12	6,708,300		6,708,300	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
13	6,822,000		6,822,000	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
14	6,935,700		6,935,700	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
15	7,049,400		7,049,400	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
16	7,163,100		7,163,100	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
17	7,276,800		7,276,800	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
18	7,390,500		7,390,500	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
19	7,504,200		7,504,200	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
20	7,617,900		7,617,900	2,817,500		2,817,500	2,592,500		2,592,500	2,242,500		2,242,500
1-20	130,755,000	12,382,000	143,137,000	67,718,800	174,493,000	242,211,800	64,231,300	167,651,000	231,882,300	77,879,100	139,594,600	217,473,700
21-40	152,358,000		152,358,000	56,350,000	27,480,000	83,830,000	51,850,000	24,888,000	76,738,000	44,850,000	21,528,000	66,378,000
1-40	283,113,000	12,382,000	295,495,000	24,068,800	201,973,000	326,041,800	116,081,300	192,539,000	308,620,300	122,729,100	161,122,600	283,851,700

higher labor costs. But since labor costs are not likely to change as a result of paving alone, the savings due to paving will be the same for U.S. trucks also.

In addition to these savings, there will be additional savings due to the shortening of the Highway. The amount of highway shortening performed will vary depending upon the specific improvement plan adopted. The savings due to such shortening will be 49.7 cents for U.S. and 34.5 cents for Canadian trucks. Incidentially, with respect to the cost savings due to shortening of the highway, it will be assumed--in the absence of any specific information to the contrary--that such shortening will be distributed evenly over the entire Highway and that traffic, utilizing only a portion of the Highway, will share proportionately in the savings due to such shortening.

The time pattern of both the paving and the shortening of the highway will also be assumed to be proportional to the expenditures on road construction in each year. That is, if 5 percent of the construction costs are incurred in one year, then it will be assumed that for the following year, an additional 5 percent of the paving and road shortening program will have been completed. It will further be assumed that all traffic will share in each increment of saving during the construction period.

Passenger Car Operations

In estimating the cost reduction likely to accrue to the automobile owner and user if the Alaska Highway were paved, the major area of savings would be in parts, labor, and tires. In general, this area can be defined as the maintenance expense category of automobile operating costs.

It has been suggested that some savings would be realized through the reduced consumption rate of fuel and oil. However, this is considered to be a doubtful possibility, and, for the purposes of this report, no such savings are recognized. On the basis of equal speed, there would be some saving due to paving; but the assumption of equal speed is unrealistic, and higher speed on a paved surface would offset any savings in gasoline consumption due to paving.

Similarly, it has been suggested that the improvements in driving time and comfort for the vehicle user should constitute an element in the calculation of the overall user benefits. These improved conditions should indeed be recognized; however, any attempt to attach a monetary value to them would be most unrealistic and would ultimately weaken the validity of the final savings forecast.

The data used in this analysis were compiled by a Canadian government agency, which operated 50 automobiles in Northwestern Alberta, Northern British Columbia, and the Yukon in fiscal 1964-65. It portrays

the average operating costs that are directly affected by the highway surface and represents a sample size of 1.2 million vehicle miles. The results of this cost analysis appear in Table 42:

Table 42

ANALYSIS OF THE INFLUENCE OF HIGHWAY SURFACES ON AUTOMOBILE OPERATING COSTS

Highway Surface	Operating Costs per Vehicle Mile: Parts and Labor	Tires	Total
Unpaved	2.75¢	0.60¢	3.35¢
Unpaved and paved	2.68	0.42	3.10
Paved	2.25	0.32	2.57
Cost reduction through paved surface	0.50	0.28	0.78

As a test of the validity of the operating costs referred to above, a comparison was made with the vehicle operating cost experience of the same government agency in the operation of its fleet in Western Canada in fiscal 1964-65, as shown in the following tabulation. This study represents a sample size of 32.3 million vehicle miles operated in Manitoba, Saskatchewan, Alberta, and British Columbia and constitutes a comparison of cost experience on paved highways only.

Area	Operating Costs per Vehicle Mile: Parts and Labor	Tires	Total
Northern B.C. & Alberta	2.25¢	0.32¢	2.57¢
Western Canada	1.84	0.37	2.21
Difference	0.41		0.36

From the foregoing tabulation, it is apparent that average operating costs are 0.36 cents per mile lower in Western Canada than in Northern British Columbia and Alberta, a difference that is primarily attributable to geographic considerations. In other words, the added costs of

transporting parts and supplies to the northern areas, plus the higher labor costs account for higher operating costs in the north.

In calculating the automobile operating cost reduction resulting from paving the Alaska Highway, two types of user must be considered:

1. The captive user, who incurs the bulk of his automobile mileage on the Alaska Highway and incurs most of his automobile repairs and maintenance expense in the northern communities along the Highway;

2. The transient user, who incurs only a part of his automobile mileage on the Alaska Highway, but incurs all of his automobile repairs and maintenance (with the exception of emergency repairs) in non-Alaska Highway communities.

The savings that are realizable to the captive user would therefore be 0.78 cents per mile, which is the difference in operating costs between users of paved and unpaved highways, as illustrated in Table 42.

However, the maximum savings per vehicle-mile realizable to the transient user are shown in the following tabulation:

Savings attributable to paved highway surface	0.78¢
Savings attributable to lower repair and parts costs	0.36
Total	1.14¢

Thus, the transient user realizes two areas of cost benefits: the first being that attributable to the reduced wear and tear on his vehicle; and the second being that attributable to his ability to purchase repairs and parts at a price lower than that which is prevalent in the northern area.

Hence, the average cost benefit to all users of the Alaska Highway would range between 0.78 and 1.14 cents per vehicle-mile, depending upon the proportion of captive to transient users. For the purposes of this report, it is suggested that a saving of 1.0 cents per vehicle-mile would be reasonable.

Savings Due to Route Shortening

It is estimated that the savings in passenger car operating costs, due to shortening of the highway, will be 6 cents per mile. This amount is

considerably higher than similar savings in Canada or the continental United States, and it primarily reflects the higher gasoline cost applicable in the area of the Alaska Highway.

Projections of Future Savings for 1975 and 1985

It is in the nature of cost savings benefits that they are applicable only to such traffic as will have occurred in 1975 or 1985, regardless of whether the Highway will have been improved by then. This is obvious, of course, because traffic that is induced by the improvement program does not experience any savings. Such traffic simply would not exist in the absence of an improvement program.

It is therefore necessary to project a "normal" traffic growth to 1985, a traffic growth that will occur irrespective of any highway improvements. It is this traffic that will experience the cost savings benefits associated with the highway improvement program. Traffic, generated over and above this normal level, will be responsible for other benefits, discussed below.

Projections of Normal Truck Traffic 1975 to 1985

The normal growth of vehicle-miles of truck traffic on the Alaska Highway has been projected at an annual rate of 3.5 percent. This rate takes into consideration several important factors that will affect the growth of truck traffic on the Highway, including regional shifts of income and population in the areas served by the Highway, the possible diversion of traffic to other roads under construction, and the intense competition of other transport modes.

An example of the first factor is the expected concentration of income and employment near tidewater in the south central region of Alaska, with Anchorage as a center, while the Fairbanks area will experience a lower rate of growth in its economic development. This regional development shift in conjunction with the increased efficiency of maritime cargo operations, where economies of scale exist in contrast with truck transportation, will restrict the growth of normal truck traffic from continental United States to Alaska to no more than 2 percent per year.

The truck traffic from Canada to Alaska is expected to grow at a somewhat higher rate of 3 percent per year, and by 1985 it will amount ~~to~~ nearly 23 percent of the U.S.-Alaska traffic as shown in Table 43.

The Yukon-Alaska traffic will grow at a 5 percent annual growth rate, higher than the above rates, but its total will be quite small--less than 300,000 vehicle-miles a year by 1985. (This rate will fix an upper limit to the possible traffic growth in the area since both the availability of natural resources for Alaskan markets and the size of Yukon markets will inhibit a growth rate higher than 5 percent.) All the above combine into a total growth rate of 2.1 percent for truck traffic to Alaska.

Table 43

PROJECTION OF NORMAL TRUCK TRAFFIC ON THE ALASKA HIGHWAY
(Thousands of Vehicle-miles)
1966-1985

Origin - Destination Patterns*	1966	1975	1985
Pacific Northwest - Alaska	2,966	3,545	4,319
U.S. Midwest - Alaska	1,397	1,670	2,035
Alaska Panhandle - Fairbanks	100	120	146
Through Canadian traffic - Alaska†	679	865	1,132
Through Canadian traffic - Fort Nelson	404	627	1,022
Through Canadian traffic - Watson Lake	813	1,237	1,975
Through Canadian traffic - Whitehorse	1,870	2,901	4,725
Fort St. John, B.C. - Anchorage, Alaska	198	258	347
Whitehorse, Yukon - Alaska	116	180	293
Dawson Creek - Whitehorse	272	387	573
Dawson Creek - Fort Nelson	980	1,656	2,966
Dawson Creek - Watson Lake	22	26	32
Fort St. John - Whitehorse	162	211	284
Fort St. John - Watson Lake	1,199	1,433	1,747
Fort St. John - Fort Nelson	2,091	3,533	6,328
Fort Nelson - Watson Lake	266	318	387
Fort Nelson - Whitehorse	96	125	168
Watson Lake - Whitehorse	4,381	5,236	6,382
Carcross road - Whitehorse	784	1,116	1,652
Whitehorse - Mile 925	656	1,108	1,985
Local Alaska border traffic	5	7	8
Whitehorse - Haines junction	972	1,268	1,704
Total	20,429	27,827	40,210
Cost - saving benefits			
Alternative B	--	$1,265,149	$1,942,596
Alternative C	--	1,953,654	2,982,620

* The origin and destination patterns cover two-way traffic.

† The term "through Canadian traffic" covers the traffic from Alberta, Vancouver, and the Prairie Provinces.

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The efficiency of the White Pass and Yukon railwater operation, plus the construction of the Stewart-Cassiar Road in Northwest British Columbia will put constraints on the future growth of traffic to points along the Alaska Highway. Therefore, a growth rate of 5 percent was projected for Canadian traffic originating in Alberta, Southwestern B.C., and the Prairie Provinces with destinations along the Highway. This rate is near the current growth trends for this traffic.

For certain areas along the Highway, namely Fort Nelson and Whitehorse, high growth rates were projected for local truck traffic. For example, a 6 percent growth rate was forecast for traffic from Fort St. John and Dawson Creek to Fort Nelson. This high rate takes into account the expected economic development of this area, particularly with respect to its oil and forest resources.

The section from Carcross Road to Whitehorse will experience a 4 percent traffic growth rate due to the increased urbanization of Whitehorse and its surrounding area. On the other side of Whitehorse, the traffic up to Mile 925 will continue to experience high rates of growth--on the order of 6 percent--due to increased economic development near Mayo and the growth of the Whitehorse area.

The rest of the local traffic will continue to grow at approximately the present rates. An exception to this may be traffic from Whitehorse and Dawson Creek to Watson Lake, which might diminish as a consequence of the construction of the Stewart-Cassiar Road that will divert a protion of asbestos shipments from Cassiar; therefore, a very small growth rate of 2 percent has been projected for this traffic. The rest of the local truck traffic has been projected at an annual rate of 3 percent.

The projected normal vehicle-miles of truck traffic on the Highway are expected to grow from present figures of 18,435,000 of vehicle-miles to 40,210,000 by 1985.

Cost saving benefits from normal truck traffic will accrue over time according to the construction schedule of the paving. For this reason, the amount of benefits will be negligible in the first years of construction; for example, not until after 1970--when 50 percent of the total construction budget will have been spent--will they approximate the $900,000 annual benefits projected in Alternative C. Table 43 presents the projected cost saving benefits for truck traffic in 1975 and 1985.

Projections of Normal Passenger Car Traffic 1975-1985

The passenger car traffic from continental United States to Alaska has been projected at an annual growth rate of 4.5 percent in accordance with our statistical projection presented in Appendix D. The rate of growth of summer travel on the Highway, which has already started to diminish from 12.6 percent during 1952 to 1964 to 8.9 percent from

1958 to 1964, is expected to decline further, yet the tourist traffic to Alaska will maintain a steady increase as specified above.

The tourist traffic from the Canadian provinces and the Yukon Territory is assumed to grow at 4 percent a year in line with expected income and population growth in the Yukon, British Columbia, and Alberta, which supply nearly 70 percent of the Canadian vacationers to Alaska.

The local passenger car growth rates were assumed to be similar to those projected for the local truck traffic, since both are a function of income and population growth. Thus, the passenger car traffic between Dawson Creek and Fort Nelson was assumed to grow at an annual rate of 7 percent; the traffic from Whitehorse to Mile 925 was projected at 6 percent; and the passenger traffic from both Dawson Creek and Carcross Road to Whitehorse was forecasted to increase at 3 percent per year.

Because of the detrimental effect of the Stewart-Cassiar Road, which will provide an alternative route for the asbestos shipments from Cassiar, the traffic from Watson Lake to Whitehorse was only projected at a 2 percent growth rate.

The total passenger car miles projected on the Alaska Highway shows a 4.1 percent annual growth rate until 1985.

Table 44 shows how the cost saving benefits arising from the normal traffic growth of passenger vehicles jumps from approximately $1.5 million in 1975, to more than $3 million for 1985.

Determination of Volume-Increasing Effects

This section covers the determination of effects that arise from the additional traffic induced by the paving of the Highway.

Generated traffic refers to new traffic resulting from the lowering of the transportation costs, as well as from the increased convenience and pleasure of traveling on a paved road. In other words, it is traffic that would not occur without the improvement program.

Before estimating the benefits arising from such traffic, the following principle should be stated: generated benefits that arise from additional traffic induced by the improvement program can only cover developments that would not have taken place in the absence of this program. And these generated benefits should not involve merely a locational shift between regions that contributes nothing from a national point of view.

The analysis of volume-increasing effects will be divided between truck and passenger car traffic. In cases where the generation of traffic-increasing effects will require investments exceeding those specified by the highway improvement program, an estimate will be made later of the additional investments needed.

Table 44

PROJECTION OF NORMAL PASSENGER CAR TRAFFIC ON
THE ALASKA HIGHWAY
(Thousands of Vehicle-Miles)
1966-1985

Origin-Destination Patterns*	1966	1975	1985
U.S.-Alaska tourist traffic			
Via Midwest Gateway	15,291	20,840	29,592
Via Pacific Gateway	8,763	14,680	25,948
U.S.-Alaska traffic by Alaska residents	36,770	52,336	77,470
Canada-Alaska tourist traffic			
Excluding Yukon residents	5,031	7,157	10,590
Including Yukon residents	376	535	792
Local traffic			
Dawson Creek-Fort Nelson	10,317	19,004	35,077
Dawson Creek-Whitehorse	16,643	21,717	29,185
Watson Lake-Whitehorse	1,808	2,161	2,634
Carcross Rd.-Whitehorse	581	757	1,018
Whitehorse-Mile 926	3,042	5,139	9,197
Total	98,622	144,326	221,503
Cost-saving benefits			
Alternative B		$1,430,329	$3,094,924
Alternative C		1,960,808	4,240,796

* The origin and destination patterns cover two-way traffic.

Truck Traffic

The analysis of the expected pattern of economic development of the area, as performed in previous chapters, reveals that it is most unlikely that any of the expected developments will receive additional impetus from Highway improvement. Resource developments within Alaska will, in all probability, be near the coast, or directed toward the coast via the shortest possible road in cases where export commodities are involved. Also, the ever increasing efficiency of joint motor carrier-water carrier shipments from the United States to Alaska leaves highway transportation with a minor stake in the freight transportation to Alaska.

The paving of the Alaska Highway will also have little influence on mineral exploration activity. Aerial exploration for minerals, which has become the standard method, does not depend on road developments or road improvement.

The situation is very similar in the Canadian portion of the area served by the Alaska Highway. In addition to the fact that sea transportation is generally more suitable for many resource-based and export-oriented industries, there are competing land transportation routes that may divert traffic from the Alaska Highway. For instance, the Stewart-Cassiar Road now under construction, the White Pass and Yukon Railway, as well as future expansion of the PGE Railroad, will limit the traffic that might be generated by the improvement.

It should not be assumed that truck traffic on the Highway will not grow; rather, growth in truck traffic will not occur as a result of the improvement, but will simply be the normal increase associated with the general growth of the area.

There could be two exceptions to the above conclusions: First, there may be some export trade of food items (meat, fresh vegetables, eggs, fruits, etc.) from Canada to Alaska that might be possible with the paving of the Highway, but the amount involved would be quite small--the value of these exports by 1985 would probably be less than $1 million per year.

Second, additional truck traffic will be generated as the result of the increase in tourism arising from the Highway improvement. Additional supplies to support the increased travel on the Highway will require a corresponding increase in truck traffic. But the benefits of this additional tourist travel will be measured in their entirety, and thus the truck traffic needed to support this activity cannot be measured separately.

We can conclude that only the small amount of additional truck-carried exports to Alaska can be counted as truck traffic-generated benefits. The amount of this benefit will be measured in terms of the savings experienced by the consumers and the profits made by the exporters. Thus the benefits resulting from this expansion of trade will be shared by Canada and the United States.

Passenger Car Traffic

Estimate and Projection of Additional Passenger Traffic to be Generated by the Improvement

For projecting the passenger traffic generated by the highway improvement, it is convenient to classify the passenger traffic on the Highway as tourist traffic, local passenger traffic, and through Alaska-United States traffic by Alaskan residents.

It is unlikely that local passenger traffic on the Highway will grow as a result of the highway improvement, since there are no alternative roads. Highway travel by Alaskan residents will grow to some extent, with or without highway improvement. It is expected that migration to and from Alaska--including seasonal migration--will be considerable, but the improvement of the Highway will only have a minimal effect in determining the mode of transportation used in the movement. Therefore, most of the generated passenger traffic will come from increased tourist traffic.

The tourist auto traffic on the Highway has been growing rapidly; the rate of growth during the last decade was more than 9 percent per year. The growth rate of tourist travel on the road was diminished from 12.6 percent in the period 1952-1964 to 8.9 percent in the period 1958-64, and there are indications that a further decline in the growth rate can be expected in the future.

It is unlikely that a growth rate of nearly 10 percent in tourist traffic can be maintained in the absence of an improvement program. There are a number of factors that indicate a gradual reduction in this growth rate, including (1) the expansion of jet service to Alaska, which has already brought significant reduction in travel time and which may bring fare reductions as well; (2) past high growth rates were achieved on an extremely small traffic base, and a normal growth pattern usually involves a reduced rate of growth; and (3) the bulk of promotion and advertising of travel to Alaska involves travel by means other than the automobile.

The planned paving and improvement of the Alaska Highway will undoubtedly have a very stimulating effect and may bring about a continuation, if not an expansion, of tourist traffic. But this beneficial effect will occur only after the completion of the highway improvement program. Even if delays and inconveniences are kept at a minimum, the public knowledge that the Highway is being paved is not likely to have a favorable publicity influence. The construction period is unlikely to have a depressing effect on traffic other than tourist traffic, simply because such traffic has no alternative routing.

In assessing the potential growth of tourism in the area, a special study of current tourism in Alaska and the Yukon was conducted (see Appendix B). On the basis of this study, the following projections of future tourist growth--both with and without highway improvement--were made.

Without Improvement. A continued normal growth rate of nearly 5 percent (4.5 percent) is projected for the next two decades. The normal tourist growth rate is composed of a 4 percent growth rate for Canadian traffic; a 5.9 percent growth rate for tourist traffic from the Pacific Northwest and California; and a 3.5 percent growth rate for tourism from the rest of the United States. These differential growth rates reflect different regional patterns of income and population growth. (See Appendix D.)

With Improvement. If an improvement program is initiated in the near future, the past trend of tourist traffic growth in the area will, of course, be altered severely. During the construction period, the effect is likely to be negative; afterwards, the change will undoubtedly be positive.

It is impossible to project precisely the quantitative effect of the improvement work during and after the construction phase; however, the following assumptions would appear reasonable, if not optimistic. During the construction period, it is assumed that the tourist travel on the Highway will grow at a reduced rate, with the yearly increase averaging about 2 percent per year. This may appear as an overly optimistic projection, but considering the very high growth rates of recent years and the fact that tourists on the Alaska Highway expect some level of discomfort as a matter of course, it is not unreasonable to forecast some growth in tourist traffic even during construction.

Following the completion of the construction program, it is assumed that tourist traffic on the Highway will increase very rapidly and that the limiting factor on the rate of increase may well be the construction of tourist facilities to accommodate the traffic increase.

Based upon observation of other tourist areas, it is believed that an average yearly increase of approximately 15 percent is about the maximum growth rate that can be expected. The attainment of such a rate would involve the expenditure of more than $20 million in tourist facilities--motels, restaurants, camp sites--between 1976 and 1985. Since such a construction requirement is formidable indeed in an area as sparsely developed as Northern British Columbia and the Yukon, the limitation imposed on tourism by inadequate facilities might be substantial.

The above projections--and projections made earlier concerning nontourist traffic--have been converted into projections of average daily traffic counts for 1985, for various segments of the Highway (Table 45). In making the conversions from annual trips to daily traffic counts, it was assumed that commercial trucks operate 200 days per year, due to the incidence of weekends and holidays, and that passenger cars operate 360 days a year. The very heavy traffic projected for the Whitehorse area reflects the incidence of local traffic.

Table 45

PROJECTED AVERAGE DAILY TRAFFIC ON THE ALASKA HIGHWAY
(Number of Vehicles)
1985

	Mile 163/ Fort Nelson	Fort Nelson/ Watson Lake	Watson Lake/ Carcross Rd.	Carcross Rd./ Whitehorse	Whitehorse/ Mile 926	Mile 926/ Haines Jct.	Haines Jct./ Alaska Border
Without highway improvement							
Passenger car traffic							
U.S.-Alaska tourist traffic							
Via Midwest Gateway	72	72	72	72	72	72	72
Via Pacific Gateway	63	63	63	63	63	63	63
U.S.-Alaska traffic by Alaska residents	189	189	189	189	189	189	189
Canada-Alaska tourist traffic							
Via Midwest Gateway	14	14	14	14	14	14	14
By B.C. residents	12	12	12	12	12	12	12
Local traffic							
Whitehorse-Alaska	7	7	7	7	7	7	7
Dawson Creek-Fort Nelson	443	--	--	--	--	--	--
Dawson Creek-Whitehorse	97	97	97	97	--	--	--
Watson Lake-Whitehorse	--	--	26	26	--	--	--
Carcross Rd.-Whitehorse	--	--	--	353	--	--	--
Whitehorse-Mile 925	--	--	--	--	3,193	--	--
Subtotal	897	454	480	833	3,550	357	357
Truck traffic							
Alaska-U.S.	28	28	28	28	28	28	28
Panhandle-Fairbanks	--	--	--	--	--	--	7
Through Canada-Alaska	5	5	5	5	5	5	5
Whitehorse-Alaska	--	--	--	--	5	5	5
Fort St. John-Alaska	2	2	2	2	2	2	2
Through Canada-Whitehorse	29	29	29	29	--	--	--
Through Canada-Watson Lake	19	19	--	--	--	--	--
Through Canada-Fort Nelson	25	--	--	--	--	--	--
Dawson Creek-local Alaska Highway	72	5	4	4	--	--	--
Fort St. John-local Alaska Highway	162	18	2	2	--	--	--
Fort Nelson-Whitehorse	--	2	2	2	--	--	--
Fort Nelson-Watson Lake	--	6	--	--	--	--	--
Watson Lake-Whitehorse	--	--	112	112	--	--	--
Carcross Rd.-Whitehorse	--	--	--	590	--	--	--
Whitehorse-Mile 925	--	--	--	--	1,418	--	--
Local Alaska Border	--	--	--	--	--	--	2
Whitehorse-Haines Rd.	--	--	--	--	88	88	--
Subtotal	342	114	184	774	1,546	128	49
Total	1,239	568	664	1,607	5,096	485	406

Table 45 (concluded)

	Mile 163/ Fort Nelson	Fort Nelson/ Watson Lake	Watson Lake/ Carcross Rd.	Carcross Rd./ Whitehorse	Whitehorse/ Mile 926	Mile 926/ Haines Jct.	Haines Jct./ Alaska Border
With highway improvement							
Passenger car traffic							
U.S.-Alaska tourist traffic							
Via Midwest Gateway	178	178	178	178	178	178	178
Via Pacific Gateway	100	100	100	100	100	100	100
U.S. Alaska traffic by Alaska residents	189	189	189	189	189	189	189
Canada-Alaska tourist traffic							
Via Midwest Gateway	32	32	32	32	32	32	32
By B.C. residents	26	26	26	26	26	26	26
Local traffic							
Whitehorse-Alaska	--	--	--	--	17	17	17
Dawson Creek-Fort Nelson	443	--	--	--	--	--	--
Dawson Creek-Whitehorse	97	97	97	97	--	--	--
Watson Lake-Whitehorse	--	--	26	26	--	--	--
Carcross Rd.-Whitehorse	--	--	--	353	--	--	--
Whitehorse-Mile 925	--	--	--	--	3,193	--	--
Subtotal	1,065	622	648	1,001	3,735	542	542
Truck traffic							
Alaska-U.S.	28	28	28	28	28	28	28
Panhandle-Fairbanks	--	--	--	--	--	--	7
Through Canada-Alaska	9	9	9	9	9	9	9
Whitehorse-Alaska	--	--	--	--	5	5	5
Fort St. John-Alaska	2	2	2	2	2	2	2
Through Canada-Whitehorse	29	29	29	29	--	--	--
Through Canada-Watson Lake	19	19	--	--	--	--	--
Through Canada-Fort Nelson	25	--	--	--	--	--	--
Dawson Creek-local Alaska Highway	72	5	4	4	--	--	--
Fort St. John-local Alaska Highway	162	18	2	2	--	--	--
Fort Nelson-Whitehorse	--	2	2	2	--	--	--
Fort Nelson-Watson Lake	--	6	--	--	--	--	--
Watson Lake-Whitehorse	--	--	112	112	--	--	--
Carcross Rd.-Whitehorse	--	--	--	590	--	--	--
Whitehorse-Mile 925	--	--	--	--	1,418	--	--
Local Alaska Border	--	--	--	--	--	--	2
Whitehorse-Haines Rd.	--	--	--	--	88	88	--
Subtotal	346	118	188	778	1,550	132	53
Total	1,411	740	836	1,779	5,285	674	595

Note: The annual figures on passenger trips were converted into daily traffic figures assuming 360 travel days per year. These 360 days were the result of dividing the total annual traffic count at the Alaska border by the daily traffic figures at the border provided by the Canadian government. The same methodology applied to truck traffic resulted in 200 days per year of truck traffic.

Determination of Secondary Effects Resulting from Growth in Tourist Travel

The benefits generated by the increase in tourist travel, above its normal growth, will be twofold: (1) increased expenditures per visitor due to improvement of facilities; and (2) quantitative increase in the number of tourist visitors.

With respect to the first, the special survey on tourism in Alaska and the Yukon (see Appendix B) indicates that approximately $20 million must be spent on tourist facilities. It is anticipated that these new facilities will be of higher quality than those currently existing on the Highway. In addition, the paving of the Highway will undoubtedly bring tourists to the area who are accustomed to more luxury and comfort. Both of these factors should contribute to greater spending per tourist--perhaps as much as 25 percent more. It is therefore assumed that average spending per tourist will increase from about $35 to about $44 per tourist party. (The number of individuals per party is assumed to remain at the present level of 3.1 persons.)

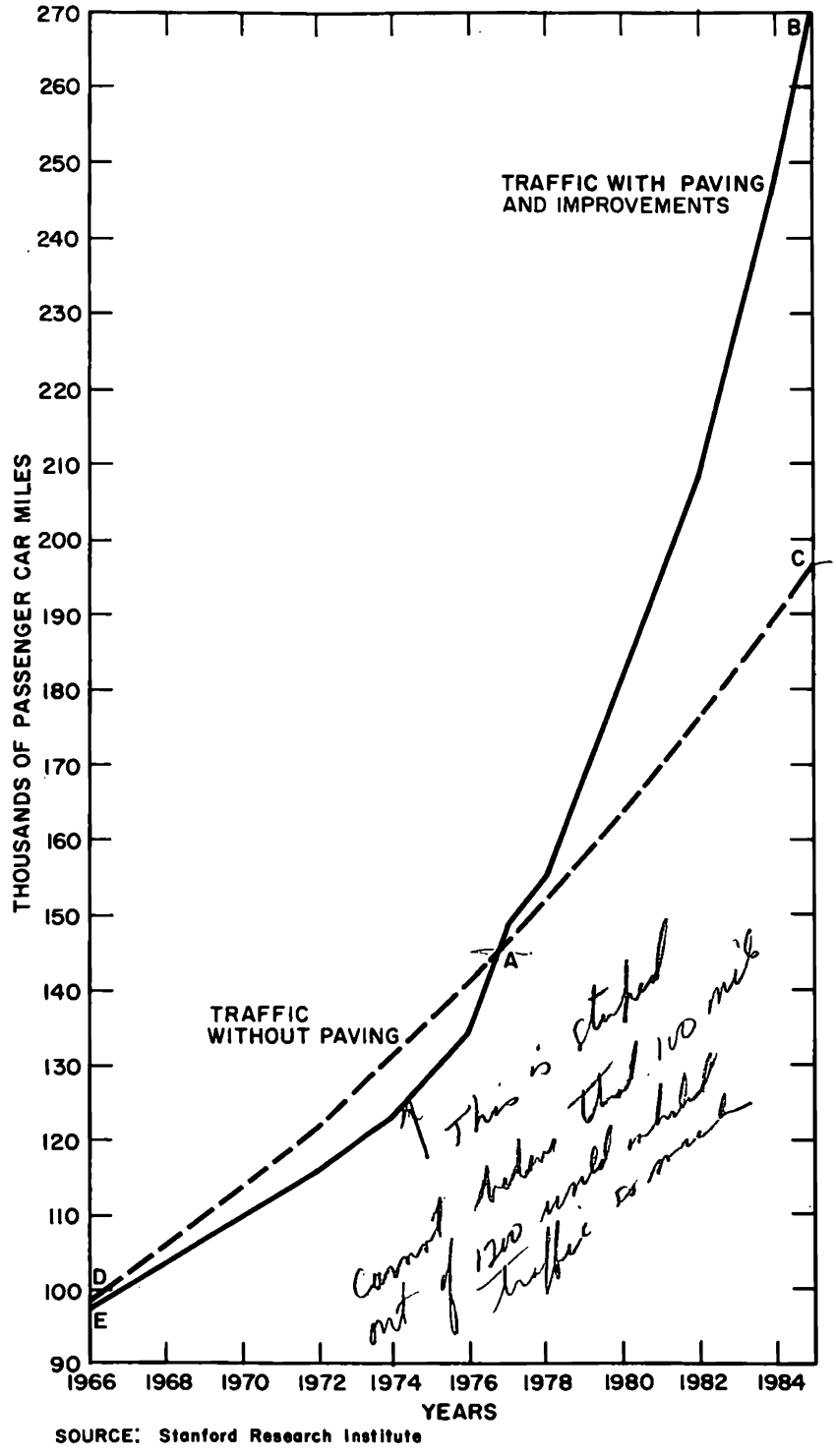
The effect of lessened tourist travel growth during the construction period must be taken into account in estimating the benefits from increased tourist travel after the completion of the improvement program. Since the generated toruist benefits are associated with tourist travel exceeding that which could be expected without the improvement, the relative tourist traffic losses must also be subtracted.

Figure 4 shows the projected tourist passenger car miles both with and without the projected improvement. In this figure, the generated traffic is given by the area ABC minus the area ADE; the latter represents the area of traffic lost during the construction period.

On the basis of the above projections, the annual amount of increased tourist spending on the Alaska Highway for 1985 has been estimated at $27,106,800. This amount will be translated into actual benefits in Section VII.

FIGURE 4

ESTIMATED PASSENGER CAR TRAFFIC ON ALASKA HIGHWAY WITH AND WITHOUT PAVING



SOURCE: Stanford Research Institute

VII DETERMINATION OF BENEFITS AND ALLOCATION AMONG BENEFICIARIES

Principles of Cost-Benefit Analysis Applicable in This Study

The overall purpose of this study is to determine the economic feasibility of the proposed improvement program involving the Alaska Highway. This determination involves both the collection and analysis of pertinent data, as well as an outline of the theoretical principles of cost-benefit analysis that seem particularly appropriate for this study. The purpose of this section is to develop these pertinent principles and to present arguments in support of the preferences or selections made.

This section is divided into three main chapters: the first is an examination of the type of effects that can be related to the highway improvement program; the second chapter deals with the relation of these effects to net benefits to be calculated; and the third chapter sets forth guidelines to be followed in the allocation of benefits among various beneficiaries, i.e., the United States or Canada.

Analysis of Impacts

Theoretically, there are only two types of beneficial effects that the Highway improvement program can have. First, it can decrease the cost of movement on the Highway--or increase its value--which is an equivalent gain. Second, it can augment the volume of traffic on the Highway exceeding the amount of traffic that would have occurred in the absence of such a program.

The cost-decreasing or value-increasing effects of the Highway improvement are perhaps the simplest and most direct effects to be analyzed. By definition, these effects can only be calculated for "normal" traffic, i.e., traffic that would move over the Highway regardless of whether the improvement program is carried out. If the traffic is, in fact, generated by the improvement program, the notion of cost reduction would not be appropriate, since such traffic never experienced the presumably higher costs inherent in the unimproved highways.

The lower cost or increased value of transportation over the improved Highway has both measurable and unmeasurable dimensions. Among the former are sheer savings in time and expense for both truck and passenger car traffic; the increased pleasure resulting from driving on the improved Highway would be counted among the intangible benefits. Theoretically, a possible reduction in the accident rate, which could be associated with the Highway improvement, could be shown as a measurable cost-reducing

effect. However, the great difficulties associated with quantifying the associated savings would suggest regarding a reduction in the accident rate as a nonmeasurable factor.

There are potentially two types of traffic-increasing effects that could be associated with the improvement program: The first involves traffic diversion from other existing modes or routes of transportation. The second type concerns traffic generated by the improvement program itself--traffic attributable to the economic growth caused by the improved Highway.

According to this breakdown, all traffic that can be projected as moving over the improved highway can be associated with specific economic effects. Normal traffic, traffic that will move over the Highway before and after the improvement program, will be associated with the cost-reducing effects of the program; diverted traffic will be associated with the amount of traffic that is diverted to the improved facility from other modes of transport or from other routes; and generated traffic will be related to the growth-generating effects of the Highway program.

Translation of Impacts into Benefits

Economic effects are neutral and not necessarily associated with any value, positive or negative. Benefits, on the other hand, are those selected impacts that can be associated with positive value. Furthermore, the magnitude of benefits is not necessarily the same as the magnitude of the economic effects from which they are derived. For instance, it may be suitable to describe the effects generated by a development project, such as a tourist industry whose growth was sponsored by the improved Highway, in terms of incremental annual sales attributable to the project. Such measurement, however, would be totally inaccurate as far as potential benefits are concerned; these could not amount to more than net profits derived from the industry and, in some cases, may even be less.

In general, the translation of neutral economic effects into benefits requires two distinct steps: One, a selection must be made of those effects that can be regarded as benefits, regardless of whether they are measurable in quantitative terms. Second, they must be measured as benefits, rather than as effects, which requires that associated costs or losses be subtracted from the gross amounts determined earlier.

The following specific guidelines will be followed in the translation of effects into benefits.

1. The benefits associated with the cost-reducing effects of the improvement program will be measured, on a unit basis, for both trucks and passenger cars by a comparison of vehicle operating costs on paved and unpaved roads in the area. As indicated earlier, these cost-reducing benefits are applicable only to the normal portion of total projected traffic, i.e., that traffic

which currently uses the Highway and which in all likelihood will continue using it regardless of the improvement program.

2. The improvement in "value" and convenience of travel for this normal fragment of total traffic will be regarded as intangible, unmeasurable benefits. (Of course, the additional traffic stimulated through this increase in convenience constitutes another set of effects and possible benefits.)

3. The probable reduction in the accident rate on the Highway will be listed as intangible, primarily because the thinness of traffic density makes quantitative projections in this area very hazardous.

4. Benefits associated with traffic diverted to the Highway as a result of the improvement will be measured on the basis of the cost margin between existing transportation modes, currently involved in the movement, and transportation costs likely to be experienced after completion of the program. Somewhat akin to the benefits associated with diverted traffic are benefits produced by more effective carrier competition made possible by the improved Highway, without such competition necessarily resulting in traffic diversions. Benefits would be measured by the rate reduction stimulated through such competition.

5. Finally, there are benefits associated with traffic generated by the improvement program. These benefits would not be measured in terms of comparative transport cost involved, but rather in terms of the net benefits resulting from the entire economic activity stimulated by the program.

Among the benefits associated with stimulated traffic would be increases in existing economic activities directly traceable to the improvement program, or the development of new activities made possible by the improvement program. Increases in tourist travel or the development of export trade between Canada and Alaska, which is clearly dependent upon the Highway for transportation, are examples of benefits associated with stimulated traffic. As is readily apparent, the benefits derived from this stimulated activity must be measured in terms of the net value derived from the entire activity, and not merely from the associated traffic.

Allocation of Benefits Among Beneficiaries

The scope of the study requires that the benefits determined above be allocated between Canada and the United States; and, within Canada, among the individual provinces or territories involved.

This allocation of benefits raises two theoretical issues that require some explanation. The first concerns the division of benefits that are shared by more than one group of beneficiaries. The second deals with the conceptual problem of reconciling the sum of individual benefits with the total benefits determined for this project.

It is apparent that certain benefits can be assigned in their entirety either to one or another group of beneficiaries. For instance, cost saving benefits that might accrue to normal, current truck traffic between the continental United States and Alaska or within Canada would be wholly allocated either to the United States or to Canada. But for other benefits, the situation is less simple. In the case of export trade stimulated by the Highway improvement program, for example, both the importing and the exporting countries can be assumed to derive benefits from such an increase.

Even more difficult is the allocation of benefits generated by increased tourism in the area served by the Alaska Highway. The theory of consumer surplus establishes that the individual consumers must derive some surplus value from their purchases, or else they would not make the particular purchases. Similarly, tourists visiting a particular area must derive benefits from such visits exceeding the cost of these visits.

It is impossible to determine scientifically what the proper division of benefits in either of these cases might be. However, it is less important to measure the correct proportion of benefits to be allocated than it is to establish the principle that in these cases benefits are shared by more than one group of beneficiaries. In this study, care has been taken to segregate benefits that can be assigned clearly to single groups of beneficiaries from those benefits that involve sharing formulas. For the latter, benefits are allocated on the basis of suggested percentage shares that appear suitable. However, these suggested percentage shares are supported only by common sense judgement and may be altered should different shares appear more appropriate.

The second point concerns the relationship of the sum of individual benefits listed and the global benefits that can be determined for the project as a whole. Global benefits are defined as those which represent true net additions to the total amount of goods and services produced, and their creation does not involve losses due to displacement elsewhere.

Not all of the benefits listed in this study can be regarded as global benefits; many of the benefits--those associated with diverted traffic, for example--would involve losses on the part of other groups. Thus, it is possible for the sum of individual benefits to be far greater than the total global benefits. Benefits to individual groups may, of course, involve offsetting losses to other groups whose activities were diminished as a result of the diversion.

Principles of Benefit Discounting

The Necessity for Discounting

The necessity for discounting net benefits arises from the fact that benefits and costs have different time patterns that must be compared to arrive at a decision or choice regarding the feasibility of the project.

For example, the costs of an investment project are usually concentrated during the early years of the project's life span, whereas benefits from the investment accrue later. Since benefits and costs have to be evaluated against one another, a common measure must be developed for purposes of comparison.

The economic theory of choices over time provides the investigator with the solution to this problem: The future benefits and costs must be discounted to present value through the rate of interest to balance the competition between the demands of the present and of the future. If no discount is made, it is implied that a dollar a year from now is valued as highly as a dollar today.

The procedure for discounting net benefits is illustrated below in (1.1) where i denotes the annual rate of interest, and S_o, S_1, S_2,...S_n denote the net benefits arising from the investment. The present value of the stream of net benefits is then expressed by:

$$(1.1) \quad V_o = S_o + \frac{S_1}{1+i} + \frac{S_2}{(1+i)^2} + \cdots\cdots + \frac{S_n}{(1+i)^n}$$

For a positive rate of interest, the distant benefits are less weighted in the computation of present value than are the benefits accruing in the near future.

Since the benefits of the project generally accrue later than the costs, the selection of a high rate of discount will discriminate against projects whose benefits accrue in the distant future; for this reason, it is important to select the proper discount rate.

Conceptual Factors that Affect the Determination of the Proper Discount Rate

The classical theory of interest maintains that a unique rate of discount of future goods and services is determined by balancing the desire of the community to obtain future benefits with the marginal productivity of the capital resources invested.

The theory of Time-Preference postulates the superiority of present over future consumption, i.e., that a dollar now is worth more than a dollar at a future time. Even without a preference for the present over the future, a positive marginal productivity of the investment alone would dictate a positive rate of interest.

The productivity explanation of the rate of interest stems from the theory of the roundabout process of production, in which an input of resources today will generate a larger or more highly valued output of resources in the future. This will hold true as long as opportunities remain with a positive net productivity.

The interest rate then becomes the rate of discount, making the rate of return over cost of investments equal to the rate of time preference of the community. This rate of interest also equates the demand and supply for loans and therefore clearing the loan market, while at the same time maximizing the economic welfare of both savers and investors.

The object of this brief introduction has been to provide the reader with a rudiment of interest theory necessary to understand the problems that will be discussed.

The Market Rate of Interest as a Discount Rate

One school of thought advocates the market rate of interest as the proper rate to use when evaluating investment decisions, whether private or public; this market rate is close to 10 percent for discounting purposes.

The main argument in support of this theory is that if the private sector is using the market rate of interest in framing its decisions, then the use by government policymakers of a different discount rate will drive the economy away from its welfare optimum, the so-called Pareto Optimum, where nobody can be made better off without making somebody worse off.

Therefore, it is argued that if the interest rate used in government decisions is lower than the market rate of interest, public projects would draw capital from private sources, where it would have earned a higher rate of return, and would lead to lower efficiency for the whole economy. There are several reasons why the above approach is not entirely acceptable. The first one has to do with the market imperfections and multiple interest rates prevalent in our capital markets. Because of institutional imperfections that impede access to credit, divergence between borrowing and lending rates, interference of risk, uncertainty, etc., there is no unique discount rate that can be taken as a measure both of time preference and productivity of capital. The market rate of interest is affected by such a multitude of government policies in the fiscal and monetary domain that it is indeed difficult to place any normative significance on it.

Another reason for the unacceptability of the market rate of interest is that in its selection as the prevailing discount rate, the claims of future welfare have not been considered. It is therefore necessary that the government act as a protector of future generations by selecting an interest rate lower than the market to permit the acceptance of projects whose benefits accrue in the distant future.

The principal objection, however, is that the selection of the market rate of interest as the appropriate discount rate implies that the government should not engage in public activities which, for whatever reasons, have a rate of return lower than the current rate on private investment. This procedure is undesirable because the government budgetary process is essentially a political process; in this process, the people--through their

elected representatives--decide how much of their income and wealth should be invested in various types of governmental activity. To make these decisions contingent upon the workings of an uncertain formula would be unacceptable in our society.

In view of the inadequacies of the market rate of interest of public utilities, the most suitable type of discount rate used in this context would be the rate of social time preference. The social rate of time preference is based primarily on the value that society places on reserving a share of current wealth for future use. This rate is an extension of an accepted public policy, and while each project under this policy must be administratively determined by the government policy-makers, the upper limits of this discount rate would coincide with the existing rates for long term government bonds.

The social rate of time preference is regarded as the most appropriate rate of discount for this study and will be used in discounting the value of the net benefits to their present values. The remaining question concerns the percentage at which this rate should be fixed, and whether the same discount rate should apply to the United States and Canada.

Interest Rates: Welfare Defined with Respect to Both Canada and the United States

It is assumed in this study that both Canada and the United States will share in planning the proposed project and will attempt a maximization of the benefits accruing to both countries. This argues for the selection of a single interest rate to be applied to the discounting of the net benefits of the two nations. It is believed that the above approach is more practical than having each country maximize its own benefits from the project on the basis of separate and different rates.

A strong argument in favor of a joint maximization of benefits is the current trend toward liberalization of trade and capital flows between both countries which will, over time, markedly reduce the current interest rate differential between both countries.

The basis for a joint discount rate to be used by both countries would be the current prevailing long term government bond rates of Canada and the United States, which are at 5-1/2 and 4-1/4 percent, respectively. However, one additional adjustment must be made to these rates concerning the element of "risk." All interest rates, including interest rates on government bonds, contain some element of risk. The risk may be the possibility of currency depreciation or devaluation, or it may relate to the possibility that the benefits may be less than estimated.

Such risks can be minimized without increasing the rate itself. The risk of monetary depreciation could be balanced by a concurrent inflation of benefits, while a possible overestimation of benefits could be countered by conservative estimates themselves. It has been estimated that approximately 1 percent of the current Canadian government bond rate and .5 percent of the current U.S. government bond rate represent such risk elements; these are therefore subtracted from the rates themselves.

Table 46

THE DETERMINATION OF THE PURE RISKLESS RATE OF INTEREST IN CANADA AND THE UNITED STATES

	Canada	United States
Long term government bond rates	5.50%	4.25%
Less monetary depreciation rate	1.00	0.50
	4.50%	3.75%
Intercountry difference in pure interest rates due to Foreign Exchange risks	0.75%	
Joint discount rate	4.20	

It is therefore proposed to use a uniform discount rate of 4.20 percent.

It is interesting to compare this discount rate with the findings of a study by G. L. Reuber and R. J. Wonnacott (The Cost of Capital in Canada) to determine a proper discount rate for joint Canadian-U.S. projects.

The Reuber and Wonnacott study concerned the estimation of the cost of capital in Canada with special reference to the development of the Columbia River Project. The authors concluded that it was unlikely that the project would be financed from federal taxes, and they shifted their efforts to the estimation of the opportunity cost of borrowed funds.

To estimate the opportunity cost of capital, they traced which borrowing sectors would forego funds if the government increased its borrowing to finance the Columbia project and what the opportunity costs of the funds foregone might have been. They arrived at an estimated rate of 4.6 percent, but failed to make any adjustment for risk. It is our belief that a lower discount rate than this figure approximates the pure riskless interest rate.

Summary of Economic Effects and Translation into Discounted Benefits

The purpose of this chapter is to summarize economic effects resulting from the improvement program on the Alaska Highway, to translate them into benefits, and to discount the benefits, as well as the costs involved, at their present value. All of these operations will be performed and the results will be shown in Table 47. Prior to presenting this tabulation, however, it is necessary to indicate the various items that are listed in this overall tabulation.

As indicated earlier, the benefits considered in this study will either be (1) cost saving benefits, related to the lower cost of operation on the Highway after the completion of the improvement program; or (2) generated benefits, related to the additional economic activity generated as a result of the improvement program.

Cost Saving Benefits

As determined earlier the unit cost savings projected here will be 4.5 cents per vehicle-mile for trucks and 1 cent per vehicle-mile for passenger automobiles. In addition, avoidable vehicle operating costs due to the shortening of the road will be calculated at 34.5 cents for Canadian trucks and 49.7 cents for U.S. trucks and 6.0 cents per passenger automobile. The amount of benefits calculated due to road shortening will, of course, depend on which of the two plans--Alternative B or Alternative C--is actually considered for construction. In the absence of specific information as to where such road shortening would take place, it has been assumed that all traffic on the highway will share proportionately in the benefits derived from such shortening.

The above unit cost savings will be applied to that volume of truck and passenger car traffic in 1975 and 1985 which is likely to use the Highway in those years irrespective of whether the Highway is improved. This so-called normal traffic includes not only the current level of traffic, but also those increments of growth that would occur regardless of the improvement program. To determine the appropriate levels of normal traffic for 1975 and 1985, the following growth rates were assumed for various types of truck traffic:

1. A 2 percent growth rate will be projected for truck traffic from continental United States to Alaska and from the Alaska Panhandle to Fairbanks, reflecting both the historically low rates of traffic growth and the expected shifts in regional development in Alaska favoring Anchorage and the south central region.

2. The through truck traffic from Canada to Alaska will be projected at a 3 percent rate of growth.

3. The truck traffic between Alaska and the Yukon will be projected at a 5 percent annual growth rate.

4. In accordance with current growth trends, a 5 percent rate of annual growth was assumed for the Canadian through traffic originating in Vancouver, Edmonton-Calgary, and the Prairie Provinces with destinations in Fort Nelson, Watson Lake, and Whitehorse.

5. A 3.6 percent rate of growth was projected for local truck traffic on the Alaska Highway. This growth rate was derived from the following traffic growth rates along the Highway:

a. A 6 percent growth rate is expected for the traffic originating in Dawson Creek and Fort St. John and ending in Fort Nelson. This high rate of growth reflects the expected continuation of the rapid development of the Fort Nelson area involving oil exploration and forest products.

b. The area around Whitehorse is expected to grow at approximately its current rate, and therefore the truck traffic between Whitehorse and Mile 925 was projected to increase at an annual rate of 6 percent; a 4 percent growth rate was used for the traffic between Whitehorse and Carcross Road.

c. A 2 percent rate of growth is projected for the traffic from Fort St. John, Dawson Creek, Fort Nelson, and Whitehorse to Watson Lake, and back again.

The rest of the local traffic has been projected at a 3 percent rate of growth. It includes the traffic from Fort St. John, Fort Nelson, and Haines to Whitehorse, and the local Alaska border traffic.

All the above growth rates for truck traffic on segments of the Alaska Highway combine to an overall 3.5 percent growth rate for the truck traffic on the Highway between now and 1985.

The "normal" passenger traffic was projected according to the following growth rates:

1. A 4.5 percent rate of growth was projected for tourists and visitors from the United States to Alaska.

2. The passenger traffic from Alaska to the United States by Alaska residents was projected at a 4 percent growth rate, in accordance with our estimates of population and income growth for Alaska.

3. The passenger traffic from Yukon to Alaska was forecasted to grow at an annual rate of 4 percent, as was traffic of Canadian vacationers to Alaska.

4. The growth of the local passenger traffic was projected in line with recent growth experience as follows:

   a. A 7 percent annual growth rate for the passenger traffic from Dawson Creek to Fort Nelson.

   b. A 6 percent annual growth rate for the traffic from Whitehorse to Mile 925.

   c. A 3 percent annual growth rate for the local traffic from Dawson Creek and Carcross Road to Whitehorse.

   d. A 2 percent annual growth rate for the traffic from Watson Lake to Whitehorse.

All these particular growth rates resulted in a total, normal annual growth rate of 4.1 percent for passenger traffic on the Alaska Highway.

Generated Benefits

The only benefits related to generated truck traffic are assumed to be additional exports of food products, primarily, from Canada to Alaska. These exports were assumed to total approximately $1 million per year following the completion of the Highway. The benefits attributable to such increased exports were estimated at approximately 12 percent of the gross value of the export, and they consist of: (1) savings to Alaskan consumers who import from alternate destinations, and (2) additional profits to Canadian producers.

The major portion of generated benefit is assumed to stem from increased tourism in the area. After a period of slower growth during the construction period, tourist travel is expected to expand rapidly after completion of the improvement program--at a rate of approximately 15 percent per year until 1985, and perhaps beyond. That portion of tourist travel which exceeds what could have been expected without the improvement program constitutes the major source of generated benefits. The benefits attributable to this excess portion of tourist traffic are estimated to amount to approximately 10 percent of the gross spending in the area, or approximately $3.52 per tourist party per day. It is also assumed that the improved facilities on the Highway will induce a level of spending per tourist approximately 25 percent higher than that existing currently. As was pointed out earlier, only the net profit portion of total spending amounting to 10 percent of revenues can be assumed to constitute benefits derived from increased tourism. The remaining 90 percent represents the cost of resources that could have been invested elsewhere and perhaps made to produce equivalent profits.

In addition to the measurable benefits attributable to tourist traffic, there are intangible benefits derived from such traffic in the form of consumer enjoyment that are reaped by the visitors to the area. The theory of consumer surplus merely indicates that the consumption of a product or a service by a consumer involves a sharing of benefits between the vendor and the consumer. However, in this, as in most other cases of consumer surplus, the benefits to the consumer cannot be quantified.

Discounting the Costs and Benefits

As indicated in the previous chapter, all of the costs and benefits related to this improvement program will be discounted at a rate of 4.2 percent per year. Since costs tend to precede the generation of benefits, such discounting at first seems to widen the gap between costs and benefits; however, to equate current costs with future benefits would be totally unrealistic. If another discount rate seems more appropriate, such a rate could be substituted in Table 47.

Table 47

BENEFIT-COST EVALUATION OF ALTERNATIVES B AND C
1966-1985

	Alternative B				Alternative C			
	Cost Alternative B Minus		Present Value		Cost Alternative C Minus		Present Value	
Year	Cost Alternative A	Benefits	Costs	Benefits	Cost Alternative A	Benefits	Costs	Benefits
1966	$ 7,070,700	$ -16,311	$ 6,785,701	$ -15,654	$ 6,363,600	$ -16,311	$ 6,107,102	$ -15,654
1967	13,117,300	73,426	12,080,770	67,623	12,387,700	129,174	11,408,822	118,966
1968	19,624,000	248,917	17,344,882	220,008	18,871,900	383,755	16,680,130	339,186
1969	18,823,600	528,276	15,967,088	448,109	18,049,000	797,199	15,310,034	676,222
1970	15,615,300	827,562	12,711,902	673,691	14,818,200	1,240,671	12,063,008	1,009,989
1971	16,305,000	1,108,759	12,738,281	866,218	15,485,400	1,664,847	12,097,968	1,300,662
1972	15,920,600	1,424,233	11,937,167	1,067,880	15,078,500	2,132,093	11,305,765	1,598,628
1973	15,947,300	1,765,721	11,474,529	1,270,484	15,082,700	2,636,435	10,852,424	1,896,987
1974	12,862,900	2,138,579	8,882,605	1,476,817	11,975,800	3,183,497	8,270,008	2,198,396
1975	4,773,600	2,474,715	3,163,419	1,639,969	3,868,000	3,693,699	2,563,286	2,447,777
1976	-1,875,100	3,181,510	-1,192,584	2,023,472	-2,100,000	4,508,307	-1,335,686	2,867,329
1977	-3,890,800	3,580,725	-2,374,756	2,185,499	-415,800	4,985,219	-2,512,084	3,042,734
1978	-4,004,500	3,794,981	-2,345,654	2,222,926	-4,229,500	5,258,065	-2,447,448	3,079,932
1979	-4,118,200	4,179,971	-2,315,026	2,349,750	-4,343,200	5,722,388	-2,441,508	3,216,812
1980	-4,231,900	4,611,995	-2,283,071	2,488,125	-4,456,900	6,243,687	-2,404,456	3,368,407
1981	-4,345,600	5,112,298	-2,249,741	2,646,662	-4,570,600	6,835,504	-2,366,224	3,538,775
1982	-4,459,300	5,657,688	-2,215,691	2,811,130	-4,685,300	7,475,447	-2,327,486	3,714,318
1983	-4,575,000	6,300,267	-2,180,630	3,004,269	-4,798,000	8,229,570	-2,287,921	3,924,254
1984	-4,686,700	7,042,560	-2,144,747	3,222,845	-4,911,700	9,094,162	-2,247,711	4,161,707
1985	-4,800,400	7,868,200	-2,108,213	3,455,508	-5,025,400	10,054,096	-2,207,026	4,415,498
Total			$91,676,231	$ 34,125,331			$84,050,998	$ 46,900,925
Present value of net benefits				-57,550,900				-37,150,073
Benefit - cost ratio			0.372				0.558	

The costs of reconstructing, paving and maintaining the existing Highway are shown as annual costs for Alternative B or C minus the cost involved under Alternative A. Alternative A, as indicated, is simply the maintenance of the Highway in its present condition. Thus the annual costs shown in this tabulation are net additional costs that would be incurred under either Alternative B or C.

As shown in Table 48, in both projects--Alternatives B and C--the cost saving benefits (user benefits) from normal traffic, predominate over the volume increasing benefits. These user benefits are 64 percent of total benefits in 1985 for Alternative B and 72 percent in Alternative C due to substantial shortening of the Highway. In both cases the user benefits from passenger traffic are greater than those from truck traffic.

The generating benefits--volume increasing benefits--arise mostly from increased tourist expenditures since the generated benefits from truck traffic are less than 2 percent of the total benefits. The cost saving benefits for earlier years have an even greater share of the total, since the generated benefits increase rapidly after the completion of the paving.

Allocation of Benefits as Between Canada and the United States

The purpose of this chapter is to indicate precisely how the benefits will be allocated between Canada and the United States. There are two principles that will be followed in allocating the cost saving benefits generated by the improvement program. With respect to passenger car traffic, the beneficiaries will be assumed to be the operators or owners of the vehicle, and the allocation will be made on the basis of the registration of the passenger cars involved.

With respect to truck traffic, however, the basic assumption will be that the beneficiary is the receiver of the goods carried by the vehicle. In the case of truck traffic, the savings experienced by the operator will be temporary only, since competition will force the operators of commercial trucks to pass on their savings to the consumer. The very competiveness of the trucking business throughout North America would seem to ensure that such savings are passed on promptly to the shippers or receivers. With respect to local trucking, this distinction as to the identity of the beneficiary--whether the operator or the receiver of goods carried by the truck--is quite immaterial; in both cases, the beneficiary will be the area in which the truck operation occurred. The distinction is of great importance, however, in relation to commercial trucking operations where long-haul deliveries are made to destinations in British Columbia, Yukon Territory, or Alaska.

Generated Benefits

Generated truck benefits, derived from increased exports of food products from Canada to Alaska,will be allocated equally to Canada and

Table 48

COMPOSITION OF BENEFITS ON THE IMPROVEMENT OF THE ALASKA HIGHWAY
1985

	Alternative B	Relative Percentages	Alternative C	Relative Percentages
Cost-saving benefits				
Truck traffic	$1,942,596	24.7%	$ 2,982,620	29.6%
Passenger traffic	3,094,924	39.3	4,240,796	42.2
Subtotal	$5,037,520	64.0%	$ 7,223,416	71.8%
Volume-increasing benefits				
Truck traffic	120,000	1.5	120,000	1.2
Passenger traffic	2,710,680	34.5	2,710,680	27.0
Subtotal	$2,830,680	36.0%	$ 2,830,680	28.2%
Total	7,868,200	100.0	10,054,096	100.0

the United States. The Alaskan benefits represent savings to the consumer over imports from other sources, whereas the Canadian benefits represent net profits derived from the additional production of goods and services. There is no precise way of estimating the sharing of benefits in the case of additional export trade; however, a 50-50 split of the benefits appears reasonable, particularly since it emphasizes the point that the benefits from increased foreign trade never accrue entirely to one country or the other.

Assuming identical daily expenditure patterns for vacationers both in Alaska and in the Yukon, the monetary-generated benefits attributable to increased tourism will be allocated in accordance with the time spent by the Highway vacationers in Alaska and in Canadian territory. In accordance with present travel patterns, a length of stay in Alaska of ten days will be assumed for all the Highway vacationers; the time spent on the Alaska Highway will be six days for all the vacationers originating in the United States and five days for those originating in Canadian territory. The shorter span of time for Canadian vacationers takes into account that 22 percent of these vacationers are from the Yukon Territory.

Intangible benefits accruing to individual travelers will also be shared, but a large portion of these nonmonetary benefits from the convenience of traveling on a paved road will accrue to the United States (the point of origin for the majority of the additional travelers).

A full tabulation of the allocated benefits is presented in Table 49.

Allocation of Benefits among Provinces and Territories

The original concept of the research study, as stated in the proposal for research submitted by the Institute, envisaged an apportioning of the Canadian benefits among the various provinces and territories. This has not proved feasible for two reasons: (1) the existing data on Highway traffic cannot be projected for 20 years hence with any degree of certainty as to the nature of the movements and the precise destinations thereof; and (2) even if such projections could be made, the resulting allocations would be somewhat misleading. The reasons for these conclusions are the following:

1. The analysis of traffic indicated that--with the exception of through traffic to Alaska--a good proportion of the traffic on the Highway is of a temporary nature, in the sense that the projects and activities associated with the movements often last only for short periods of time. In addition, if the Highway improvement program adopted involves considerable Highway relocation, the actual pattern of supply traffic to the area served may be altered, as some communities are abandoned and new communities are established. Such a foreknowledge of the destination of traffic is necessary to allocate benefits within the area, because, in the case of commercial traffic, the recipients of the goods carried are the beneficiaries of the Highway

Table 49

ALLOCATION OF BENEFITS BETWEEN CANADA AND THE UNITED STATES
1966-1985

Year	Alternative B				Alternative C			
	United States Benefits	Present Value of United States Benefits	Canadian Benefits	Present Value of Canadian Benefits	United States Benefits	Present Value of United States Benefits	Canadian Benefits	Present Value of Canadian Benefits
1966	$ -10,313	$ -9,898	$ -5,998	$ -5,756	$ -10,313	$ -9,898	$ -5,998	$ -5,756
1967	26,455	24,364	46,971	43,259	52,538	48,386	76,636	70,580
1968	101,473	89,688	147,444	130,320	163,896	144,861	219,859	194,325
1969	221,708	188,063	306,568	260,046	345,293	292,894	451,906	383,328
1970	349,759	284,727	477,803	388,964	538,683	438,524	701,988	571,465
1971	468,784	366,238	639,975	499,980	721,440	563,625	943,407	737,037
1972	602,252	451,564	821,981	616,316	922,852	691,948	1,209,241	906,680
1973	745,425	536,353	1,020,296	734,131	1,137,569	818,512	1,498,866	1,078,475
1974	900,829	622,076	1,237,750	854,741	1,370,105	946,140	1,813,392	1,252,256
1975	1,039,325	688,750	1,435,390	951,219	1,584,301	1,049,900	2,109,398	1,397,877
1976	1,415,566	900,314	1,765,944	1,123,158	2,005,987	1,275,828	2,502,320	1,591,501
1977	1,649,698	1,006,895	1,931,027	1,178,604	2,273,796	1,387,814	2,711,423	1,654,920
1978	1,741,164	1,019,894	2,053,817	1,203,032	2,387,955	1,398,754	2,870,110	1,681,178
1979	1,963,457	1,103,748	2,216,514	1,246,002	2,649,976	1,489,671	3,072,412	1,727,141
1980	2,217,439	1,196,286	2,394,556	1,291,839	2,947,890	1,590,357	3,295,797	1,778,050
1981	2,511,245	1,300,084	2,601,053	1,346,578	3,290,536	1,703,527	3,544,968	1,835,248
1982	2,848,944	1,415,552	2,808,744	1,395,578	3,682,548	1,829,744	3,792,899	1,884,574
1983	3,237,456	1,543,774	3,062,811	1,460,495	4,131,689	1,970,188	4,097,881	1,954,066
1984	3,690,743	1,688,973	3,351,817	1,533,872	4,652,666	2,129,172	4,441,496	2,032,535
1985	4,197,981	1,843,644	3,670,219	1,611,864	5,235,688	2,299,378	4,818,408	2,116,120
Total		$16,261,089		$17,864,242		$22,059,325		$24,841,600
Percentage of total benefits		47.7%		52.3%		47.0%		53.0%

improvement. Somewhat the same consideration applies to local passenger traffic, where the future distribution of population will be a deciding factor.

2. The second conclusion--that such allocations, even if made, would be misleading--is an even stronger factor against making a precise allocation. One of the basic findings of this study is that the vast majority of benefits generated by the program would accrue directly to the area served by the Highway. While it is true, of course, that a portion of the Highway is within the province of British Columbia, to allocate a portion of the benefits to British Columbia would imply that the province, as a whole, would benefit from the program. And this would not be the case. The reason for this lack of dispersion of benefits is the relatively high incidence of cost saving benefits that accrue only to direct or indirect users of the Highway.

While no precise allocation of Canadian benefits among the various provinces and territories is therefore made, it is deemed appropriate to summarize the following points concerning the probable dispersion of benefits within Canada.

1. As stated above, the vast majority of benefits accruing will be cost saving benefits, and most of the beneficiaries would be residents of the area served by the Highway.

2. Monetary benefits derived from generated tourism would accrue to the same area, except that the generation of these benefits requires not only the prior improvement of the Highway itself, but prior investment in additional tourist facilities amounting to perhaps $20 million.

3. The only Canadian benefits accruing to individuals or interests residing outside of the area served by the Highway will be those derived from increased agricultural exports to Alaska--probably originating in Alberta or British Columbia--and benefits accruing to Canadian tourists from outside the area. Both of these groups of benefits combined would constitute only a small fraction of the total Canadian benefits.

Appendix A

COMMERCIAL FREIGHT TRANSPORTATION ON THE ALASKA HIGHWAY

Table A-1

MOTOR COMMON CARRIER VEHICLE MILES AND NUMBER OF TRIPS
ON THE ALASKA HIGHWAY SEGREGATED BY MAJOR AND SMALL CARRIERS
1964

	Number of Trips			Vehicle Miles		
	Canadian	U.S.	Total	Canadian	U.S.	Total
Major carriers						
Northbound	4,878	1,470	6,348	2,270,704	1,647,555	3,918,259
Southbound	4,878	1,470	6,348	2,270,704	1,647,555	3,918,259
Total	9,756	2,940	12,696	4,541,408	3,295,110	7,836,518
Small carriers						
Northbound	1,767	338	2,105	759,193	304,425	1,063,618
Southbound	1,767	338	2,105	759,193	304,425	1,063,618
Total	3,534	676	4,210	1,518,386	608,850	2,127,236
All carriers						
Northbound	6,645	1,808	8,453	3,029,897	1,951,980	4,981,877
Southbound	6,645	1,808	8,453	3,029,897	1,951,980	4,981,877
Total	13,290	3,616	16,906	6,059,794	3,903,960	9,963,754

Source: Source of data in this table and in all tables in this appendix is Travacon Research Limited, Calgary, Alberta.

Alaska Highway Transportation Study Questionnaire

1. What type of equipment do you typically operate over the Alaska Highway? (e.g., Kenworth Diesel Tractors, 40-foot box tandem semi-trailer, flat bed, etc.)

_____

_____

_____

_____

_____

2. What would be the average or typical content weight per trip over that portion of the Highway lying between Tok, Alaska, and Dawson Creek, B.C.?

(a) Northbound _____

(b) Southbound _____

3. During 1964 how many trips per month did you operate over that portion of the Highway lying between Tok, Alaska, and Dawson Creek, B.C.?

	Northbound	Southbound	Total
January	_____	_____	_____
February	_____	_____	_____
March	_____	_____	_____
April	_____	_____	_____
May	_____	_____	_____
June	_____	_____	_____
July	_____	_____	_____
August	_____	_____	_____
September	_____	_____	_____
October	_____	_____	_____
November	_____	_____	_____
December	_____	_____	_____

4. Would you consider 1964 to be a typical year in terms of traffic volume?

_____

If not, was it lower or higher than normal? _____

And by how much? _____

5. What proportion of Northbound loads would originate in each of the following areas?

(a) United States Pacific Northwest: _____

(b) Vancouver and surrounding area: _____

(c) Northern British Columbia: _____

(d) Alberta points: _____

(e) United States Midwest: _____

(f) Other (specify): _____

_____

_____

6. What proportion of Southbound loads would terminate at each of these points?

(a) United States Pacific Northwest: _____

(b) Vancouver and surrounding area: _____

(c) Northern British Columbia: _____

(d) Alberta points: _____

(e) United States Midwest: _____

(f) Other (specify): _____

_____

_____

7. Of Northbound traffic what proportion would terminate at the following points?

(a) Fairbanks area: _____

(b) Anchorage-Valdez area: _____

(c) Other Alaska points: _____

(d) Yukon points: _____

8. Of Southbound traffic what proportion would originate at the following points?

(a) Fairbanks area: _____

(b) Anchorage-Valdez area: _____

(c) Other Alaska points: _____

(d) Yukon points: _____

9. Of total traffic moving between Alaska/Yukon and the Lower 48, or other Canadian points, what proportion would be routed:

(a) Over the Alaska Highway: _____

(b) Via Haines and water movement _____

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10. What proportion of total trips would be comprised of trailer-load shipments versus less-than-trailer-load shipments?

    (a) Northbound trips: _____

    (b) Southbound trips: _____

11. What proportion of total traffic which you handle would move under controlled temperature conditions (i.e., requiring special trailer equipment such as reefer units)?

_____

_____

_____

12. What commodities are handled most frequently on Northbound trips over the Alaska Highway? (e.g., meat, food stuffs, clothing, household effects, etc.)

_____

_____

_____

13. What commodities are handled most frequently on Southbound trips over the Alaska Highway?

_____

_____

_____

14. What would be the average annual mileage incurred by tractors operating in Alaska Highway service?

_____

15. What would be the typical useful life in terms of both mileage and time of a tractor operating over the Alaska Highway?

_____

_____

16. What would be the average elapsed time for a tractor trailer unit moving between the following points?

	Hours
(a) Seattle and Anchorage:	_____
(b) Seattle and Vancouver:	_____
(c) Chicago and Anchorage:	_____
(d) Vancouver and Whitehorse:	_____
(e) Edmonton and Whitehorse:	_____

17. Are in-service equipment failures over the Alaska Highway sufficiently frequent to prevent making delivery commitments based on departure time? (i.e., 4th morning, 5th morning, etc.)

18. Do equipment failures occur more commonly on the paved or gravelled section of the Highway?

19. What are the most common types of equipment failure in operation over the unpaved portion of the Highway?

20. What are the typical average line haul operating costs per mile by account classification as follows?

Driver's wages	
Fuel and Oil	
Driver's Allowances	
Insurance	
Tractor Maintenance	
Trailer Maintenance	
Tire and Tubes	
Other (specify)	
Total typical average line haul costs	

21. In the event the unpaved portion of the Alaska Highway is paved how would you expect each of the cost categories to be affected in terms of operating costs per mile?

	Decrease in cents per mile
Driver's wages	
Fuel and Oil	
Driver's Allowance	
Insurance	
Tractor Maintenance	
Trailer Maintenance	
Tire and Tubes	
Other (specify)	

22. Is the cost of special protective equipment for vehicles operating over the unpaved portion a significant item of expense?

_____

If so, what would be the approximate annual cost of such equipment per tractor trailer unit?

_____

23. In the event the Highway is paved would you anticipate a major increase in truck traffic?

_____

If so, where is this traffic likely to originate and what type of commodities are most likely to be carried?

_____

_____

_____

_____

_____

24. What would be the average revenue per trailer load moving between the following points?

From Seattle to Anchorage: _____

From Chicago to Anchorage: _____

From Vancouver to Whitehorse: _____

From Anchorage to Seattle: _____

From Whitehorse to Vancouver: _____

(1) For the year 1964 please indicate the number of trips made over the Alaska Highway by principal points of origin and destination.

(a) Northbound Trips

Number of Loads	From	To
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

(b) Southbound Trips

Number of Loads	From	To
.....	.....	.....
.....	.....	.....
.....	.....	.....
.....	.....	.....

(2) What commodities are most commonly handled on northbound trips?

.....

(3) What commodities are most commonly handled on southbound trips?

.....

(4) Do you experience frequent equipment failures in operation over the Alaska Highway? .....

If so, what are the most common types?

(i).....

(ii).....

(iii).....

(5) Would you expect any reduction in your operating costs as a result of paving the highway? .....

If so, what would you estimate them to be for each of the following categories:

	Cents/Mile
Driver's wages	.....
Fuel and Oil	.....
Tractor Maintenance	.....
Trailer Maintenance	.....
Tires and Tubes	.....
Other	.....

Alaska Highway Supplemental Questionnaire

For Contract Operators

In the event you do contract hauling for other commercial highway carriers please provide the following information for 1964:

Name of Commercial Carrier for Whom Service was Performed	From	To	Number of Trips 1964
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....
.....	.....	.....	.....

Remarks

Method of Data Collection

Alaska Highway motor common carrier traffic falls into three major categories:

1. Major carriers--Any common carrier holding annual Public Service Vehicle licenses in the Yukon Territory and operating more than one heavy tractor unit, a heavy tractor being any unit weighing 10 tons or more.

2. Small licensed carriers--Any common carrier holding annual Public Service Vehicle licenses in the Yukon Territory and operating only one heavy tractor unit, a heavy tractor being any unit weighing 10 tons or more.

3. Small unlicensed carriers--Any common carrier not holding annual Public Service Vehicle licenses in the Yukon Territory but performing commercial hauling on the Alaska Highway.

The methods employed to procure information concerning the operating characteristics of the three categories of carrier were interview, questionnaire, and estimate. Naturally every attempt was made to maximize coverage through interviews and questionnaires.

Major Carriers

From the outset, it was apparent that the major carriers accounted for by far the most commercial vehicle activity on the Alaska Highway (in fact, it amounts to 79 percent of total vehicle miles). Therefore, every attempt was made to interview personally the senior operating officers of each major motor common carrier. The purpose of this interview was to procure as much information as possible on the operating experience of the carrier over the Alaska Highway. Also, during the interview the full questionnaire, as illustrated earlier, was completed.

If it became impossible to arrange a personal interview with a representative of a major motor common carrier, the full questionnaire was either left at his office of mailed to the company with an explanatory letter emphasizing the importance attached to the information being requested. Follow-up procedures, consisting of a telephone call or a second letter, were employed to expedite return of these questionnaires.

In cases where an interview could not be arranged, or where the questionnaire was not returned, it became necessary to estimate the mileages incurred by the motor common carrier in question.

A list of the major motor common carriers contacted, including those who did not submit a completed questionnaire, appears later in this appendix.

The means of collection of data from the major motor common carrier group in Alaska Highway service is tabulated below.

	Canadian Carriers	U.S. Carriers	Total
Interview and questionnaire	8	6	14
Questionnaire	--	1	1
Estimate	6	3	9
Total	14	10	24

In estimating the mileages operated by the nonreporting major Canadian motor common carriers, it was assumed that each licensed tractor in their fleet would operate 100,000 miles per year. These carriers and assumptions made for each individual carrier, which were based on the maximum information obtainable at the time, are listed below.

1. Gordie's Trucking Limited, Whitehorse, Yukon

   a. This carrier has five licensed tractors in the Yukon, but it operates out of Whitehorse in the winter only. In the summer, the operating base moves to Edmonton.

   b. For estimating purposes, it has been assumed that for the winter only, the five tractors are in Alaska service and that 50 percent of their mileage is on the Alaska Highway.

   c. The length of haul from Whitehorse is approximately 300 miles in each direction, i.e., Dawson City, Alaska Border, Watson Lake.

   d. Mileage incurred in Alaska service during the four winter months is: 1/3 x 100,000 or 33,000 miles/tractor.

   e. Therefore, the trip (100 percent empty return movement) and vehicle mileage characteristics for this carrier on the Alaska Highway are as follows:

	Trips	Mileage
Loaded		
Northbound	69	20,700
Southbound	69	20,700
Total	138	41,400
Empty		
Northbound	69	20,700
Southbound	69	20,700
Total	138	41,400

2. K & J Trucking Limited, Watson Lake, B.C.

   a. This carrier is restricted to hauling freight to Canadian Tungsten only, and has two tractors licensed in the Yukon for this purpose.

   b. If this carrier were hauling from Dawson Creek to Canadian Tungsten (a distance of 824 miles) an average of 2.5 round trips per week would be made to accumulate an average of 100,000 miles per tractor per year. However, no record exists of this carrier passing through the Watson Lake checkpoint during the three-week highway traffic sample taken in October 1964. Therefore, it is assumed that this carrier does not haul freight on the Alaska Highway.

   c. The probable hauling route for K & J Trucking Limited is from Watson Lake to Canadian Tungsten only. With two licensed tractors, this would mean five round trips per tractor per week.

3. Klondike Transport Ltd., Dawson City, Yukon

   This carrier is headquartered in Dawson City and since there is no record of any trips through Watson Lake during the three-week highway traffic sample, it is assumed that its trips originate at Whitehorse only. Thus, no significant mileage is recorded on the Alaska Highway.

4. H.M. Olson Trucking, Whitehorse, Yukon, and Russell Transport (Yukon) Ltd., Whitehorse, Yukon

   a. These two carriers have two and three tractors licensed in the Yukon respectively, but there is no indication that they hauled through Watson Lake.

   b. For estimating purposes, it has been assumed that 50 percent of their mileage is on the Alaska Highway.

   c. The length of haul from Whitehorse is approximately 300 miles in each direction, i.e., Dawson City, Alaska Border, Watson Lake.

   d. Mileage incurred in Alaska Highway service in a typical year is 1/2 x 100,000 or 50,000 miles/tractor.

   e. Therefore, the trip (100 percent empty return movement) and vehicle mileage characteristics on the Alaska Highway for these two carriers are as follows:

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	Trips	Mileage
Loaded		
Northbound	208	62,400
Southbound	208	62,400
Total	416	124,800
Empty		
Northbound	208	62,400
Southbound	208	62,400
Total	416	124,800

5. Tamac Freightlines Ltd., Edmonton, Alberta

   a. During the three-week Highway sample at Watson Lake, this carrier made seven return trips to Whitehorse.

   b. This carrier has three tractors licensed in the Yukon.

   c. From its base in Edmonton, a return trip to Whitehorse is 2,578 miles.

   d. If the frequency of trips throughout the year is similar to that in the three-week sample period, this carrier would make 119 trips, or accumulate 119 x 2,578 = 306,782 vehicle miles between Edmonton and Whitehorse. (This would average 102,000 per tractor per year, which is a realistic target for the industry.)

   e. The empty return movement characteristics of this carrier would be similar to those of Canadian Freightways, i.e., 87 percent of southbound trips are empty.

   f. Therefore, Alaska Highway trip and vehicle mileage characteristics for this carrier are as follows:

		Mileage	
	Trips	Total	Unpaved Alaska Highway
Loaded			
Northbound	119	153,391	99,722
Southbound	16	20,624	13,408
Total	135	174,015	113,130
Empty			
Northbound	--	--	--
Southbound	103	132,767	86,314
Total	103	132,767	86,314

As in the case of Canadian carriers, in estimating mileages for the nonreporting major U.S. common carriers, an average of 100,000 per year per licensed tractor was assumed. These carriers and the assumptions made for each individual carrier are listed below.

1. F.A.S. Transportation Limited, Bellevue, Washington

    a. The number of trips made by this carrier will be 2.3 times the number of reported trips at the government scale at Tok Junction.

    b. Distance traveled on the Canadian portion of the Alaska Highway on all trips is 1,140 for the main route and 205 on the Panhandle route.

    c. Trips reported at scale, 27; estimated total trips, 62, of which main route, 54, Panhandle route, 8.

    d. On the main route, northbound trips are loaded and 10 percent of southbound trips are loaded. On the Panhandle route, all northbound trips are empty and all southbound trips are loaded.

2. Glendenning Motorways, Inc., St. Paul, Minnesota

    a. The number of trips made by this carrier will be 2.3 times the number of reported trips at the government scale, at Tok Junction.

    b. Distance traveled on the Canadian portion of the Alaska Highway on all trips is 1,140 for the main route and 205 on the Panhandle route.

    c. Trips reported at scale, 24; estimated total trips, 56.

    d. All of the northbound trips are loaded and 25 percent of the southbound trips are loaded.

3. Wrightway Auto Carriers, Anchorage, Alaska

    a. The number of trips made by this carrier will be 2.3 times the number of reported trips at the government scale at Tok Junction.

    b. Distance traveled on the Canadian portion of the Alaska Highway on all trips is 1,140 for the main route and 205 on the Panhandle route.

    c. Trips reported at scale, 48; estimated total trips, 110.

    d. Both northbound and southbound trips are 100 percent loaded.

Small Licensed Carriers

Although there were virtually the same number of small unlicensed carriers as there were major carriers, it was evident at the outset that they accounted for a small portion of total commercial vehicle activity on the Alaska Highway (in fact, they constituted only 10 percent of total vehicle miles). Hence, although every attempt was made to interview representatives of each of these carriers personally, the necessity of follow-up was not considered as vital as in the cases of the major carriers.

If a personal interview was not possible, the full questionnaire was either left at the office of the carrier or mailed directly. If, after two to three weeks, the questionnaire was not returned, an abbreviated questionnaire as shown earlier was mailed with a second letter of explanation and self-addressed envelope.

In cases where even the abbreviated questionnaire was not returned, it became necessary to estimate the mileages incurred by the carriers in question.

A list of the small licensed motor common carriers contacted, including those who did not submit a completed questionnaire, appears later in this appendix.

The degree of coverage achieved in this category of common carrier is tabulated below.

	Canadian Carriers	U.S. Carriers	Total
Interview and questionnaire	4	1	5
Questionnaire	7	2	9
Estimate	5	2	7
Total	16	5	21

As in the case of the major carriers, in estimating mileages for the small licensed motor common carriers an average of 100,000 miles per year per licensed tractor was assumed. The assumptions made for each individual carrier are listed below.

1. Antonio Fekette, Whitehorse, Yukon, and Lorne D. Harper, Whitehorse, Yukon

   a. There was no record of these two carriers passing through the Watson Lake Highway checkpoint.

   b. It is assumed that 50 percent of mileage is on the Alaska Highway and the loaded movement is in one direction only.

c. Trip and vehicle mileage characteristics are as follows:

	Trips	Mileage
Loaded		
Northbound	84	25,200
Southbound	84	25,200
Total	168	50,400
Empty		
Northbound	84	25,200
Southbound	84	25,200
Total	168	50,400

2. Highway Distributors, Watson Lake, Yukon

a. There was no record of this carrier passing through the Watson Lake Highway checkpoint.

b. It is assumed that two-thirds of mileage is on the Alaska Highway and the loaded movement is in one direction only.

c. Trip and vehicle mileage characteristics are as follows:

	Trips	Mileage
Loaded		
Northbound	110	33,000
Southbound	--	--
Total	110	33,000
Empty		
Northbound	--	--
Southbound	110	33,000
Total	110	33,000

3. Thos. Osborne, Grande Prairie, Alberta

a. There was no record of this carrier passing through the Watson Lake Highway checkpoint.

b. It is assumed that 50 percent of mileage is on the Alaska Highway and the loaded movement is in the northbound direction only.

c. Trips are made only to Alaska Border, because of restricted license.

d. Trip and vehicle mileage characteristics are as follows:

	Trips	Mileage
Loaded		
Northbound	20	22,800
Southbound	--	--
Total	20	22,800
Empty		
Northbound	--	--
Southbound	20	22,800
Total	20	22,800

4. Scandia Trucking Ltd., Edmonton, Alberta

a. There was no record of this carrier passing through the Watson Lake Highway checkpoint.

b. It is assumed that 50 percent of mileage is on the Alaska Highway and the loaded movement is in the northbound direction only.

c. Trips are to Whitehorse only.

d. Trip and vehicle mileage characteristics are as follows:

	Trips	Mileage
Loaded		
Northbound	20	16,760
Southbound	--	--
Total	20	16,760
Empty		
Northbound	--	--
Southbound	20	16,760
Total	20	16,760

Small Unlicensed Carriers

After some familiarity with the operations of the major carriers and the small licensed carriers, it became quite apparent that the small unlicensed carriers, although an important element in Alaska Highway motor common vehicle activity, did not play a major role in this transportation picture (in fact, they account for only 11 percent of total vehicle miles). Secondly, since they are not licensed in the Yukon, there were no reliable records available from which names and addresses could be taken to identify and trace the carriers in question. The only official Yukon government records that gave some clue as to names and locations of unlicensed carriers were copies of the Freight Vehicle Permits and Through Freighter Permits that were sold to unlicensed carriers as a permit to use the highway for a single trip. Unfortunately, the sale of permits cannot be rigidly policed so the permit receipt proved to be an inadequate source of information for tracing unlicensed carriers using the Alaska Highway.

To simplify the tracing job and to adapt the estimating to the information available, the unlicensed carriers were divided into two groups, Canadian and U.S., and vehicle mileage estimates for each group of carriers was made.

During a three-week period in October 1964, the Yukon government conducted a 24-hour highway check of all commercial vehicles passing through Watson Lake, Yukon. This check recorded the name and address of the carrier, the date the trip was made, and the total number of miles the carrier was going to operate in the Yukon on the round trip. By eliminating the carriers who were already covered in the "major" or "small licensed" categories, private carriers, and carriers operating small (under 10 tons) equipment, it was possible to develop an excellent statistical picture of the operations of the small unlicensed Canadian carriers on the Alaska Highway during the three-week sample period.

After confirming that the sample period was representative of the general commercial highway traffic volumes during the rest of the year, an expansion factor of 17.33 was applied to the data to provide an estimate of annual vehicle mileages on the Alaska Highway for small unlicensed Canadian motor carriers.

The Alaska Public Service Commission operates a scale at Tok, Alaska. Data compiled here show the date the vehicle entered Alaska, the name of the carrier, and its destination point. By eliminating Canadian carriers, carriers who were already covered in the "major" and "small licensed" categories, private carriers, and carriers operating small (under 10 tons) equipment, it was possible to develop an excellent statistical picture of the operations of the small unlicensed U.S. motor common carriers on the Alaska Highway during 1964. To correct for the deficiency in these data resulting from the fact that the scale was closed during the night and hence had no record of carriers passing Tok during the nighttime hours, a comparison was made with the mileages of six specific carriers for which

complete data was available through interviews and questionnaires. The resulting correction factor was then applied to the data in question and a total volume estimate, as a function of volume through the scale, was made. This was verified through a favorable comparison with the Watson Lake checkpoint records and through a comparison with total vehicle counts reported at the U.S. Customs Office at Tok, which records the movement of every passing vehicle. Further refinements were made to the correction factor and a final estimate, based on 2.3 times the reported vehicle count at the Tok scale, was made to arrive at the annual vehicle mileage operated over the Alaska Highway by unlicensed U.S. motor common carriers.

Major Motor Common Carriers Holding Annual Public Service Vehicle Licenses For Operation Within and Through the Yukon Territory*

Canadian Carriers Responding to Interviews and Questionnaires

1. Alaska Highway Express Co. Ltd.
   12114 - 68 Street
   Edmonton, Alberta

2. Bartz Transport Ltd.
   Box 4001
   9807 - 62 Avenue
   South Edmonton, Alberta

3. Canadian Freightways Ltd.
   411 Meredith Road
   Calgary, Alberta

4. Loiselle Transport Limited
   (incl. British Yukon Navigation Co. Ltd.)
   P.O. Box 358
   Dawson Creek, B.C.

5. Warren Nelson Transport Ltd.
   Dawson Creek, B.C.

6. Rempel Trail Transportation Limited
   8710 - 126 Avenue
   Edmonton, Alberta

7. Robertson Transport Limited
   1425 - 97th Avenue
   Dawson Creek, B.C.

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* A major motor common carrier is defined as any company holding annual Public Service Vehicle licenses in the Yukon Territory and operating more than one heavy tractor unit, a heavy tractor unit being any unit weighing ten tons or more.

Table A-2

ACTUAL AND ESTIMATED VEHICLE MILES OPERATED
OVER THE UNPAVED PORTION OF THE ALASKA HIGHWAY
1964

	Reported Mileage	Estimated Mileage	Total Mileage	Estimated Mileage as Percent of Total Mileage
Canadian carriers				
General freight	2,586,354	1,446,272	4,032,626	35.9%
Bulk petroleum	1,809,436	--	1,809,436	--
House trailers	102,712	--	102,712	--
Household effects	115,020	--	115,020	--
Automobile haulers	--	--	--	--
Total	4,613,522	1,446,272	6,059,794	23.9
U.S. carriers				
General freight	2,957,090	340,390	3,297,480	11.5
Bulk petroleum	--	--	--	--
House trailers	93,480	210,170	303,650	69.2
Household effects	88,920	5,180	94,100	5.5
Automobile haulers	62,400	146,330	208,730	70.1
Total	3,201,890	702,070	3,903,960	17.9
All carriers				
General freight	5,543,444	1,786,662	7,330,106	24.4
Bulk petroleum	1,809,436	--	1,809,436	--
House trailers	196,192	210,170	406,362	51.8
Household effects	203,940	5,180	209,120	2.5
Automobile haulers	62,400	146,330	208,730	70.1
Total	7,815,412	2,148,342	9,963,754	21.6

Table A-3

ALASKA HIGHWAY MILEAGES

City	Continuous Mileage	Interval Mileage
Dawson Creek	0	--
Fort St. John	49	49
Mile #80 (end of paving)	80	31
Fort Nelson	300	220
Watson Lake	634	334
Whitehorse	918	284
Haines Junction	1,015	97
Alaska Border	1,220	205
Tok Junction	1,317	97
Fairbanks	1,525	208
Anchorage	1,641	324
Haines Junction Gateway	0	--
Haines Junction	158	158
Whitehorse	0	--
Stewart Crossing	211	211
United Keno	275	64
Dawson Creek	321	110
Edmonton - Dawson Creek		371
Vancouver - Dawson Creek		759
Seattle - Dawson Creek		908
Midwest Gateway (Coutts) - Dawson Creek		798
Prairie Gateway (Portal) - Dawson Creek		1,187

8. H.M. Trimble & Sons Ltd.
   1510 - 40 Avenue SE
   Calgary, Alberta

Canadian Carriers Not Responding to Interviews and Questionnaires

1. Gordie's Trucking Ltd.
   Whitehorse, Yukon

2. K & J Trucking Ltd.
   Watson Lake, Yukon

3. Klondike Transport Ltd.
   Dawson City, Yukon

4. H.M. Olson Trucking Ltd.
   Box 669
   Whitehorse, Yukon

5. Russel Transport (Yukon) Ltd.
   Box 838
   Whitehorse, Yukon

6. Tamac Freightlines
   11716 - 103 Avenue
   Edmonton, Alberta

U.S. Carriers Responding to Interviews and Questionnaires

1. Alaska Auto Transport
   501 "C" Street
   Fairbanks, Alaska

2. Consolidated Freightways Corporation of Delaware, Inc.
   Anchorage, Alaska

3. Hill & Hill Truck Lines, Inc.
   Houston, Texas

4. K & W Trucking Inc.
   Box 501
   Anchorage, Alaska

5. Lynden Transfer, Inc.
   P.O. Box 433
   Lynden, Washington

6. North American Van Lines, Inc.
   Fort Wayne, Indiana

7. Weaver Bros. Transport
   Anchorage, Alaska

U.S. Carriers Not Responding to Interviews and Questionnaires

1. F.A.S. Transportation Ltd.
   129 - 99th Northeast
   Bellevue, Washington

2. Glendenning Motorways Inc.
   c/o Ar-Dee Alaska Truck Lines, Inc.
   1515 East Ivy Street
   St. Paul, Minnesota

3. Wrightway Auto Carriers
   526 Denali Street
   Anchorage, Alaska

Small Motor Common Carriers Holding Annual Public Service Vehicles Licenses For Operation Within and Through the Yukon Territory*

Canadian Carriers Responding to Interviews and Questionnaires

1. Alberta Trailer Co. Ltd.
   1243 - 48 Avenue NE
   Calgary, Alberta

2. Murray O. Boyd
   Fort St. John, B.C.

3. Capital Transport Ltd.
   200 - 12418 - 118 Avenue
   Edmonton, Alberta

4. J. H. Christy
   Watson Lake, Yukon

5. Fred Loucks Trucking Service
   2750 Aldergrove-Bellingham Highway
   Aldergrove, B.C.

6. Art Mohr Trucking Ltd.
   Dawson Creek, B.C.

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* A small motor carrier is defined as any company holding annual Public Service vehicle licenses in the Yukon Territory, and operating only one heavy tractor unit, a heavy tractor being any unit weighing ten tons or more.

7. Torval Moncrieff
   13532 - 120 Street
   Edmonton, Alberta

8. R. D. Moore
   Dawson Creek, B.C.

9. Douglas R. Rushfeldt
   Box 1005
   Whitehorse, Yukon

10. Norrie Simpson
    Fort Nelson, B.C.

11. Donald Taylor
    Watson Lake, Yukon

Canadian Carriers Not Responding to Interviews and Questionnaires

1. Antonio Fekette
   Box 2227
   Whitehorse, Yukon

2. Hiway Distributors Ltd.
   Watson Lake, Yukon

3. Lorne D. Harper
   Box 271
   Whitehorse, Yukon

4. Thos. S. Osborne
   Grande Prairie, Alberta

5. Scandia Trucking Ltd.
   Box 4191
   Edmonton, Alberta

U.S. Carriers Responding to Interviews and Questionnaires

1. Arctic Motor Freight, Inc.
   Box 6243
   Anchorage, Alaska

2. Al Renk & Sons, Inc.
   2922 Commercial Drive
   Anchorage, Alaska

3. A. F. Tischer
   Spenard, Alaska

U.S. Carriers Not Responding to Interviews and Questionnaires

1. O. G. Ness Truck Co.
   Box 41
   Valdez, Alaska

2. Persinger Transport Co.
   Box 277
   College, Alaska

Table A-4

NUMBER OF TRIPS AND VEHICLE MILES OPERATED BY MOTOR COMMON CARRIERS
OVER THE UNPAVED PORTION OF THE ALASKA HIGHWAY
1964

	Number of Trips			Vehicle Miles		
	Canadian	U.S.	Total	Canadian	U.S.	Total
Loaded						
Northbound	5,769	1,802	7,571	2,744,869	1,950,750	4,695,619
Southbound	1,987	1,054	3,041	813,884	1,139,335	1,953,219
Total	7,756	2,856	10,612	3,558,753	3,090,085	6,648,838
Empty						
Northbound	876	6	882	285,028	1,230	286,258
Southbound	4,658	754	5,412	2,216,013	812,645	3,028,658
Total	5,534	760	6,294	2,501,041	813,875	3,314,916
Total						
Northbound	6,645	1,808	8,453	3,029,897	1,951,980	4,981,877
Southbound	6,645	1,808	8,453	3,029,897	1,951,980	4,981,877
Total	13,290	3,616	16,906	6,059,794	3,903,960	9,963,754
Percent Loaded						
Northbound	86.8%	99.7%	89.6%	90.6%	99.9%	94.3%
Southbound	29.9	58.4	36.0	26.9	58.3	39.2
Average	58.0%	81.2%	62.8%	58.7%	79.1%	66.7%

Table A-5

ORIGIN AND DESTINATION OF MOTOR COMMON CARRIER LOADED VEHICLE MILES OVER THE UNPAVED PORTION OF THE ALASKA HIGHWAY
1964

	Destination		
	Canadian Alaska Highway Communities	State of Alaska	Total
Northbound traffic origin			
Vancouver area	250,822	71,090	321,912
Calgary-Edmonton area	1,132,225	111,737	1,243,962
Other Prairie points	49,841	47,443	97,284
Canadian Alaska Highway communities	981,303	87,780	1,069,083
U.S. Pacific Northwest	--	1,274,820	1,274,820
Other U.S. points	--	651,328	651,328
State of Alaska	--	8,830	8,830
Total	2,414,191	2,253,028	4,667,219

	Origin		
	Canadian Alaska Highway Communities	State of Alaska	Total
Southbound traffic destination			
Vancouver area	251,122	1,209	252,331
Calgary-Edmonton area	68,474	1,489	69,963
Other Prairie points	31,376	110	31,486
Canadian Alaska Highway communities	490,744	--	490,744
U.S. Pacific Northwest	--	1,034,664	1,034,664
Other U.S. points	--	101,676	101,676
State of Alaska	--	755	755
Total	841,716	1,139,903	1,981,619

	And		
	Canadian Alaska Highway Communities	State of Alaska	Total
Total traffic between			
Vancouver area	501,944	72,299	574,243
Calgary-Edmonton area	1,200,699	113,226	1,313,925
Other Prairie points	81,217	47,553	128,770
Canadian Alaska Highway communities	1,472,047	87,780	1,559,827
U.S. Pacific Northwest	--	2,309,484	2,309,484
Other U.S. points	--	753,004	753,004
State of Alaska	--	9,585	9,585
Total	3,255,907	3,392,931	6,648,838

Table A-6

ORIGIN AND DESTINATION BY PERCENT OF MOTOR COMMON CARRIER LOADED VEHICLE MILES OVER THE UNPAVED PORTION OF THE ALASKA HIGHWAY
1964

	Destination		
	Canadian Alaska Highway Communities	State of Alaska	Total
Northbound traffic origin			
Vancouver area	10.4%	3.1%	6.9%
Calgary-Edmonton area	46.9	5.0	26.7
Other Prairie points	2.1	2.1	2.1
Canadian Alaska Highway communities	40.6	3.9	22.9
U.S. Pacific Northwest	--	56.6	27.3
Other U.S. points	--	28.9	13.9
State of Alaska	--	0.4	0.2
Total	100.0%	100.0%	100.0%

	Origin		
	Canadian Alaska Highway Communities	State of Alaska	Total
Southbound traffic destination			
Vancouver area	29.9%	0.1%	12.7%
Calgary-Edmonton area	8.1	0.1	3.5
Other Prairie points	3.7	--	1.6
Canadian Alaska Highway communities	58.3	--	24.8
U.S. Pacific Northwest	--	90.8	52.2
Other U.S. points	--	8.9	5.1
State of Alaska	--	0.1	0.1
Total	100.0%	100.0%	100.0%

	And		
	Canadian Alaska Highway Communities	State of Alaska	Total
Total traffic between			
Vancouver area	15.4%	2.1%	8.6%
Calgary-Edmonton area	36.9	3.3	19.8
Other Prairie points	2.5	1.4	1.9
Canadian Alaska Highway communities	45.2	2.6	23.5
U.S. Pacific Northwest	--	68.1	34.7
Other U.S. points	--	22.2	11.3
State of Alaska	--	0.3	0.2
Total	100.0%	100.0%	100.0%

Table A-7

LOADED AND EMPTY VEHICLE MILEAGE BY GEOGRAPHIC SEGMENT
OF CANADIAN PORTION OF ALASKA HIGHWAY
1964

	Canadian Carriers	U.S. Carriers	Total
Loaded vehicle miles			
Dawson Creek - Fort St. John	215,240	131,614	346,854
Fort St. John - Mile #80	175,212	83,266	258,478
Mile #80 - Fort Nelson	1,251,198	591,025	1,842,223
Fort Nelson - Watson Lake	1,240,778	897,254	2,138,032
Watson Lake - Whitehorse	835,231	762,824	1,598,055
Whitehorse - Alaska Border	234,941	838,982	1,073,923
Total	3,952,500	3,304,965	7,257,565
Empty vehicle miles			
Dawson Creek - Fort St. John	210,354	34,594	244,948
Fort St. John - Mile #80	137,802	21,886	159,688
Mile #80 - Fort Nelson	934,017	155,320	1,089,337
Fort Nelson - Watson Lake	786,020	235,806	1,021,826
Watson Lake - Whitehorse	549,026	200,504	749,530
Whitehorse - Yukon Border	235,373	222,245	457,618
Total	2,852,592	870,355	3,722,947
Total vehicle miles			
Dawson Creek - Fort St. John	425,594	166,208	591,802
Fort St. John - Mile #80	313,014	105,152	418,166
Mile #80 - Fort Nelson	2,185,215	746,345	2,931,560
Fort Nelson - Watson Lake	2,026,798	1,133,060	3,159,858
Watson Lake - Whitehorse	1,384,257	963,328	2,347,585
Whitehorse - Yukon Border	470,314	1,061,227	1,531,541
Total	6,805,192	4,175,320	10,980,512

Table A-8

MOTOR COMMON CARRIER TRAFFIC DENSITY* BY GEOGRAPHIC SEGMENT
OF CANADIAN PORTION OF ALASKA HIGHWAY
1964

	Canadian Carriers	U.S. Carriers	Total
Loaded movement			
Dawson Creek - Fort St. John	4,393	2,686	7,079
Fort St. John - Mile #80	5,652	2,686	8,338
Mile #80 - Fort Nelson	5,687	2,686	8,373
Fort Nelson - Watson Lake	3,715	2,686	6,401
Watson Lake - Whitehorse	2,941	2,686	5,627
Whitehorse - Alaska Border	823	2,778	3,601
Average	3,240	2,709	5,949
Empty movement			
Dawson Creek - Fort St. John	4,293	706	4,999
Fort St. John - Mile #80	4,445	706	5,151
Mile #80 - Fort Nelson	4,246	706	4,952
Fort Nelson - Watson Lake	2,353	706	3,059
Watson Lake - Whitehorse	1,933	706	2,739
Whitehorse - Yukon Border	825	736	1,561
Average	2,338	713	3,051
Total			
Dawson Creek - Fort St. John	8,686	3,392	12,078
Fort St. John - Mile #80	10,097	3,392	13,489
Mile #80 - Fort Nelson	9,933	3,392	13,325
Fort Nelson - Watson Lake	6,068	3,392	9,460
Watson Lake - Whitehorse	4,874	3,392	8,366
Whitehorse - Yukon Border	1,648	3,514	5,162
Average	5,578	3,422	9,000

* Vehicle miles per mile of highway.

Table A-9

MOTOR COMMON CARRIER VEHICLE MILES ON ALASKA HIGHWAY
BY TYPE OF CARRIER
1964

	Canadian Carriers	U.S. Carriers	Total
Loaded vehicle miles			
General freight	2,531,775	2,634,600	5,166,375
Bulk petroleum	904,718	--	904,718
House trailers	51,356	155,245	206,601
Household effects	70,904	91,510	162,414
Automobile haulers	--	208,730	208,730
Total	3,558,753	3,090,085	6,648,838
Empty vehicle miles			
General freight	1,500,851	662,880	2,163,731
Bulk petroleum	904,718	--	904,718
House trailers	51,356	148,405	199,761
Household effects	44,166	2,590	46,706
Automobile haulers	--	--	--
Total	2,501,041	813,875	3,314,916
Total vehicle miles			
General freight	4,032,626	3,297,480	7,330,106
Bulk petroleum	1,809,436	--	1,809,436
House trailers	102,712	303,650	406,362
Household effects	115,020	94,100	209,120
Automobile haulers	--	208,730	208,730
Total	6,059,794	3,903,960	9,963,754

Table A-10

ALASKA HIGHWAY MOTOR COMMON CARRIER AVERAGE CONTENT WEIGHT PER LOADED VEHICLE
(Tons)
1964

	Northbound	Southbound	Total
Canadian carriers			
General freight	17.1	17.6	17.3
Bulk petroleum	21.7	22.5	21.8
House trailers	8.0	--	8.0
Household effects	10.0	10.0	10.0
Automobile haulers	--	--	--
Average	18.9	17.3	18.5
U.S. carriers			
General freight	18.4	5.7	13.4
Bulk petroleum	--	--	--
House trailers	7.0	8.0	7.1
Household effects	10.0	5.0	7.5
Automobile haulers	12.3	12.3	12.3
Average	17.7	5.8	13.0
All carriers			
General freight	18.0	9.5	14.7
Bulk petroleum	21.7	22.5	21.8
House trailers	7.5	8.0	7.6
Household effects	10.0	7.8	8.6
Automobile haulers	12.3	12.3	12.3
Average	18.3	9.9	15.6

Table A-11

TYPICAL LINE HAUL OPERATING EXPENSES FOR MOTOR COMMON CARRIERS OPERATING ON THE ALASKA HIGHWAY, BY AVOIDABLE AND NONAVOIDABLE CATEGORIES
(Cents per Vehicle Mile in Canadian Funds)
1964

	Avoidable	Nonavoidable	Total
U.S. carriers			
Drivers' wages	20.2¢	¢	20.2¢
Fuel and oil	12.5		12.5
Insurance		1.1	1.1
Equipment maintenance	11.0	1.5	12.5
Tires and tubes	6.0	1.1	7.1
Licenses		3.3	3.3
Other		1.6	1.6
Total	49.7¢	8.6¢	58.3¢
Canadian carriers			
Drivers' wages	14.0		14.0
Fuel and oil	7.5		7.5
Insurance		4.0	4.0
Equipment maintenance	8.0	1.5	9.5
Tires and tubes	5.0	1.0	6.0
Licenses		2.0	2.0
Other		1.5	1.5
Total	34.5¢	9.5¢	44.5¢

Appendix B

TOURISM IN ALASKA AND THE YUKON

Appendix B

TOURISM IN ALASKA AND THE YUKON

Introduction

In estimating the potential benefits that might be derived from paving the gravel portion of the Alaska Highway, tourism appeared to be an industry that could conceivably benefit to a considerable degree from a paving program. To measure the nature and extent of such benefits to this industry, it was first of all necessary to determine the size of the present tourist industry and then establish its normal growth picture, i.e., the growth in tourism that is likely to occur regardless of paving the Alaska Highway. The growth that could be attributable to the paving of the Highway would be derived separately and superimposed on the normal growth to constitute a total growth figure for tourism in Alaska and the Yukon. Hence, the specific objectives of the portion of the study reported in this appendix can be summarized as follows:

1. To establish the size of the present tourist market in Alaska and the Yukon.

2. To review recent developments for each type of transportation used by the tourist and indicate the outlook for the future for each area by mode of transportation.

3. To examine the existing facilities along the Alaska Highway and determine the requirements to handle the anticipated growth to 1985.

Tourism in Alaska

Alaska offers the tourist a unique combination of facilities and natural splendor. The sparsely populated tundra, Mount McKinley in the midnight sun, and the Indians and Eskimos (and the prices) are in contrast with the standard vacation resort formula of warmth and ease. This, combined with the geographic location of the state, means that most tourists to Alaska will be somewhat different from the 'typical' American traveler. Also, there is a high probability that many tourists regard their trip to Alaska as a once-in-a-lifetime effort. The tourist surveys strongly suggest this is true.

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The Tourist Market

As indicated above, most tourists to Alaska have not been there previously. The 1964 survey showed that only 15 percent of all tourists to Alaska had made the trip before. A comparable figure for Alberta is 41 percent and for British Columbia, 75 percent. Since Alaska has only recently become a state, care should be used in the interpretation of this data, but the strong suggestion is that the typical tourist does not return. The implication follows that the state may receive poor word-of-mouth promotion, which could be an important negative impact on Alaskan tourism. However, the historical growth of tourist traffic to Alaska has been impressive.

Comparison of data from a 1953 tourist survey with that of the 1963-64 study supports the conclusion that total tourist traffic showed an annual rate of increase of about 12 percent over the decade 1953 to 1963. Statistics on the estimated numbers of tourists visiting Alaska in the summers of 1953, 1963, 1964, and 1965 are tabulated below.

Year*	Number of Tourists
1953	20,200
1963	88,000
1964	71,000
1965	75,000

It can also be seen that a large drop in tourist traffic occurred in 1964. The earthquake suspended the plans of many tourists, and tourism has not yet fully recovered. This evidence of the extreme sensitivity of the Alaskan tourist market could indicate the marginal acceptability of the relatively costly and arduous trip. A drastic change in the composition of tourists with respect to their primary purpose for visiting Alaska also occurred in 1964. The number of persons traveling to visit friends and relatives increased sharply, while those simply making the trip as a vacation decreased even more sharply than the figures in the tabulation indicate.

Method of Travel

The most frequent method of travel for the Alaska tourist has shown some remarkable changes over the past decade. The 1953 survey showed that some 57 percent of all tourists traveled by steamship to the state.

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* The rate of increase in period 1953 to 1965 was 11.6 percent per year.

In 1964, only 25 percent arrived by ship*. The tabulation below shows the comparative data for each means of travel for summers of 1953 and 1964.

Principal Means of Travel†	Percentages 1953	1964
Highway (bus, auto)	27%	47%
Airline	16	24
Ferry }	57	16
Cruise }		9
Railroad	--	4
Total	100%	100%

Clearly, the rates of change in tourist traffic by each method of travel have differed widely. The rates have also been unstable. All steamship arrivals (tourists and others), for example, showed a decreasing rate of about 8 percent per year in the period 1950 to 1956. In the same period, Highway traffic increased at approximately 13 percent per year. Airlines traffic also showed high growth in the period, although it was from a relatively small base amount. Since 1956, the trend in steamship arrivals has reversed, and in the period 1957 to 1963, tourist traffic carried showed a rate of increase of 7.6 percent.

This observation shows the complex interrelationship between the methods of transportation used by the tourist. The Alaska tourist typically uses a broad range of travel methods. The tabulation below, for example, shows that for those travelers whose primary method of travel was automobile, 58 percent also used the Alaska Ferry System and 25 percent used an airline within the state. Each of the travel methods, particularly the ferry and Highway systems, act both as complementary and competitive means of transportation for the typical tourist.

Primary Method of Travel	Percentage Using Other Methods of Travel in Alaska					
	Automobile	Bus	Ferry	Airline	Cruise Ship	Railroad
Highway	100%	--%	58%	25%	11%	19%
Ferry	71	14	100	7	4	10
Airline	18	9	5	100	9	18
Cruise Ship	--	26	3	25	100	86
Railroad	40	32	56	52	16	100

* Note that data for 1964 is used only when the effect of the earthquake did not change the statistics appreciably from 1963.

† For comparative purposes, it was estimated that 86 percent of tourists from the United States to British Columbia in 1963 traveled by auto.

The Tourist Carriers

To assess the development and importance of each of the carriers and their importance to future tourism, the historical trends and current plans of each of the transportation systems are summarized below.

Airlines. Airlines have never been of major importance to the absolute volume of tourism in Alaska. The 1964 (May 1 to August 31) survey showed that about 24 percent of the state's tourists arrived by airline, and that only 28 percent of airline traffic to Alaska was tourists (about 70 percent of airline traffic is from the western United States).

Examination of the passenger statistics of the airlines for the summers of 1959 to 1963 revealed little (about 5 percent in the case of one airline only) growth in tourist traffic in that period. However, the airlines did have a peak summer in 1964, but it must be assumed to have been a result of an increase in nontourist traffic.

The airline operators themselves reported that their plane capacities would be significantly increased on the Alaska flights in the near future. They also estimated that 1965 traffic counts would be about 30 percent above the 1964 level, but undue weight should not be given to their most recent and tentative data.

The major question for the tourist airlines traffic is assumed to be that of fares. Airline operators who were interviewed expressed a strong belief that fares would be substantially reduced within three years. In view of comparative airline fares to other destinations, this appears very likely, but its impact on the total volume of tourists is not simple to judge.

The reason that relatively few tourists fly to Alaska does not appear to be the high cost. The 1964 tourist survey showed that the typical vacationer traveled slowly to and from Alaska by choice. The state functions as an important part of the tourist's whole experience of the northern tour.

In this respect, it is noteworthy that in 1964 about 50 percent of vacationing tourists who traveled primarily by auto, and some 64 percent of those on the cruise ships came from the central and eastern United States.

The survey of 1964 also showed that some 75 percent of tourists on the airlines were visiting friends rather than simply vacationing. This proportion was higher than usual on account of the earthquake, but it is probably true that more than half of the airline tourists in typical years are visiting friends. Such traffic would be expected to increase at least in proportion with the Alaska population. This rate (about 5 percent per year) seems a reasonably low estimate for tourist airline traffic growth, and it would be expected that a fare reduction would initiate an abrupt upward shift in the number of tourists in this category,

particularly for those tourists from the central and eastern states. Little evidence exists, however, that the airlines would capture a sizable part of the tourist traffic from the other methods of transportation.

Steamships. Virtually all steamship passengers are tourists. In 1964, steamship (or cruise ship) traffic constituted some 9 percent of the total tourist traffic into Alaska. As mentioned previously, steamship traffic into Alaska showed significant decreases up to 1956, but since then the number of passengers carried in the summer months has increased at a rate of 7.6 percent per year. Each of the steamship companies responsible for this traffic has definite plans for expansion of its fleet.

Ferries Traffic. In 1963 and 1964, tourists traveled extensively on the Alaska Ferry System. The interrelation between Highway and ferry traffic has already been shown. The Alaska Ferry System only became fully operative in 1963, and therefore no analysis of historical trends can be made, but the statistics show a marked increase in 1964 over 1963 and it is said that 1965 will evidence a further growth in traffic volumes. The ferries operate three ships on the Prince Rupert, Juneau, Haines run, and two on the Anchorage-Kodiak run.

There is some evidence in the 1964 survey that the ferry system is fast becoming an important alternative means for entering Alaska, but the short experience argues against premature conclusions. Tourist ferry traffic would be expected to increase in close step with Highway traffic.

Railroads. Passengers carried by the White Pass & Yukon Route Railway have increased at a rate of about 10 percent per year since 1959. Their traffic is closely related to the cruise ship and Highway traffic.

Buses. West Tours are the largest operators of tours to Alaska. They operate offsetting tours using bus, air craft, and ferry. One group will fly to Anchorage, take the railroad to Fairbanks, the bus to Haines, and the ferry south from there. Another group will move in the opposite direction. Other buses operate from Edmonton to Alaska along the Alaska Highway.

The statistics on bus travel indicate past increases in traffic at the rate of about 12 percent per year.

Automobiles. Tourist automobile traffic is examined in the section on the Yukon following.

Conclusions

1. Airline tourist traffic constitutes about 24 percent of all tourist traffic into Alaska. It has not shown significantly large increases in the years since 1959 (except perhaps in the current year). A fare reduction could increase the volume of tourist traffic at initiation.

2. Steamships (cruise ships included) carry about 9 percent of all tourists into Alaska. Their traffic has shown a steady rate of growth since 1957 of some 7.6 percent per year.

3. Some 16 percent of tourists use the ferry as their primary means of transportation into Alaska. Ferry tourist traffic is expected to increase, but the relatively short experience with this form of travel makes future estimates particularly hazardous.

4. Some 47 percent of tourists traveled on the highway to Alaska. Most were driving their own automobiles. Bus and auto traffic have shown relatively high growth rates in the past five years of about 12 percent. However, the extreme smallness of the base makes projection of expected growth rates very hazardous.

Tourism in the Yukon

The Visitor Market

The Yukon Territory must be regarded as a nondestination tourist area. In other words, it serves as a corridor through which the bulk of the tourists pass on their Alaska tour.

In a recent study conducted by the Yukon Travel and Publicity Department, it was determined that approximately 80 percent of the Yukon visitors were from the United States, a proportion which supports the conclusion that the majority of tourists use the Yukon as a corridor between the U.S. mainland and Alaska.

Notwithstanding this fact, this is a significant element in the Yukon tourist economy because of the time entailed in traveling through the Yukon to or from Alaska. The normal driving time from Dawson Creek to the Alaska-Yukon border is approximately four days, thus necessitating five nights' accommodation over the 1,220 miles.

The principal modes of transportation used by visitors in coming to the Yukon are automobile, commercial aircraft, and bus, with the automobile being the most commonly used transportation vehicle. The tabulation on the following page illustrates the respective share of the total visitor transportation market realized by these modes, and shows that there has been no appreciable shift from one mode to the other during the past three years.

Year	Percent of Total Visitors		
	Automobile	Plane	Bus
1962	76%	16%	8%
1963	78	14	8
1964	76	15	9
Average	77	15	8

In analyzing the growth trend over this period, the following tabulation shows an annual average growth rate of 8.8 percent for visitors using automobiles as their mode of transportation to the Yukon and 4.0 percent for commercial aircraft passengers. The highest growth rate has been realized by bus passengers; however, because of problems encountered in the way these data are compiled, it is possible that an experimental increase in scheduled service in 1964 might have resulted in a higher level of intra-Yukon traffic that, because of the method of statistical compilation, was interpreted as visitor traffic. Hence, it is possible that visitor bus traffic is not growing at as high a rate as indicated in the tabulation.

Year	Number of Visitors			
	Automobile	Plane	Bus	Total
1962	52,956	11,304	5,651	69,911
1963	60,784	11,244	5,859	77,887
1964	62,743	12,229	7,182	82,154
Average Annual Growth Rate	8.8%	4.0%	12.7%	8.4%

The method used to determine the visitor count for each category itemized in the foregoing tabulation was quite straightforward in the case of plane and bus visitors, that is, records of passengers carried were supplied by the carriers serving the Yukon, and the data were taken directly from these documents.

The information used to determine the automobile visitor count was procured from the Yukon Travel and Publicity Department in Whitehorse. It represents a count of the number of persons passing into the Yukon through the border-crossing points of Beaver Creek, Dawson City, Carcross, and Pleasant Camp. The data are collected by the Canadian Custom and Immigration officials at these points and serve as the basis for various Dominion Bureau of Statistics publications; hence, its validity and accuracy should be of the highest standard. The four border-crossing points cover the travel routes into the Yukon listed on the following page.

98474—16

1. Beaver Creek and Dawson City: All visitors entering the west boundary of the Yukon from the mainland of Alaska.

2. Pleasant Camp: All visitors entering the southwest portion of Alaska from Haines. This represents the traffic that has come into the Alaska Panhandle by Alaska Ferry Service from Prince Rupert and is en route to the mainland of Alaska.

3. Carcross: All visitors entering the Yukon by means of the White Pass & Yukon Railway. These visitors have also come up the coast on the Alaska Ferry Service or on a cruise ship, and most are en route to the mainland of Alaska.

The assumptions that had to be made in applying these data are listed below.

1. All visitors arriving in the Yukon through the border-crossing points at Beaver Creek or Dawson are returning from their Alaska tour. Hence, in the vast majority of cases, this entry constitutes their second visit to the Yukon on this tour.

2. Ninety percent of the visitors entering the Yukon through the border-crossing points at Pleasant Camp or Carcross are en route to the mainland of Alaska, and they will be counted on their return trip to the Yukon through Beaver Creek or Dawson. Hence, only 10 percent of the entries at these border-crossing points are added to the Beaver Creek-Dawson figures to arrive at a realistic total.

For purposes of this study, it is necessary to distinguish between the tourist and the business or local traveler. By definition, the tourist is a person who comes to the area primarily for pleasure, and could choose between coming to the Yukon or going to an alternative holiday area. On the other hand, the business or local traveler is a person who comes to the area for reasons other than pleasure or vacation and who, for the most part, has no choice as to the route and destination of the visit. Hence, the business or local visitor forms the year-round visitor base, and the tourist traffic is superimposed on it.

In the case of the Yukon, the base is composed of local residents, traveling businessmen, and commercial truckers, and for the most part it maintains a fairly constant level throughout the year. The visitor season from November to April, inclusive, is made up almost exclusively of business and local travelers and this base is maintained throughout the six-month tourist season. Therefore, the tourists can be said to constitute all visitors over and above the monthly year-round base established by business and local travelers.

The tabulation on the next page illustrates the year-round base and the tourist portion of the total Yukon visitor market for the year 1964.

Mode of Transportation	Business and Local Travelers		Tourists	
	Number	Percent	Number	Percent
Automobile	24,580	39%	38,163	61%
Plane	11,129	91	1,100	9
Bus	6,682	93	500	7
Total	42,391	52%	39,763	48%

From the foregoing tabulation, it is apparent that the tourist visitors generated by plane and bus travel constitute only about 4 percent of the total tourist market in the Yukon in 1964. Hence, automobile travel is expected to be the major factor in the growth of tourism in the Yukon, and this study will be devoted to its impacts on the area.

An analysis of the ratio of tourist to nontourist visitors in the Yukon indicates that the tourist volume is roughly two-thirds and the nontourist volume one-third of total visitors. The tabulation below illustrates these ratios over the past four years.

Year	Percent of Total Visitors	
	Nontourist	Tourist
1962	37%	63%
1963	33	67
1964	39	61
1965	33	67
Average	35	65

Notwithstanding these relatively static ratios, the tourist visitor market is experiencing a much higher average annual growth rate than the nontourist, as illustrated in the tabulation below for the past four years.

Year	Estimated Number of Visitors		
	Nontourist	Tourist	Total
1962	19,646	33,310	52,956
1963	20,172	40,612	60,784
1964	24,580	38,163	62,743
1965	23,102	46,661	69,763
Average Annual Increase	1,152	4,450	5,602
Average Annual Growth Rate	5.5%	11.9%	9.6%

98474—16½

From the foregoing tabulation, it is apparent that the tourist visitor market is growing at approximately twice the rate (11.9 percent) of the nontourist visitor market (5.5 percent). Also, the total Yukon visitor market is experiencing a growth rate of 9.6 percent per year. As pointed out previously, the Yukon visitor count is closely related to the Alaska visitor count, and this is borne out by their comparative growth rates. It was estimated in the Alaska section of this report that the visitor market has grown recently at a rate of 10 percent per year in that state, while a 9.6 percent rate is being experienced in the Yukon. This similarity of growth rate is attributable in large measure to the significant relationship of the visitor markets of the two adjacent areas.

Tourist Traffic Routes

In evaluating the impact that a future increase in tourist traffic would likely have on the economy of the Yukon, it is necessary to estimate what percentages of these visitors will make their complete tour over the full length of the Alaska Highway and what percentage will use the Alaska Ferry Service in at least one direction. A direct one-way automobile trip over the Canadian portion of the Alaska Highway requires approximately four days and four or five nights: two days in Northern B.C. and two days in the Yukon. A one-way trip to Alaska on the Alaska Ferry System entails only one day in the Yukon. Therefore, a visitor using the Alaska Highway in both directions would be in Yukon and Northern B.C. a total of eight days and possibly ten nights, whereas if he took the Alaska Ferry System in one direction he would be in this area five days and possibly seven nights. It should be noted that both of these estimates assume the most direct route, with virtually no allowance for sightseeing.

Notwithstanding the unpleasant driving conditions experienced on the unpaved portion of the Alaska Highway, a great number of visitors are still using it in both directions on their tour. The tabulation below makes a comparison of the southbound traffic flow of noncommercial vehicles to the Alaska Ferry System, and illustrates conclusively the eroding influence on northbound highway traffic that this service has exerted since its introduction in 1963.

	Vehicles Entering Yukon and B.C. from Alaska		
Year	Mile 1202	Prince Rupert	Percent by Ferry
1962	14,692	135	1%
1963	18,292	4,330	24
1964	19,092	4,960	26

The monthly data, on which the above tabulation is based, indicates that, in the peak tourist months of July and August, 30 to 35 percent of southbound visitor vehicles use the ferry system rather than the Highway.

Vehicle-carrying records from the Alaska Ferry System have revealed that the vehicle movement northbound and southbound is well balanced; hence, it is realistic to conclude that about the same percentage of northbound visitors are using the ferry system. Thus, in 1964 it can be said that approximately one-quarter of all visitors to Alaska used the ferry system in one direction.

Meetings with sales officials of the Alaska Ferry System have revealed that the vessels are operating at maximum capacity during July and August; thus, if the fleet is not increased, it is not possible for further erosion of highway traffic to take place during the peak tourist season. In other words, the increasing tendency of Alaska-bound tourists to use the Alaska Ferry System in July and August will be governed not by the condition of the Alaska Highway, but by the size and capacity of the Alaska ferry fleet.

Assuming that the present ferry fleet will be increased at a rate sufficient to maintain the present level of 26 percent of one-way non-commercial vehicle trips to Alaska, a fleet of 10 ferries would be needed during July and August.

Facility Inventory and Future Requirements

The facilities for lodging, feeding, and servicing traffic on the Alaska Highway can be described as inferior when compared to similar facilities in southern Alberta or British Columbia. Undoubtedly, the highly seasonal character of Alaska Highway tourism is the major reason for the inadequate facilities. However, even the urban facilities along the highway are not equal, generally, to urban-located facilities in similar sized communities elsewhere in Alberta or British Columbia. For the most part, the Highway-located facilities are primitive. Notwithstanding the condition of the facilities, it should be acknowledged that they are located at sufficiently close intervals to provide an adequate servicing network along the highway.

A summary of all facilities from Dawson Creek to the Alaska border appears in Table B-1

Table B-1

ALASKA HIGHWAY FACILITIES

	Hotels or Lodges	Restaurants	Camp Grounds	Service Stations
Urban locations				
Dawson Creek	18	19	--	24
Fort St. John	14	14	--	15
Fort Nelson	10	7	--	7
Watson Lake	6	6	--	5
Whitehorse	15	12	--	13
Subtotal	63	58	--	64
Highway locations				
Dawson Creek-Fort St. John	2	6	2	4
Fort St. John-Fort Nelson	10	8	4	17
Fort Nelson-Watson Lake	14	13	3	21
Watson Lake-Whitehorse	10	11	11	13
Whitehorse-Alaska border	15	16	9	21
Subtotal	51	54	29	76
Total	114	112	29	140

From Table B-1 it is apparent that slightly more than half of the hotels and restaurants along the Alaska Highway are located in urban centers; however, approximately two-thirds of accommodation and restaurant capacity is centered in the urban areas. The hotels and lodges are for the most part small operations, and approximately 75 percent of them have fewer than 20 rooms. Naturally, establishments of this size have great difficulty in justifying and supporting any food facilities other than very small coffee shops. For the most part, the accommodation and food facilities along the Alaska Highway are small in size and very limited in the type and quality of services offered.

The tabulation on the following page illustrates the capacity of the facilities by highway segment between Dawson Creek and the Alaska border.

Highway Segment	Hotels or Lodges	Restaurant Seats	Camping Sites	Service Stations
Dawson Creek-Fort Nelson	888	1,263	111	60
Fort Nelson-Watson Lake	356	518	65	28
Watson Lake-Whitehorse	226	393	280	18
Whitehorse-Alaska border	532	648	230	34
Total	2,002	2,822	686	140

It is evident from the foregoing tabulation that by far the greatest capacity is at the south end of the Highway, whereas the north end of the Highway will experience the heaviest daily visitor traffic loads during the peak summer travel season.

In estimating peak tourist traffic in 1985, the assumption was made that tourist traffic would be 300% of the present level, representing an annual rate of growth of somewhat more than 5 percent.

In estimating the facility requirements to handle the anticipated visitor traffic during the peak summer months, the following assumptions are made:

1. The accommodation demand by nontourist visitors will be: 20 percent will not require commercial lodging, 30 percent will use trailer parks, and 50 percent will purchase hotel accommodation.

2. The accommodation demand by tourist visitors will be: 35 percent will use trailer parks and 65 percent will purchase hotel accommodation. The Alberta Travel Survey for 1964 indicates that only about 30 percent of tourists brought their own accommodation (trailers or tents), while the similar study for Alaska indicated that more than 50 percent of Highway travelers brought their own accommodation. Assuming the Highway is paved, it may be reasonable to conclude that the tourist characteristics of Alaska Highway users would more nearly approach those of the Alberta tourist.

3. The average tourist party consists of 3.1 persons, and the average nontourist party consists of 2.1 persons. This is in keeping with the findings of the 1964 Alaska Tourist Study.

4. On the basis of the above averages, it is assumed that approximately 60 percent of all tourist and nontourist parties will require hotel rooms, 30 percent will require camping facilities, and 10 percent will obtain lodging with friends, etc. It is also assumed that for parties requiring hotel accommodations, slightly more than one hotel room per party will be needed.

Therefore, the average peak accommodation demands will be as tabulated on the following page.

Peak Seasonal Demand for Accommodation, 1985

	Visitor Requirement	
	Hotel Rooms	Camping Sites
Dawson Creek-Fort Nelson	270	135
Fort Nelson-Watson Lake	270	135
Watson Lake-Whitehorse	270	135
Whitehorse-Alaska border	700	400
Total	1,610	805
Plus allowance for higher daily peaks	1,700	900

The forecast peak demand for 1,700 hotel rooms in 1985 would be approximately three times the present accommodation demand by Alaskan visitors using the highway. Although the present inventory of hotel rooms along the highway is recorded at approximately 2,000, it should not be construed that this capacity could in fact handle future demand to 1985. As mentioned previously, much of the hotel and lodge accommodation is of very poor quality and for the most part would be below the minimum standards acceptable to tourists and visitors. In fact, with the business and commercial demand for hotel accommodation superimposed on the tourist demand, there appears to be a shortage of good hotel accommodation during July and August even at the present time. Hence, new hotel and lodge capacity will have to be provided in order to meet future tourist accommodation demand.

No estimate of additional service station requirements has been made as it is considered that these facilities will be included in the hotel-restaurant service centers which have been forecast in the above table.

At an approximate present-day cost of $12,000 per room for first-class hotel or lodge accommodation (including dining room, coffee shop, recreation lounge, swimming pool, service station, parking space, etc.) and $400 per spot for camping facilities, the capital requirements for facilities to service the estimated visitor traffic in 1985 is illustrated in the tabulation below.

Estimated Capital Requirements for Tourist Facilities in 1985

Facility	Millions of Dollars
Hotels and restaurants	$20.40
Camping sites	0.36
Total	$20.76

No attempt has been made to evaluate specifically the basic profitability of investments in hotel and restaurant facilities in the area, considering the extreme seasonality of the tourist season. However, since such highly seasonal facilities are in operation elsewhere--winter resorts, for instance--it is assumed that through competent management, they can be made profitable.

An assumption that perhaps 10 percent of the total revenues accruing would constitute net profits can, therefore, be considered as realistic.

Tables B-3 through B-18 on the following pages show pertinent data on tourist traffic in Alaska and the Yukon by various modes of transportation.

Table B-4

ALASKA HIGHWAY FACILITIES

	Accommodations		Eating Facilities		Campgrounds		Number of Service Stations
	Number	Rooms	Number	Capacity	Number	Capacity	
Urban locations							
Dawson Creek	18	507	19	570 est.	--	--	24
Fort St. John	14	288	14	350 est.	--	--	15
Fort Nelson	10	200	7	263	--	--	7
Watson Lake	6	112	6	195	--	--	5
Whitehorse	15	322	12	360 est.	--	--	13
Subtotal	63	1,429	58	1,738	--	--	64
Highway locations							
Dawson Creek - Fort. St. John	2	39	6	172	2	51	4
Fort St. John - Fort Nelson	10	54	8	171	4	60	17
Fort Nelson - Watson Lake	14	156	13	255	3	65	21
Watson Lake - Whitehorse	10	114	11	198	11	280	13
Whitehorse - Alaska border	15	210	16	288	9	230	21
Subtotal	51	573	54	1,084	29	686	76
Total	114	2,002	112	2,822	29	686	142

Table B-5

HOTEL, MOTEL, AND LODGE FACILITIES IN THE YUKON
SERVING THE ALASKA HIGHWAY, BY NUMBER OF ROOMS

	Number of Rooms						
	0-10	11-20	21-30	31-40	41-50	51-60	61-70
Urban locations							
Dawson Creek	2	7	4	1	1	1	2
Fort St. John	4	6	1	1	1	1	--
Fort Nelson	5	2	--	1	1	1	--
Watson Lake	1	3	1	1	--	--	--
Whitehorse	4	5	4	1	--	--	1
Subtotal	16	23	10	5	3	3	3
Highway locations							
Fort St. John - Fort Nelson	9	2	1	--	--	--	--
Fort Nelson - Watson Lake	6	7	1	--	--	--	--
Watson Lake - Whitehorse	6	3	1	--	--	--	--
Whitehorse - Alaska border	8	5	1	--	--	--	1
Subtotal	29	17	4	--	--	--	1
Total	45	40	14	5	3	3	4

Appendix C

FEASIBILITY OF A TOLL SYSTEM ON THE ALASKA HIGHWAY

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FEASIBILITY OF A TOLL SYSTEM ON THE ALASKA HIGHWAY

In the formulation of this research study, it was agreed that one of the tasks of the overall project should be a preliminary investigation of the feasibility of initiating toll collection as a means of financing the Alaska Highway improvement program.

This preliminary investigation can perhaps best be performed by stating what appear to be the primary requirements for a successful toll road and by examining to what extent an Alaska Highway toll scheme would meet the requirements.

Some of the requirements of a toll road scheme are:

1. There should be a preponderance of user benefits associated with a toll road. If tolls are used as a primary means for financing a road building or road improvement program, the burden of financing would fall on the users of the facility. If there are significant nonuser beneficiaries, for example, individuals or organizations whose land holdings appreciated substantially in value as a result of the improvement program, a toll system to some extent discriminates against highway users by requiring them to pay back a part of their benefits.

2. A toll road scheme must be administratively feasible, and the costs of administration must be reasonable in relation to total expected revenues. The administrative or operational feasibility of a toll road involves the design of an access control system that would permit the levying of an equitable toll on all highway users. A major constraint of such a system, however, would be that its total installation and administration costs should only be a small portion of the expected revenues.

3. The total user benefits derived from a toll road should be considerably in excess of costs, so that the recapture of a portion of user savings will be sufficient to meet the financing cost of the road involved. In cases where tolls are designed to recapture no more than 50 percent of total user benefits, for example, it can be assumed that tolls will not materially decrease the level of traffic. If tolls attempt to recapture a larger portion of user savings, the effect on traffic volume becomes uncertain since individual computations of user savings tend to be imprecise. In cases where total costs exceed total user savings, administrators might raise tolls to the point where the level of tolls would have a detrimental effect on traffic volume.

In examining the prospective situation on the Alaska Highway, it would appear that only with respect to the first requirement--preponderance of user benefits--would an improved Alaska Highway make a suitable candidate for a toll road. The majority of benefits that could be derived from an improved Alaska Highway would be user benefits, and thus tolls would be a very equitable method of financing.

As to the administrative feasibility of controlling use of the road, it would appear that control of local use, at least, would be a very difficult problem, and it is doubtful whether an elaborate administrative control machinery would be justified from the point of view of cost in relation to the expected traffic densities. On the other hand, control of through traffic and collection of tolls from the vehicles involved would be a relatively simple matter; however, the collection of tolls from such vehicles would hardly be equitable.

The strongest argument against the use of tolls on an improved Alaska Highway is the third requirement, i.e., that user benefits greatly exceed the total costs involved. Since the expected costs would be greater than the projected user savings, the tendency would be to raise tolls to the point where their level would discourage normal traffic growth. By such reduction in traffic growth, the economic justification of the improvement would be even further limited.

Appendix D

ATTEMPT AT STATISTICAL PROJECTION OF TOURIST TRAFFIC ON THE ALASKA HIGHWAY

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ATTEMPT AT STATISTICAL PROJECTION OF TOURIST TRAFFIC ON THE ALASKA HIGHWAY

In the process of projecting tourist traffic on the Alaska Highway, several statistical regression models were attempted with the available data, in order to analyze the relationships between tourist travel, travel times, income, population, distances, and cost of travel. Unfortunately, the data required to construct a sophisticated model were not available in the needed quantity or quality and the final results of this exercise must be regarded as inconclusive.

Since a time series of number of tourists traveling on the Highway since 1952 was not available except for a few observations, a cross section analysis of tourist travel to Alaska from different regions of the country was made. In this respect, data on tourist travel to Alaska in 1952, 1960, and 1964 published by the National Park Service,* the University of Alaska† and the Department of Economic Development and Planning,‡ were used to perform a regression analysis of tourist traffic on the Highway. Because the original data sources used 10 regions as the origins of trailers, this same regional breakdown was used in this study. These regions are:

Canada: British Columbia, Alberta, Yukon, from which 70 percent of the Canadian tourists come

Pacific Northwest: Washington, Oregon, Idaho, Montana

West: California, Arizona

Mountain: Nevada, New Mexico, Colorado, Wyoming, Utah

Western Midwest: North Dakota, South Dakota, Minnesota, Iowa, Nebraska, Kansas, Missouri

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* Hinkson, Charles E., Traveler Profiles: A Study of Summer Travel to Alaska During 1963 and 1964, Department of Economic Development and Planning, Juneau, December 1964, page 39.

† Stanton, William J., Alaska Recreation Survey, Part I, Vol. II, U.S. Department of the Interior, National Park Service, Washington, D.C., 1953, page 54.

‡ Kiely, Vernon R. and John R. Hilpert, Tourist Industry in Alaska, University of Alaska, College, Alaska, March 1961, page 60.

Eastern Midwest: Michigan, Illinois, Ohio, Indiana, Wisconsin

Southwest: Texas, Oklahoma, Arkansas

Middle-South: Virginia, Kentucky, Tennessee, West Virginia, North Carolina, District of Columbia

Southeast: Florida, Louisiana, Mississippi, Alabama, Georgia, South Carolina

East and New England: Pennsylvania, New York, New Jersey, Maryland, Delaware, Connecticut, Rhode Island, Massachusetts, New Hampshire, Maine, Vermont

It was hoped that the statistical analysis would provide a basis for calculating the volume of projected tourist travel on the Highway as a function of such variables as population, income, travel cost, and time by alternative means, etc.

The actual regression functions fitted were:

$$HPAss_{it} = f\left(Y_{it}, \frac{P_{it}}{D_i}, \frac{TP_{it}}{TA_{it}}, \frac{CP_{it}}{CA_{it}}\right)$$

$$HPAss_{it} = g(Y_{it}, P_{it}, TP_{it}, TA_{it}, CP_{it}, CA_{it})$$

$$\frac{HPAss_{it}}{P_{it}} = h\left(D_i, Y_{it}, \frac{TP_{it}}{TA_{it}}, \frac{CP_{it}}{CA_{it}}\right)$$

$$HPAss_{it} = k\left(P_{it}, Y_{it}, D_i, \frac{TP_{it}}{TA_{it}}, \frac{CP_{it}}{CA_{it}}\right)$$

in which,

$HPAss_{it}$ = Highway tourists in year "t" traveling to Alaska from region "i."

Y_{it} = Per capita personal disposable income from region "i" in time "t," in constant 1954 dollars.

D_i = Distance from the metropolitan center of the region to Anchorage, in miles.

P_{it} = Population of region "i" in year "t," in thousands of persons.

TP_{it} = Travel time in hours by airplane from the metropolitan center in region "i" to Anchorage, in year "t."

TA_{it} = Hours of travel times in auto from the metropolitan center in region "i" to Anchorage, in year "t."

CP_{it} = Average cost of plane ticket from center of region "i" to Anchorage, in current dollars in year "t."

CA_{it} = Average cost of auto trip from center of region "i" to Anchorage, in current dollars in year "t."

f,g,h,k represent the different functions.

For each of the functions shown above, the linear, semilog, double-log, log-reverse, hyperbola, and assymptotic* forms were fitted to find the one that explained best the data shown in Table D-1.

The function finally selected was of the double-log form:

$$\underset{(0.5826)}{\text{Log}(HPAss_{it}/P_{it}) = 26.7255 - \underset{(6.7764)}{4.7433}\ \text{Log}\ D_i + \underset{(0.5789)}{1.3506}\ \text{Log}\ Y_{it}}$$

$R^2 = 0.7419$
Degrees of freedom = 27

The standard errors of the regression coefficients appear in parentheses. The tests of significance at the 95 percent significance level show that the regression coefficients are significantly different from zero. The multiple correlation coefficient (R^2) shows the percentage of the variance of the dependent variable (Log $HPAss_{it}/P_{it}$) that is explained by the independent variables (Log D_i, Log Y_{it}).

As the data presented in the table show, the assumption of homogeneity of the variance of the residuals--so important in cross section analysis--holds and therefore no correction is deemed necessary.

On the assumption that the rates of growth of income during this period will be approximately the same through 1980, the following projections of tourist highway passengers to Alaska was made. These projections represent at least an upper limit to the normal growth of tourist traffic in the absence of any highway improvement.

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* The assymptotic form fitted was:

$$\text{Log}\ HPAss_{it} = f\left(\frac{1}{P_{it}}\ ;\ \frac{1}{Y_{it}}\ ;\ \frac{1}{TP_{it}}\ ;\ \frac{1}{TC_{it}}\ ;\ D_i\ ;\ \frac{1}{CP_{it}}\ ;\ \frac{1}{CA_{it}}\right)$$

Table D-1

HIGHWAY TOURIST TRAVELERS TO ALASKA BY REGION OF ORIGIN
1952-1964

Region	Year	Tourist Travelers	Population (thousands)	Per Capita Disposable Income (in 1954 dollars)	Distance (miles)	Travel Times* of One-way Trip by Auto (hours)	Cost of One-way Trip by Auto† (in current dollars)	Travel Times of One-way Trip by Plane‡ (hours)	Cost of One-way Trip by Plane‡ (in current dollars)
Canada	1964	5,550	3,186	$1,506	2,517	60.75	$150.50	4.00	$130.00
Pacific Northwest	1964	4,533	6,285	2,178	2,659	62.50	155.50	3.00	104.00
West	1964	6,059	19,667	2,626	3,348	82.25	180.10	5.00	146.35
Mountain	1964	879	4,717	2,113	3,478	83.80	184.70	5.75	174.10
W. Midwest	1964	2,313	15,752	2,067	3,482	84.40	184.85	7.40	195.95
E. Midwest	1964	9,204	37,648	2,368	3,902	94.00	199.80	6.60	209.45
Southwest	1964	508	14,796	1,817	4,283	102.00	213.30	7.30	239.25
Middle South	1964	1,295	18,793	1,756	4,598	112.00	224.54	8.30	241.25
Southeast	1964	370	21,744	1,649	4,616	113.25	225.20	10.00	249.80
East & New England	1964	2,683	51,049	2,526	4,743	116.00	229.71	9.00	249.10
Canada	1960	2,688	2,907	1,412	2,517	60.75	169.10	7.30	106.00
Pacific Northwest	1960	3,763	5,989	1,720	2,659	62.50	174.70	6.40	82.50
West	1960	6,182	17,180	2,058	3,348	82.25	202.30	9.30	116.80
Mountain	1960	806	4,251	1,687	3,478	83.80	207.50	12.25	176.60
W. Midwest	1960	2,100	15,418	1,672	3,482	84.40	207.70	11.25	158.25
E. Midwest	1960	7,109	36,300	1,889	3,902	94.00	224.50	12.50	162.55
Southwest	1960	370	13,771	1,500	4,283	102.00	239.70	14.75	180.50
Middle South	1960	950	16,735	1,365	4,598	112.00	252.30	15.30	185.45
Southeast	1960	537	17,032	1,317	4,616	113.25	253.00	17.00	190.60
East & New England	1960	2,376	42,971	1,986	4,743	116.00	258.10	16.30	186.50
Canada	1952	173	2,187	1,484	2,517	60.75	198.70	9.00	128.40
Pacific Northwest	1952	1,735	5,233	1,628	2,659	62.50	205.30	8.50	75.00
West	1952	2,192	12,523	1,862	3,348	82.25	237.70	12.50	118.50
Mountain	1952	1,388	3,310	1,487	3,478	83.80	243.80	19.50	149.35
W. Midwest	1952	1,293	14,246	1,452	3,482	84.40	244.00	17.25	146.85
E. Midwest	1952	1,253	31,332	1,705	3,902	94.00	263.80	18.75	164.35
Southwest	1952	814	12,391	1,281	4,283	102.00	281.70	21.50	216.40
Middle South	1952	241	18,024	1,179	4,598	112.00	296.50	24.25	189.00
Southeast	1952	567	20,482	1,077	4,616	113.25	297.30	23.75	223.25
East & New England	1952	805	48,346	1,720	4,743	116.00	303.30	22.25	193.55

* Supplied by the American Automobile Association.

† Travel costs (including lodging and meals) were assumed at 4¢ per passenger-mile over paved roads and 10¢ for the Alaska highway in 1960. The last item was taken from U.S. News and World Report, July 17, 1961.

‡ Air Traffic Conference of America. Official Airline Guides, May 15 edition for respective years, Chicago, Ill.

Region	Highway Tourists, 1980
Canada*	6,400
Pacific Northwest	7,917
West	19,425
Mountain	2,626
Western Midwest	6,948
Eastern Midwest	12,773
Southwest	2,155
Middle South	1,788
Southeast	2,392
East and New England	7,289
Total	69,713

Compared with the 33,625 highway tourists of 1964, the above projection shows an annual rate of growth of 4.5 percent. Clearly, with the technological changes in airplane travel expected in the next two decades--which will reduce significantly both travel times and costs--a 4.5 percent growth rate can be regarded as an upper limit for tourist traffic on the Alaska Highway. However, the approach described here cannot be used to forecast the traffic generated by highway improvement, because travel times and cost variables were excluded from the equation. But for the purposes of projecting the traffic generated by highway improvement, it was assumed for the period under review here (up to 1985) that the growth rate will be very much higher, namely, 15 percent per year.

* Population and income rates of growth to 1980 were assumed to be the same as during the period 1952-64.

Appendix E

BIBLIOGRAPHY

Appendix E

BIBLIOGRAPHY

Economic Forecasting and Investment Criteria

Arrow, R. J., "Alternative Approaches to the Theory of Choice in Risk-taking Situations," Econometrica, October 1953

Balestro, Pietro, and N. K. Rao, Population Projections for the United States through 1980, Stanford Research Institute, Menlo Park, Calif., 1963

Eckstein, Otto, "A Survey of the Theory of Public Expenditure Criteria," A Conference on Public Finances: Needs, Sources and Utilization, National Bureau of Economic Research, Princeton, N.J., 1961

_____, "International Welfare Economics and Investment Criteria for Economic Development," Quarterly Journal of Economics, February 1957

Fisher, I., The Theory of Interest, MacMillan Co., New York, 1930

Graff, J. de V., Theoretical Welfare Economics, Cambridge University Press, Cambridge, Mass., 1957

Harberger, Arnold C., "Cost-Benefit Analysis and Economic Growth," Economic Weekly, Annual Number, Bombay, February 1962

Heil, A. T., Economic Forecasts and Policy, North Holland Publishing Co., Amsterdam, 1961

Hirschleifer, J., "On the Theory of Optional Investment Decisions," Journal of Political Economy, August 1958

Hitcher, Charles J., and Roland N. McKean, Economics of Defense in the Nuclear Age, Harvard University Press, Cambridge, Mass., 1960

Lipsey, R. G., and K. Lancaster, "General Theory of the Second Best," Review of Economic Studies, Vol. 24 (1956)

Little, I. M. D., A Critique of Welfare Economics, 2nd edition, Oxford University Press, Oxford, 1957

McKean, Roland N., Efficiency in Government through Systems Analysis, John Wiley and Sons, New York, 1958

Marglin, Stephen A., Approach to Dynamic Investment Planning, North-Holland Publishing Co., Amsterdam, 1963

_____, "The Opportunity Costs of Public Investment," Quarterly Journal of Economics, Vol. 47 (May 1963)

Marglin, Stephen A., "The Social Rate of Discount and the Optional Rate of Investment," Quarterly Journal of Economics, February 1963

Meyer, John R., and Robert R. Glauber, Investment Decisions, Economic Forecasting and Public Policy, Harvard University Graduate School of Business Administration, Boston, Mass., 1964

Raiffa, Howard, and Robert Schlaifer, Applied Statistical Decision Theory, Division of Research, Harvard University Graduate School of Business Administration, Boston, Mass., 1961

Samuelson, P. A., "The Price Theory of Public Expenditure," Review of Economics and Statistics, Vol. 36 (November 1957)

Sen, A. K., Choice of Techniques, Basil Blackwell, Oxford, 1960

_____, "Some Notes on the Choice of Capital Intensity," Quarterly Journal of Economics, November 1957

General Background and Economic Data

General

"Employment Impact of Changing Defense Programs," Monthly Labor Review, May 1964, pp. 512-3

Hicks, J. R., A Revision of Demand Theory, Oxford University Press, London, 1956

_____, Value and Capital, 2nd Edition, Oxford University Press, London, 1948

Knight, F. H., "Some Fallacies in the Interpretation of Social Cost," Quarterly Journal of Economics, Vol. 38 (1924)

Margolis, Julius, Land Use Related to Fiscal Issues, Research Report 11, University of California, Bureau of Business and Economic Research, Real Estate Research Board, Berkeley, Calif., 1957

Moses, Leon, "A General Equilibrium Model for Production, Interregional Trade, and Location of Industry," The Review of Economics and Statistics, Vol. 42, No. 4 (November 1960)

Pigou, A. C., The Economics of Welfare, 1st Edition, The MacMillan Company, London, 1918

Wendt, Paul F., "The Theory of Urban Land Values," Land Economics, Vol. 33, No. 3 (August 1957)

Alaska

Little, A. D., Inc., An Evaluation of the Feasibility of Native Industry in Northwestern Alaska (report to the U.S. Bureau of Indian Affairs), September 1963

_____, Industrial Opportunities in Alaska (prepared for the Alaska Dept. of Economic Development and Planning, Div. of Industrial Development), Juneau, Alaska, September 1962

Alaska Dept. of Commerce, Active Corporations (Domestic and Foreign), 1964

_____, Directory of Manufactures, June 1962

_____, List of Qualified Corporations, monthly issues, January 1963, June 1964

Alaska Dept. of Economic Development and Planning, Alaska Development Digest (periodical), January-July 1964

_____, Div. of Industrial Development, Industrial Opportunities in Alaska--An Official Publication of the State of Alaska, 1962

_____, Div. of Planning and Research, This Is Alaska--Regions/ Resources, September 1962

Alaska Dept. of Labor, Div. of Employment Security, Alaska Employment Trends (periodical), January-June 1964

_____, Alaska's Manpower--A Look at the 1960's, 1963

_____, Average Employment by Area and Industry, quarterly reports, 1961-1963

_____, Going Rates of Various Employers, Anchorage, Alaska; Fairbanks, Alaska; Juneau, Alaska; Ketchikan, Alaska; Petersburg, Alaska, 1963

Alaska Dept. of Natural Resources, Div. of Tourist and Economic Development, Alaska: Comparative Tariff Analysis (1957), by Llewellyn C. Jones, 1959

Alaska Educational Department, Alaska Educational Directory, Juneau, Alaska, Annual

Alaska Employment Security Commission, Alaska Job Facts

Alaska Legislative Council, Directory of State Officials, 1963 and 1964

Alaska Municipal League, Alaska Municipal Directory, 1964

Alaska Resource Development Board, Charting Alaska's Progress, Biennial Report, 1951-52, 1953-55, 1955-57

_____, Estimate of Alaska Population

_____, Fairbanks, Alaska - A Survey of Progress, by Richard A. Cooley, Juneau, Alaska, July 1954

_____, Financial Data Regarding the Incorporated Towns and Cities of Alaska

_____, Juneau - A Study of the Gastineau Channel Area, by Juan Munoz, Juneau, Alaska, October 1956

_____, Valdez Industrial Report

Alaska Resource Development Board, Word Index of Consumer Prices in Seven Alaskan Cities

Alaska State Bond Committee, Official Statement, State of Alaska, $7,600,000 General Obligation Bonds, 1963

_____, Official Statement, State of Alaska, 1961

Alaska State Chamber of Commerce, Alaska

_____, Standard Industrial Survey, 1964

Alaska State Development Corporation, Alaska--Economic and Fiscal Data, 1963

Alaska State Housing Authority, Population and Economy of the Haines-Port Chilkoot Region, 1963

_____, 1980 General Plan for Sitka, Alaska, 1963

Alaska - The 49th State in Pictures, Sterling Publishing Company, Inc., New York

Alaska - Who's Here - What's Doing - Who's Doing It, Teffry Publishing Company, Anchorage, 1955

Anchorage City Planning Commission, Economic Base of the Greater Anchorage Area, September 1956; Supplement No. 1, June 1958, with projections to 1963 and 1980

Annabel, Russell, Alaskan Tales, A. S. Barnes, New York, 1953

Bright, Elizabeth (Parks), Alaska, Treasure Trove of Tomorrow, Exposition Press, New York, 1956

British Columbia Dept. of Industrial Development, Trade, and Commerce, Bureau of Economics and Statistics, Hawaii and Alaska--A Market Study, Victoria, March 1964

Dawson Creek, City of, Office of Industrial Director, "Industrial Brochure"

Egan, William A., Gov., address to the Joint Assembly of the Third State Legislature, Second Session, Jan. 28, 1964

Election District No. 2 (Ketchikan), Overall Economic Development Plans

Election District No. 3 (Petersburg-Wrangell-Kate), Overall Development Plans

Election District No. 6 (Haines-Port Chilkoot-Skagway), Overall Economic Development Plans

Emerson, William Canfield, The Land of the Midnight Sun, Dorrance, Philadelphia, Pa., 1956

Engstrom, Emil, John Engstrom: The Last Frontiersman, Vantage Press, New York, 1957

Ferber, Edna, Ice Palace, Doubleday, New York, 1958

Historic Supplement--Haines-Port Chilkoot, Overall Development Plans

"Income to Alaska," Commerce, June 1960

Jones, J. Wilbur, and Marjorie Metcalf Nielson, Analytical Study and Foundations for the Establishment of Counties in the State of Alaska, (recommendations for the Governor of Alaska, et al., collated material from public and private sources in Alaska, California, and Washington, D.C.), 1959

Kitchener, Lois Delano, Flag Over the North, Superior Publishing Company, Seattle, Wash., 1954

Kursh, Harry, This Is Alaska, Prentice-Hall, Inc., New York, 1961

Lantis, David W., Alaska (prepared with the cooperation of the American Geographical Society), Doubleday, Garden City, N.Y., 1957

Lineberry, William P., The New States: Alaska and Hawaii, H. W. Wilson Company, New York, 1963

Lomen, Carl J., Fifty Years in Alaska, David McKay, New York, 1954

McCracken, Harold, The Story of Alaska, Books, Garden City, N.Y., 1956

Machetanz, Sara, Where Else but Alaska? (lithographs and pictures by Fred Machetanz), Charles Scribner's Sons, New York, 1954

Melin, Margaret, Modern Pioneering in Alaska, Pageant Press, New York, 1954

Our 49th State - An Adventure in Marketing, Benton and Bowles, Inc., 1959

Renber, G. L., and R. D. Wonnacott, The Cost of Capital in Canada, Resources for the Future, Inc., Washington, D.C., 1961

Richardson, Harold, "Alaska and the Aleutians," in Bulldozers Come First, Bowman, et al., McGraw-Hill, 1944

Rogers, George W., Alaska in Tradition: The Southeast Region (study sponsored by the Arctic Institute of North America and Resources for the Future, Inc.), John Hopkins Press, Baltimore, Md., 1960

_____, The Future of Alaska: Economic Consequences of Statehood (study sponsored by the Arctic Institute of North America and Resources for the Future, Inc.), John Hopkins Press, Baltimore, Md., 1962

Rogers, George W., and Richard A. Cooley, Alaska's Population and Economy, Regional Growth, Development, and Future Outlook, Vol. I - Analysis, Vol. II - Statistical Handbook, (report to Division of State Planning Office of the Governor), Juneau, Alaska, March 1962

Seattle First National Bank, Alaska-Frontier for Industry, Seattle, Wash.

Stefansson, Evelyn, Here Is Alaska; Revised Statehood Editions, Charles Scribner's Sons, New York, 1959

Territory of Alaska, Territory of Alaska - Chapter 129 - An Act to Declare the Policy . . . In Connection with . . . Industrial Tax Incentives, March 29, 1957

U.S. Bureau of the Census, Alaska Detailed Characteristics, 1960

_____, Alaska - General Population Characteristics, 1960

_____, Alaska General Social and Economic Characteristics, 1960

_____, Alaska - Number of Inhabitants, 1960

_____, Census of Business, Alaska Retail Trade, 1958

_____, Census of Business, Alaska Selected Services, 1958

_____, Census of Business, Alaska Wholesale Trade, 1958

_____, Census of Business, Alaska and Hawaii Retail Trade, 1958

_____, Census of Business, Alaska and Hawaii Wholesale Trade, 1958

_____, Census of Manufactures, Alaska, 1958

_____, Census of Mineral Industries, Alaska, 1959

_____, Census of Population, Alaska - Detailed Characteristics, Final Report PC (1)-30

U.S. Bureau of the Census, Illustrative Projections of the Population of States, Current Population Reports--Population Estimates, Feb. 26, 1965

U.S. Bureau of Indian Affairs, The Indian Industrial Development Program, 1960

U.S. Bureau of Labor Statistics, Consumer Expenditures and Income, Anchorage, Alaska--1959, November 1963

_____, Indexes of Living Costs for Alaskan Cities (reprint from the Monthly Labor Review, March 1962), 1962

_____, The Interim City Worker's Family Budget (reprint from Monthly Labor Review, August 1960), 1960

U.S. Congress, Background Material on Economic Aspects of Military Procurement and Supply, hearings before Joint Economic Committee, 88th Congress, 1st Session, 1963

U.S. Dept. of Commerce, Income in Alaska, supplement to Survey of Current Business, June 1960

_____, Business and Defense Services Administration, Alaska - Its Economy and Market Potential, 1959

U.S. Dept. of Defense, Prime Contract Awards by State, U.S. Government Printing Office, Washington, D.C., September 1964

U.S. Dept. of the Interior, Office of Territories, Mid-Century Alaska

_____, Alaska - 1956-1957

U.S. Dept. of Labor, Employment and Earnings Statistics for the United States, periodical, January 1963 - July 1964; Historical Series for the United States, 1909-62; Historical Series for the States, 1939-62

U.S. Federal Reconstruction and Development, Impact of Earthquake of March 27, 1964, upon the Economy of Alaska, 1964

_____, "Response to Disaster--Alaska Earthquake, March 27, 1964"

U.S. Office of the Secretary of Defense, Five Year Trends in Defense Procurement, June 1963

U.S. Small Business Administration, Expanding Distribution and Warehousing in Alaska, January 1961

U.S. Small Business Administration, Small Business Administration--What It Is and What It Does, September 1962

University of Alaska, Alaska Monthly Review of Business and Economic Conditions, January-June 1964

_____, Alaska's Population and Economy, 2 volumes: I - Analysis, II - Statistical Handbook (report to Department of Economic Development and Planning), 1963

_____, Agricultural Extension Service, Quarterly Report on Alaska's Food Prices, December 1963

Wolf Management Services, A Technical Study of Investment Opportunities in Southeastern Alaska, (for Area Redevelopment Admin., U.S. Dept. of Commerce), New York, 1964

Canada

Alaska-British Columbia-Yukon Conference Minutes, Sept. 14-16, 1964

British Columbia Dept. of Industrial Development, Trade, and Commerce, Bureau of Economics and Statistics, Canada's Exports to Southeast Asia--A Study of Trade and Transportation, Victoria, November 1963

_____, Export Opportunities in the Near East, Victoria, British Columbia, 1962

_____, Import Items Meriting Further Investigation for Domestic Production or Substitution, Victoria, August 1964

Canadian Dept. of Northern Affairs and National Resources, Annual Report for 1962-1963, Ottawa

Caves, Richard E., and Richard H. Holton, The Canadian Economy: Prospects and Retrospect, Harvard University Press, Cambridge, 1961

Cote, E. A., Deputy Minister, Canadian Department of Northern Affairs and National Resources, speech to the National Northern Development Conference, October 1964

Dominion Bureau of Statistics, Canada Year Book, Ottawa

_____, Census of Canada, Ottawa

"Government Aids to Industry--Plans to Open up Canada's North," Journal of Commerce Weekly, Aug. 8, 1964

98474—18½

The Financial Post, Survey of Markets, Toronto, Ontario, 1964-65

Hamilton, G. C., Chairman of Second National Northern Development Conference, A Summary Report on the Action and Progress in Respect of the Resolutions Adopted by the First and Second Conferences, October 1964

Sharp, Mitchell, Hon., Canadian Minister of Trade and Commerce, speech to the Third National Northern Development Conference in Edmonton, October 1964

British Columbia

Atlin District Board of Trade, A Proposed Plan of Development for Northwestern British Columbia, 1964

"British Columbia Blueprint: Bigger Markets, More Skilled Labor," Western Business and Industry, March 1965, pp. 11-20

British Columbia Dept. of Finance, British Columbia Financial and Economic Review, Victoria, July 1964

British Columbia Dept. of Industrial Development, Trade, and Commerce, Annual Report for Year Ended December 31, 1962, Victoria

_____, British Columbia Manual of Resources and Development, Victoria, 1964

_____, "Northwestern British Columbia, Census Division 9, 1961 Population by Enumeration Areas" (map), Victoria, 1963

_____, "Peace River, British Columbia Census Division 10, 1961 Population by Enumeration Areas" (map), Victoria

_____, "Population Distribution - 1961" (map), Victoria

_____, Bureau of Economics and Statistics, British Columbia Facts and Statistics, Victoria, 1963

_____, British Columbia Trade Index, Victoria, British Columbia, 1962

_____, "Current Conditions in British Columbia," Monthly Bulletin of Business Activity, Victoria, November 1964

_____, Establishing a Business in British Columbia: Outline of Government Regulations and Services, 5th edition, Victoria, British Columbia, 1963

British Columbia Dept. of Industrial Development, Trade, and Commerce, Bureau of Economics and Statistics, Exports and Imports through British Columbia Customs Ports, Victoria, 1958

_____, "Industrial and Economic Development in Northern British Columbia," submitted to the Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 14-16, 1964

_____, Industrial Expansion in British Columbia by Census Divisions, Victoria, 1963

_____, Preliminary Statement of External Trade through British Columbia Customs Ports for the Calendar Year 1963 (also 1962), Victoria, British Columbia

_____, Regional Index of British Columbia, 1957 edition

_____, The Pacific Rim of Latin America--A Trade Aid for British Columbia Businessmen, Victoria, British Columbia, September 1963

British Columbia Dept. of Lands, Forests, and Water Resources, "British Columbia - General" (map), Victoria

_____, "British Columbia - Relief" (map), Victoria

_____, "Northeastern British Columbia" (map), Victoria

Vancouver Sun, Factual Inventory of British Columbia, 1956, 1964

Western Development and Power, Ltd., The British Columbia-Alberta Market in Relation to Other Canadian Markets, Vancouver, British Columbia, 1957

Yukon

"Commissioner Discusses Potential," Journal of Commerce Weekly, Sept. 4, 1965

"Development Opportunities in Yukon," Journal of Commerce Weekly, Aug. 7, 1965

"The Yukon Today," Macleans, Oct. 17, 1964

Yukon Government, Annual Report, 1963, 1964, Whitehorse

Alberta

"Alberta's Economic Pillars Strengthen with New Industry, More Oil, Gas, Chemicals," Western Business and Industry, July 1965, pp. 26-32

Alberta Dept. of Industry and Development, Bureau of Statistics, Alberta Industry and Resources, Edmonton

_____, Annual Review of Business Conditions, Alberta, Edmonton

_____, Population of Alberta 1956 and 1961; Forecast 1966, 1971, 1976, and 1981, Edmonton, April 1965

_____, Industrial Development Branch, Alberta Opportunities for You, Province of Alberta Resources and Developments, Edmonton

_____, Province of Alberta, Edmonton

"Alberta: Working Model of a Healthy Industrial Climate," Western Business and Industry, (an interview with Premier Manning), July 1965, pp. 34-5

Calgary Power Ltd., Alberta--Province of Opportunity

"The Changing Face of Canada's North," The Edmonton Journal, Oct. 21, 1964

Northern Alberta Development Council, Annual Report for 1964, Grande Prairie, Alberta

_____, Economic Report--Alberta's Peace River Country, Grande Prairie, Alberta, January 1965

Natural Resources, Water Power, and Agriculture

General

Eckstein, Otto, Water Resource Development, Harvard University Press, Cambridge, 1961

_____, Water Resource Development: The Economics of Project Evaluation, Harvard University Press, Cambridge, Mass., 1958

Hirshleifer, J., et al., Water Supply: Economics, Technology and Policy, The University of Chicago Press, Chicago, Ill., 1963

Krutilla, John V., and Otto Eckstein, Multiple Purpose River Development, The Johns Hopkins Press, Baltimore, Md., 1958

Maass, Arthur, et al., Design of Water-Resource Systems, Harvard University Press, Cambridge, Mass., 1962

Steiner, Peter O., "Choosing among Alternative Public Investments in the Water Resource Field," American Economic Review, Vol. 49 (December 1959)

U.S. Senate, Water Resources Activities in the United States, Population Projections and Economic Assumptions, Committee Print No. 5, 86th Cong., 2nd Sess., U.S. Government Printing Office, Washington, D.C., 1960

U.S. Inter-Agency Committee on Water Resources, Subcommittee on Evaluation Standards, Proposed Practices for Economic Analysis of River Basin Projects, U.S. Government Printing Office, Washington, D.C., 1958

West Coast Lumberman's Association, West Coast Hemlock Lumber, 1963

Alaska

A. D. Little, Inc., Alaska's Forest Resources as a Base for Industrial, Development (report to the State of Alaska), November 1961

_____, Possibilities for Agricultural Industry in Alaska, 1961

_____, Potential for Use of Alaska's Energy Resources (report to the State of Alaska), January 1962

Alaska Department of Fish and Game, Progress Report--1960-1962, 1963

Alaska Development Board, Possibility of Commercial Development of Gubik Gas Field and Use of Natural Gas as a Source of Heat and Power in the Railbelt Area of Alaska, Juneau, Alaska, June 30, 1964

Gazoway, H. P., Facts and Observations on Agricultural Development in Alaska (prepared for the Alaska Division of Lands)

Greater Anchorage Chamber of Commerce, Survey of the Future Growth of the Petroleum Industry in Alaska and Its Impact on Anchorage, by James W. Dalton, Anchorage, Alaska, 1958

Iowa State College, Soil Research Laboratory, Alaska Soils, February 1959

Ivan Bloch & Associates, Background Facts on Rampart Canyon Project--Yukon River, Alaska (prepared for the State of Alaska), October 1963

Kirkness, Walter, Commissioner, Alaska Dept. of Fish and Game, "Alaska Fishery Development," submitted to the Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 16, 1964

U.S. Bureau of Land Management, Establishing a Farm in Alaska, 1961

U.S. Congress Subcommittee on Benefits and Costs of the Federal Inter-Agency River Basin Committee, Proposed Practices for Economic Analysis of River Basin Projects: Report to the Federal Interagency River Basin Committee, U.S. Government Printing Office, Washington, D.C., 1950

U.S. Dept. of Agriculture, Forest Products Laboratory, Characteristics of Alaska Woods, January 1963

_____, Marketing Economics Division, Marketing of Farm Products in Alaska--Our 49th State, April 1961

U.S. Dept. of the Interior, Bureau of Land Management, Information Relative to the Use and Disposal of Public Lands in Alaska (revised)

_____, Project Twenty-Twelve: A Long Range Program for our Public Lands (Part II, State Distribution), 1961

U.S. Federal Power Commission, San Francisco Regional Office, Alaska Power Market Study

U.S. Forest Service, Forest Service Manual and Handbook and Supplements, October 1958

_____, National Forest Recreation Survey, Alaska Region, 1960

U.S. Geological Survey, Mineral and Water Resources of Alaska (prepared for the Committee on Interior and Insular Affairs, U.S. Senate), 1964

U.S. Senate Committee on Interior and Insular Affairs, Crater-Long Lakes Division, Snettisham Project, Alaska, Jan. 3, 1961

U.S. Senate Committee on Public Works, The Market for Rampart Power: Yukon River, Alaska, U.S. Government Printing Office, Washington, D.C., 1962

University of Alaska, Agriculture Experiment Station, Farm and Consumer Research, April 1963

_____, Cooperative Extension Service, Alaska's 1962 Dairy Business

_____, Alaska's 1963 Farm Outlook, January 1963

Canada

Battelle Memorial Institute, "The North--A Continental Storehouse," a paper presented at the Third National Northern Development Conference, October 1964

B.C. and Yukon Territory with an Index of Mining Properties (map)

British Columbia Hydro and Power Authority, Industrial Development Department, The Mining Industry of British Columbia and the Yukon, Vancouver, May 1964

British Columbia and Yukon Chamber of Mines, List of Mines, Oils, and Quarries, Vancouver, May 1964

_____, Mining Exploration Companies, Vancouver

_____, Submission re proposal to establish a national park in the area of the St. Elias Mountain Range, Yukon Territory, Vancouver, December 7, 1959

Canadian Dept. of Mines and Technical Surveys, "Principal Mineral Area of Canada, 1963" (map), Ottawa

_____, Mineral Resources Division, The Canadian Minerals Yearbook, 1962, Ottawa, 1964

_____, Mineral Resources of the Canadian Northland, by W. Keith Buck, Ottawa, October 1964

_____, Some Economic Factors Affecting Northern Mineral Development in Canada, by Amil Dubrie, Mineral Information Bulletin MR 38, Ottawa, December 1959

Canadian Dept. of Northern Affairs and National Resources, Economics of Oil and Gas Development in Northern Canada, by G. David Quirin, Ottawa, January 1962

Canadian Dept. of Northern Affairs and National Resources, Northern Administration Branch, Resources Division, Forests and Forestry in the North, 1963-64, Ottawa, Nov. 1, 1964

_____, Mining in the North, 1963-64, Ottawa

_____, Northern Oil and Gas (summary of data presented to Northern University), Ottawa, November 1963

_____, Oil and Gas Canada Lands, 1963-64, Ottawa, November 1964

_____, Water Power Resources of Canada, Ottawa, March 1964

_____, Water Resources Branch, Development of Electric Power in Canada, Ottawa, Jan. 1964

_____, Principal Power Developments in Canada, Ottawa, March 1964

_____, Quarterly Report--Mining in Northern Canada, April-June 1964, Ottawa

_____, Territorial Lands Administration, Ottawa, Nov. 1, 1964

Canadian Petroleum Association, Statistical Year Book, Calgary, Alberta

Inayama, Yoshihiro, Leader of 1964 Japanese Economic Mission to Canada, "Canada's Northern Resources and Japan," speech presented to the Third National Northern Development Conference in Edmonton, October 1964

McKinnoa, I. N., Chairman, National Energy Board, "Future Power Development," speech presented to the Third National Northern Development Conference held in Edmonton, October 1964

"Oil and Gas--A Feature Report," The Financial Post, Nov. 28, 1964

"Our Northern Frontier May Become North America's Dinner Plate," The Financial Post, Sept. 26, 1964, p. 50

Pipelines of British Columbia, Alberta, and the Western States (map)

Turner, D. B., "The Resources Future," The Canadian Northwest: Its Potentialities, Frank H. Underhill, ed., Symposium presented to the Royal Society of Canada in 1958, University of Toronto Press, 1959

British Columbia

"Big Refinery Expansion Ahead," Oilweek, June 7, 1965, p. 38

British Columbia, Attorney General, Intervention before the National Energy Board re Applications of Alberta and Southern Gas Co., Ltd., Alberta Natural Gas Company, and Trans-Canada Pipe Lines Limited for the Export of Gas, Victoria, March 1965

"B.C. Changing Rules to Spur Exploration," The Globe and Mail, Jan. 20, 1965

British Columbia Dept. of Agriculture, Annual Report for 1963, Vancouver

_____, Extension Service, "Inventory of Agriculture in British Columbia, 1964," by J. S. Allin, speech presented to the Fifteenth British Columbia Natural Resources Conference

British Columbia Dept. of Industrial Development, Trade, and Commerce, Bureau of Economics and Statistics, British Columbia Forest Industry Statistics 1960, Victoria, January 1963

_____, British Columbia Manual of Resources and Development, Victoria, 1964

_____, Initial Approach to Muskeg Problems and Potentials in British Columbia, 1957

_____, Petrochemicals--A British Columbia Industry Study, 2nd ed., Victoria, 1964

_____, Recent Developments in the British Columbia Pulp and Paper Industry, Victoria, 1964

_____, Some Major Mineral Developments in British Columbia, Victoria, March 1962

British Columbia Dept. of Lands, Forests, and Water Resources, "British Columbia" (map), Victoria, 1957

_____, Water Resources Service, Annual Report for 1964, Victoria

_____, "Northern Power Resources," submitted to Alaska-B.C.-Yukon Conference, Whitehorse, Sept. 14-16, 1964

"British Columbia--A Feature Report," The Financial Post, March 13, 1965

"B.C. Gas Field Given Big Push," The Globe and Mail, March 23, 1965

British Columbia Hydro and Power Authority, Peace River Power, Vancouver

98474—19½

British Columbia Hydro and Power Authority, Area and Industrial Development Department, British Columbia's Pulp and Paper Industry, Vancouver, September 1963

_____, Summary of Expansion in the Pulp and Paper Industry, Vancouver, November 1964

British Columbia Lumber Manufacturers Association, B.C. Timber Harvest, Vancouver

British Columbia Minister of Mines and Petroleum Resources, Annual Reports, Victoria, Dec. 1, 1963

British Columbia Natural Resources Conference, Inventory of the Natural Resources of British Columbia, 1964

British Columbia and Yukon Chamber of Mines, "Current Mining Developments in British Columbia," by T. Elliott, Manager, speech to the Northwest Mining Association Convention in Spokane, December 1964

Canadian Forestry Association of British Columbia, Forest Facts of British Columbia, Vancouver, 1962

Canadian Pulp and Paper Association, Pulp and Paper in British Columbia, Montreal

Holland, Stuart S., "Prospecting and Mineral Development in Northern British Columbia," Western Miner and Oil Review, February 1962

"Noranda Asks Permission to Build Canada; Cost Is Put at $10 Million," The Wall Street Journal, March 19, 1965

Rehwald, G. V., "Petroleum and Natural Gas Resources," British Columbia Natural Resources Conference, 1964 (also Addendum dated September 1964)

Turner, D. B., "Inventory of National Resources of British Columbia," British Columbia Natural Resources Conference, 1964

"Union Oil of Canada Slates Refinery in British Columbia," The Wall Street Journal, April 5, 1965

Yukon

Aho, A. E., Consulting Geological Engineer (Vancouver, B.C.), "Mineral Potential of the Mayo District," Western Miner, October 1964, pp. 80-89

Baxter, Clive, "Canada Is Cool toward Power Plan for Alaska," The Financial Post, March 13, 1965

Brown, Charles J., Geologist, The White Pass and Yukon Corporation Limited, "Yukon Mining Developments, 1964," a speech to the Northwest Mining Association Convention, Spokane, December 1964

Canadian Dept. of Agriculture, Gardening in the Yukon, Ottawa, June 1963

Canadian Dept. of Agriculture, Research Branch, Soil Research Institute, Central Experimental Farm, Reconnaissance Soil Survey of the Takhiai and Dezadeash Valleys in the Yukon Territory, by J. H. Day, Ottawa, 1962

Canadian Dept. of Mines and Technical Surveys, Geological Survey of Canada, The Mineral Industry of Yukon Territory and Southwestern District of Mackenzie, Northwest Territories, 1963, by L. H. Green and C. I. Goodwin, Ottawa, 1964

Canadian Dept. of Northern Affairs and National Resources, Information Service Division, The Yukon Territory, Ottawa

_____, Northern Administration Branch, Resources Division, Catalogue of Natural Resources Data on Yukon and Northwest Territories, Ottawa, May 1964

_____, Guide to Northern Non-Renewable Resources--Yukon, Northwest Territories, and Arctic Islands, Ottawa, July 1964

_____, "Yukon and Northwest Territories" (map), Ottawa, 1962

Canadian Government, Facts about Canada's Yukon, Ottawa

"Mineral Discoveries in North Bright," Journal of Commerce Weekly, Aug. 14, 1965

Mineral Exploration, Yukon Territory, 1962-63 (map)

"Northern Oil Play Just Getting Started," Oilweek, Oct. 5, 1964, p. 32

"Record Year Shaping up in Northern Territories," Oilweek, Feb. 15, 1965, p. 11

Resources for the Future, Inc., 1850-1975

White, C. E., "World's Demand for Minerals," a speech to the Third National Northern Development Conference, Edmonton, October 1964

Yukon Government, Annual Report, 1962-63, Whitehorse

Yukon Government, Commissioner, "Yukon Mineral Resources," a speech to the Alaska-B.C.-Yukon Conference, Whitehorse, Sept. 14-16, 1964

Yukon Government, Whitehorse Experimental Farm, Yukon Horticultural Guide

The Yukon--Minerals and Transportation Routes (map)

Yukon Mining Development - 1963, address to the Canadian Institute of Mining and Metallurgy, Vancouver, Jan. 9, 1965

Alberta

"Alberta Coal Sample to Japan," Financial Times of Canada, June 14, 1965

Alberta Dept. of Agriculture, Farm Economics Branch, "Census Data 1956 and 1961 for Census Division 15" (table), Edmonton

_____, Statistics of Agriculture for Alberta, 1962 and 1963, Edmonton

Alberta Dept. of Industry and Development, Bureau of Statistics, Alberta Industry and Resources, Edmonton

Alberta Dept. of Lands and Forests, Forest Surveys Branch, Alberta Forest Inventory, Edmonton, November 1961

Alberta Dept. of Lands and Forests, "Alberta Forest Inventory Record Map Forest Management Planning" (map), Edmonton

_____, Annual Report for Year ended March 31, 1964, Edmonton

_____, "Areas in Forest Inventory and Annual Production, Census Districts 14 and 15" (table), Edmonton

_____, Forest Management Units, Edmonton

_____, The Homestead Lease Loan Regulations under the Homestead Lease Loan Act, Edmonton, June 21, 1960

_____, Homestead Sales, extracts from The Public Lands Act, Edmonton

_____, "Province of Alberta--Potential and Doubtful Arable Land" (map), Edmonton

Alberta Dept. of Mines and Minerals, "Alberta Oil and Gas Picture, 1947-1964" (map and tables), Edmonton, 1965

Alberta Dept. of Mines and Minerals, Mines Division, Annual Reports, Edmonton

Alberta Government, Appendix D--Some Statistics of Agriculture, Peace River Area, 1941, 1951, and 1956, submission to Battelle Memorial Institute, 1958

Alberta Oil and Gas Conservation Board, "Alberta--Showing Reserves of Gas by Field and Area" (map)

_____, Application of Trans-Canada Pipelines Limited and Alberta and Southern Gas Co. Ltd. under the Gas Resources Preservation Act, 1956, Report No. 64-11

_____, Cumulative Annual Statistics, Alberta Oil and Gas Industry, Report No. 65-7

_____, Report to the Lieutenant Governor in Council with Respect to the Application under the Gas Resources Preservation Act, 1956, of West Coast Transmission Co., Ltd., August 1962

_____, Reserves of Gas, Natural Gas Liquids, Crude Oil and Sulphur, Province of Alberta, Report No. 65-8

Dominion Bureau of Statistics, Fisheries--Alberta and Northwest Territories, Catalogue No. 24-212, Ottawa

Calgary Power Ltd., Alberta--Province of Opportunity

Canadian Petroleum Association, Alberta Division, Supply and Transportation of Natural Gas in the Peace River Area, April 25, 1962

Foster Associates Ltd.--Volume I of the Application of Alberta and Southern Gas Co. Ltd. before the National Energy Board re Gas Export to Northern California, study for Alberta and Southern Gas Co. Ltd. on Future Use of Natural Gas in Canada, 1964

"Homestead Hunting Still Brisk in Spite of New Regulations," Within Our Borders, June 1965

Research Council of Alberta, Geology of the Chinchaga River and Clear Hills (North Half) Map Areas, Alberta, by R. Green and G. B. Mellon, Edmonton, 1962

_____, Geology of the Peace River Glass Sand Deposit, by M. B. B. Crockford, Edmonton, April 1959

"Returning of Prices to 1960 Level Will Mark Canadian Sulphur Boom," Oilweek, April 5, 1965, p. 26

Schmidt, John, "Agricultural Alberta," The Calgary Herald, Sept. 18, 1965

Transportation and Communication

General

Adler, Hans A., "Economic Evaluation of Transport Projects," in Transport Investment and Economic Development," Gary Fromm, ed., Brookings Institution, Washington, D.C., c. 1965

American Association of State Highway Officials, Committee on Planning and Design Policies, Road User Benefit Analyses for Highway improvements, Washington, D.C., 1960

American Road Builders' Association, Increase in Land Values following Construction of Expressways, by D. C. Greer, Technical Bulletin 202, Washington, D.C., 1953

Automobile Manufacturers Association, Inc., Automobile Facts and Figures, Detroit, 1964

The Economics of Highway Planning, by R. H. Baldock, et al., Oregon State Highway Commission, Tech. Bull. No. 17, Salem, Oregon, September 1938

Bangs, R. L., "Boost for Freeways," California Highways and Public Works, Vol. 28, Nos. 11 and 12 (November-December 1949), p. 29-33

Beckman, Martin, et al., Studies in the Economics of Transportation, Yale University Press, New Haven, Conn., 1956

Berry, Brian J. L., "Recent Studies Concerning the Role of Transportation in the Space Economy," Annals of the Association of American Geographers, Vol. 49, No. 3, (September 1959), pp. 328-42

Brown, Robert F., and Clell G. Harral, "Estimating Highway Benefits in Underdeveloped Countries," paper presented at the 44th Annual Meeting of the Highway Research Board, Washington, D.C., January 1965

Brownlee, O. H., and Walter W. Heller, "Highway Development and Financing," American Economic Review, Vol. 46, No. 2 (May 1956), pp. 232-50

Chase Manhattan Bank, America's Road Problem, New York, 1955

Denver University, College of Business Administration, Bureau of Business and Social Research, A "Before and After" Study of Effects of Limited Access Highway upon the Business Activity of By-Passed Communities and Upon Land Value and Land Use, Denver, Colorado, October 1958

Grant, E. L., and W. G. Ireson, Principles of Engineering Economy, Ronald Press, New York, 1960

Grant, E. L., and C. H. Oglesby, "A Critique of Some Recent Economy Studies Comparing Alternate Route Locations," Highway Research Board Proceedings, 1960

Horwood, Edgar M., and Ronald R. Boyce, Studies of the Central Business District and Urban Freeway Development, University of Washington Press, Seattle, Wash., 1959

Hotelling, Harold, "The General Welfare in Relation to Problems of Taxation and of Railway and Utility Rates," Readings in the Economics of Taxation, Richard D. Irwin, Homewood, Ill., 1959

Huff, David L., and Duane F. Marble, "Economic Impact of Highway Improvements," University of Washington Business Review, October 1959

Jones, E. P., "Outer Highway Increased Business for Roadside Restaurant," California Highways and Public Works, Vol. 28, Nos. 1 and 2, (January-February 1949)

Kelly, John F., "Industry and Freeways," California Highways and Public Works, Vol. 33, Nos. 5 and 6 (May-June 1954)

_____, "Motels and Freeways," California Highways and Public Works, Vol. 33, Nos. 1 and 2 (January-February 1954)

_____, "Residences and Freeways," California Highways and Public Works, Vol. 36, Nos. 3 and 4 (March-April 1957)

Kelly, John F., and Edward P. Reilly, "Industry and Frontage Roads," California Highways and Public Roads, Vol. 33, Nos. 7 and 8 (July-August 1954)

Kuhn, Tillo, Public Enterprise Economics and Transport Problems, University of California Press, Berkeley, Calif., 1962

Lefeber, Louis, Allocation in Space: Production Transport and Industrial Location, North-Holland Publishing Company, Amsterdam, 1958

Los Angeles Street and Parkway Division, The Economy of Freeways, June 1953

_____, A Study of Freeway Ststem Benefits, September 1954

Lubar, Robert, "Interchange Ahead," Fortune, Vol. 59, No. 10 (October 1958), pp. 131-34 and 216-19

McCoy, George T., "Techniques of Making Land Economic Studies," California Highways and Public Works, Vol. 35, Nos. 9 and 10 (September-October 1956)

MacDonald, Thomas H., A Factual Discussion of Motor Truck Operations, Regulations, and Taxation, Government Printing Office, Washington, D.C., 1951

Michigan State University, Highway Traffic Safety Center and College of Business and Public Service, The Impact of Highways on Land Uses and Property Values: A Review of Current Studies, by A. E. Warner, East Lansing, Mich., March 1958

Michigan University, Institute for Social Research, Survey Research Center, Gasoline Prices, Price Changes, and Price Setting: A Study of Consumer Opinion, Ann Arbor, Mich., 1956

Mottring, Herbert D., and Mitchell Harwitz, Highway Benefits, An Analytical Framework, Northwestern University Press, Evanston, Ill., 1962

National Academy of Sciences, National Research Council, Highway Research Board, Developing Concepts of Land Acquisition: 1957, Bulletin 169, Washington, D.C., 1957

_____, Economic Impact of Highway Improvement: Conference Proceedings, March 18-19, 1957, Special Report 28, Washington, D.C., 1957

_____, Economy Studies for Highways, Bulletin 306, 1961

_____, Highway Investment and Financing, Bulletin 222, Washington, D.C., 1957

_____, Highway Planning and Urban Development, Bulletin 64, Washington, D.C., 1952

_____, Highways and Economic Development, Bulletin 227, Washington, D.C., 1959

_____, "Influence of Transportation Changes on Urban Land Uses and Values," Some Evaluations of Highway Improvement Impacts, Bulletin 268, Washington, D.C., 1961

_____, Interest and the Rate of Return on Investment, by Eugene L. Grant, Special Report 56, 1959

_____, Land Acquisition and Economic Impact Studies, Bulletin 189, Washington, D.C., 1958

_____, Some Economic Effects of Highway Improvement, Bulletin 67, Washington, D.C., 1953

Nolen, J., and H. V. Hubbard, Parkways and Land Values, Harvard City Planning Studies XII, Cambridge, Mass., 1937

Oglesby, C. H., and E. L. Grant, "Economic Analysis--The Fundamental Approach to Decisions in Highway Planning and Design," Highway Research Board Proceedings, Vol. 37, 1958

Oglesby, C. H., and L. I. Hewes, Highway Engineering, John Wiley and Sons, New York, 1963

Oklahoma State Highway Department, Economic Impact Research: Public Information Program in Oklahoma, by Jerome J. Waters, Oklahoma State Highway Department, Oklahoma City, 1957

Oklahoma State Highway Department of Statistics, Manual of Procedure for Conducting an Economic Survey, Oklahoma City, September 1956

Owen, Wilfred, The New Highways: Challenge to the Metropolitan Region, Connecticut General Life Insurance, Hartford, Conn., 1957

Pendleton, William C., "The Economic Impact of Highway Improvement on Land Resources," Modern Land Policy, University of Illinois Press, Urbana, 1961

Stanford Research Institute, A Ten-Year Highway Program for Honduras (prepared for the Minister of Communications and Public Works of the Republic of Honduras), Menlo Park, Calif., 1962

Stanford University, Institute in Engineering-Economic Systems, Criteria for Planning Rural Roads in a Developing Country: The Case of Mexico, by Henry Malcolm Steiner, Report EEP-17, August 1965

U.S. Chamber of Commerce, Businessmen's Guide to the Road Program, Washington, D.C., 1957

_____, How Bypasses Affect Business, Washington, D.C., 1956

U.S. Corps of Engineers, Waterborne Commerce of the United States, Calendar Yearbook 1963, Part IV, Government Printing Office, Washington, D.C., 1964

U.S. Dept. of Commerce, Bureau of Public Roads, Highway Capacity Manual, Government Printing Office, Washington, D.C., 1950

U.S. President's Advisory Committee on a National Highway Program, A Ten-Year National Highway Program, Government Printing Office, Washington, D.C., January 1955

U.S. Secretary of Commerce, First Progress Report of the Highway Cost Allocation study, 85th Cong., 1st Sess., Government Printing Office, Washington, D.C., 1957

_____, Second Progress Report of the Highway Cost Allocation Study, 85th Cong., 2nd Sess., Government Printing Office, Washington, D.C., 1958

U.S. Secretary of Commerce, Third Progress Report of the Highway Cost Allocation Study, 86th Cong., 1st Sess., Government Printing Office, Washington, D.C., 1959

University of Birmingham, Faculty of Commerce and Social Science, "The Theory and Measurement of Private and Social Cost of Highway Congestion," by A. A. Walters, Applied Economics, Series B, No. 1, Birmingham, England, no date (mimeographed)

University of California, Institute of Transportation and Traffic Engineering, Highway Benefit and Cost Analysis as an Aid to Investment Decision, by Richard M. Zettel, Reprint No. 49, Berkeley, Calif.

_____, "Notes on the Incidence of Highway Benefits," by Richard M. Zettel (paper presented at the workshop conference on Economic Analysis in Highway Programming, Location and Design, National Academy of Sciences, Washington, D.C., Sept. 18, 1959), Berkeley, Calif. 1959

University of Washington, The Benefits of Rural Roads to Rural Property; Part IV of Allocation of Road and Street Costs, by W. L. Garrison, Seattle, Wash., June 1958

_____, Geographic Impact of Highway Improvement, by W. L. Garrison and Marion E. Marts, Seattle, Wash., 1958

_____, Influences of Highway Improvements on Urban Land: A Graphic Summary, by W. L. Garrison and Marion E. Marts, Seattle, Wash., 1958

_____, Studies of Highway Development and Geographic Change, by W. L. Garrison, et al., Seattle, Wash., 1959

Winfrey, Robley, "Highway Economics," in Highway Engineering Handbook, Kenneth B. Woods, et al., eds., McGraw-Hill Book Company, New York, 1960

_____, "Motor Vehicle Costs for Highway Economy Studies," Arlington, Va., 1963

Young, W. S., "Freeway Values," California Highways and Public Works, Vol. 30, Nos. 9 and 10 (September-October 1951)

Zettel, Richard M., "Effect of Limited-Access Highways on Property and Business Values," in Proceedings, Twenty-fourth Annual Meeting of Institute of Traffic Engineers, New Haven, Conn., October 1953, pp. 83-96

Alaska

"Maintenance of Haines Highway," submitted to Alaska-British Columbia-Yukon Conference, September 14-16, 1964

Alaska, State of, "Summary of Reaction in United States to Alaska International Rail and Highway Commission Report, dated May 25, 1961," submitted to the Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 14-16, 1964

Alaska Dept. of Commerce, Div. of Tourism and Economic Development, Alaska Passenger Traffic Survey, Juneau, Annual issues 1958, 1959, and 1960

Alaska Dept. of Economic Development and Planning, Brief before the Inter-state Commerce Commission at Ketchikan, Alaska, July 14, 1964 (matter of Alaska Forwarding Company, Inc., Docket #275 and #275/1)

_____, A Summary of Alaska's Transportation--1964, By Richard A. Berg, August 1964

Alaska Dept. of Natural Resources, Alaska Comparative Tariff Analysis, 1959

Alaska Dept. of Public Works, Proposed Ferry Service for Southeastern Alaska, February 1959

_____, Div. of Marine Transportation, Alaska Ferry Service, April 1, 1964

_____, Passenger and Vehicle Rates for the Alaska Ferry System, April 1964

_____, "Transcript of Motor Freight Hearing," Aug. 22, 1963

Alaska Resource Development Board, Alaska Passenger Traffic Survey

Battelle Memorial Institute, Transportation Requirements for the Growth of Northwest North America (report to the Alaska International Rail and Highway Commission), 3 volumes, 1961

Bellingham Chamber of Commerce, Economic Justification for Extending the Marine Highway System to Bellingham, Washington, 1964

_____, Reasons for an Alaskan Ferry Terminal at Bellingham, Washington, 1964

"Gold Rush Begins for Alaska Trade," Business Week, Oct. 10, 1964, pp. 186-90

"North to Alaska by Trainship," Railway Age, Feb. 8, 1965, pp. 17-18

Taylor, H. J., "Motor Vehicle Ordinance and Regulations," submitted to the Alaska-British Columbia-Yukon Converence, Whitehorse, Sept. 14-16, 1964

U.S. Civil Aeronautics Admin., Aviation Information Office, Alaska Flight Information Manual

U.S. Coast Guard, Rules and Regulations for Passenger Vessels, 1962

_____, Rules and Regulations for Small Passenger Vessels, 1961

U.S. Congress, House of Representatives, Transportation Requirements for the Growth of Northwest North America, Volume II, Research Reports by Battelle Memorial Institute, House Document No. 176, Vol. 2, 87th Cong., 1st Sess., Government Printing Office, Washington, D.C., 1961, pp. 1-15

W. C. Gilman and Company, Report on--A Proposed Passenger and Vehicle Ferry for Southeast Alaska, 1958 and 1959 supplement (prepared for the U.S. Bureau of Public Roads, 1961 supplement for Department of Public Works)

Canada

"Annual Commercial Vehicle Licence Fees for Canadian Provinces" (map); British Columbia Dept. of Commercial Transport, "Traffic at Weigh Stations on Alaska Highway, 1959-1962 (table), Victoria

Canadian Ministry of Northern Affairs and National Resources, North, July-August 1964

Canadian National Telecommunication, C. N. Mores North

_____, Communications in the North, by J. S. Ford, Chief Engineer

Canadian National Railways, The Northern Railways, by G. R. Graham, Vice-President, Edmonton

"Comparison of Fuel Taxes for Canadian Provinces" (table)

"Consolidated Freightways System Map"

Dominion Bureau of Statistics, Railway Freight Traffic, year ended Dec. 31, 1958

"Route of the Pacific Great Eastern Railroad" (map)

British Columbia

Atlin District Board of Trade, "The Atlin-Juneau Highway--A Proposal for the Alaska-Canada Centennial Project for 1967," by Thomas J. Kirkwood, submitted to Alaska-British Columbia-Yukon Conference, September 1964

British Columbia Minister of Highways, "Transportation and Development," by the Hon. P. A. Gaglardi, submitted to the Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 14-15, 1964

British Columbia Transportation Committee, submitted to the Alaska-British Columbia-Yukon Conference, Sept. 14-16, 1964

British Columbia Government News, Victoria, November-December 1964

British Columbia Dept. of Commercial Transport, Act and Regulations of the Province of British Columbia, Victoria, 1961

_____, Annual Report for 1963, Victoria

_____, Mileage Chart, Victoria

_____, "Trucks and Freight Tonnage Entering Alaska via Haines Road during Open Periods, 1948-1957" (chart), Victoria

British Columbia Dept. of Industrial Development, Trade, and Commerce, Bureau of Economics and Statistics, "Proposed Road, Rail, and Ferry Connections to Alaska via British Columbia, 1961" (map), Victoria

_____, "Routes to the North" (map), Victoria

_____, Transportation Routes in the Economic Development of Northern British Columbia, by Gordon W. Sutherland, Victoria, July 1956

"Motor Vehicle Registration and Licensing in Northern British Columbia," Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 14-16, 1964

British Columbia Energy Board, "Electric Service Areas of British Columbia, 1960" (map)

Yukon

Canadian Dept. of Mines and Technical Surveys, "Northwestern Canada--Transportation Facilities, 1964" (map), Ottawa

Canadian Dept. of Northern Affairs and National Resources, Northern Administration Branch, Resources Division, Communications and Transportation Facilities--Queen Elizabeth Group, Artic Islands, Ottawa, Oct. 1, 1964

Canadian Dept. of Northern Affairs and National Resources, Northern Administration Branch, Resources Division, "Communication Systems of Northern Canada" (map), Ottawa, 1963

_____, "Communication Systems of Western Arctic" (map), Ottawa, Oct. 1, 1964

"Transportation Key to Development," Journal of Commerce Weekly, Aug. 21, 1965

"Unique Auction of Equipment," Journal of Commerce Weekly, July 31, 1965

The White Pass and Yukon Corporation Limited, The White Pass and Yukon Corporation Limited Serves Yukon

Alberta

"Alberta to Back Northern Railway," The Calgary Herald, Feb. 24, 1965

"Alberta Plans Railway Link with North," The Globe and Mail, Feb. 19, 1965

Alberta Government, "Submission Two to the Alaska International Rail and Highway Commission and the Battelle Memorial Institute" (supplementary to submission on Feb. 4, 1958), Edmonton

Alberta Minister of Highways, Submission by the Hon. Gordon E. Taylor, to the Alaska International Rail and Highway Commission in Edmonton in February 1958

Canadian Dept. of Highways, "Highways of Alberta, Ottawa" (map)

Yackulic, George, "Alberta's Railroad to the Future," Western Business and Industry, July 1965

Tourism

General

Dominion Bureau of Statistics, Travel between Canada and Other Countries, Catalogue 66-201 annual, Queen's Printer and Controller of Stationery, Ottawa, annual series, 1958-1964

_____, Travel between Canada and the United States, Catalogue 66-001, Queen's Printer and Controller of Stationery, Ottawa, monthly issues, 1964 and 1965

U.S. Bureau of the Census, National Travel Survey--First Quarter 1963, Dec. 2, 1963 (preliminary)

University of Colorado, Bureau of Business Research, The Characteristics of the Tourist or Travel Marker of a Given Destination Area, by L. J. Crampon, 1964

Alaska

A. D. Little, Inc., A Survey of Potential Interest in Tourist Travel to Alaska, Report to the Alaska Department of Economic Development and Planning, 1962

Alaska Dept. of Economic Development and Planning, Alaska Passenger Traffic Survey, September 1962

_____, Traveler Profiles: A Study of Summer Travel to Alaska during 1963 and 1964, by Charles E. Hinkson, Juneau, December 1964

_____, Alaska Travel Division, What's Happening in Alaska, 1963 and 1964

Alaska Dept. of Natural Resources, "State of Alaska--Statement on Tourist Development'," by Phil R. Holdsworth, submitted to the Alaska-British Columbia-Yukon Conference, Whitehorse, Sept. 14-16, 1964

_____, Div. of Tourist and Economic Development, Financial Data Regarding the Incorporated Towns and Cities of Alaska - 1958, October 1959

Alaska Travel Promotion Association, Alaska Travel Manual--1963, Juneau, 1962

American Automobile Association, Alaska and the Alaska Highway--1963-1964, 1963

Conservation Foundation, Outdoor Recreation Resources Review Commission, Alaska Outdoor Recreation Potential, Study Report 9, Washington, D.C., 1962

Guide to Alaska Inc., Guide to Alaska and the Yukon, 12th Edition, by Lou Jacobin, Anchorage, Alaska, 1958 and 17th edition, 1963, U.S. Dept. of Interior, National Park Service, Alaska Recreation Survey, by William J. Stanton, Parts I and II, Government Printing Office, Washington, D.C., 1953

University of Alaska, Tourist Industry in Alaska (prepared for the U.S. Small Business Administration), March 1961

Canada

British Columbia Automobile Association, Annual Report for 1963

_____, British Columbia Motorist, January-February 1964; May-June 1964; July-August 1964

British Columbia Government Travel Bureau, British Columbia Tourism, 1962, Victoria

_____, British Columbia Tourist Accommodation Directory, 1964, Victoria

_____, Visitors 1963--A Study of Visitors to British Columbia in the Summer of 1963, Victoria

Canadian Government Travel Bureau, Accommodation and Roadside Facilities, 1964 Revision, Ottawa

_____, Alaska Highway - Road to Yukon Adventure, Ottawa

Chamber of Commerce, The Big Peace River Country of British Columbia, Peace River District, British Columbia

Tourist Development in Northern British Columbia, Alaska-British Columbia-Yukon Conference, Sept. 14-16, 1964

Yukon Dept. of Travel and Publicity, A Survey of the Tourist Industry of the Yukon Territory, Whitehorse, July 1962

_____, Tourist Development in the Yukon Territory, September 1964

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Figure 2

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N.H.H./62

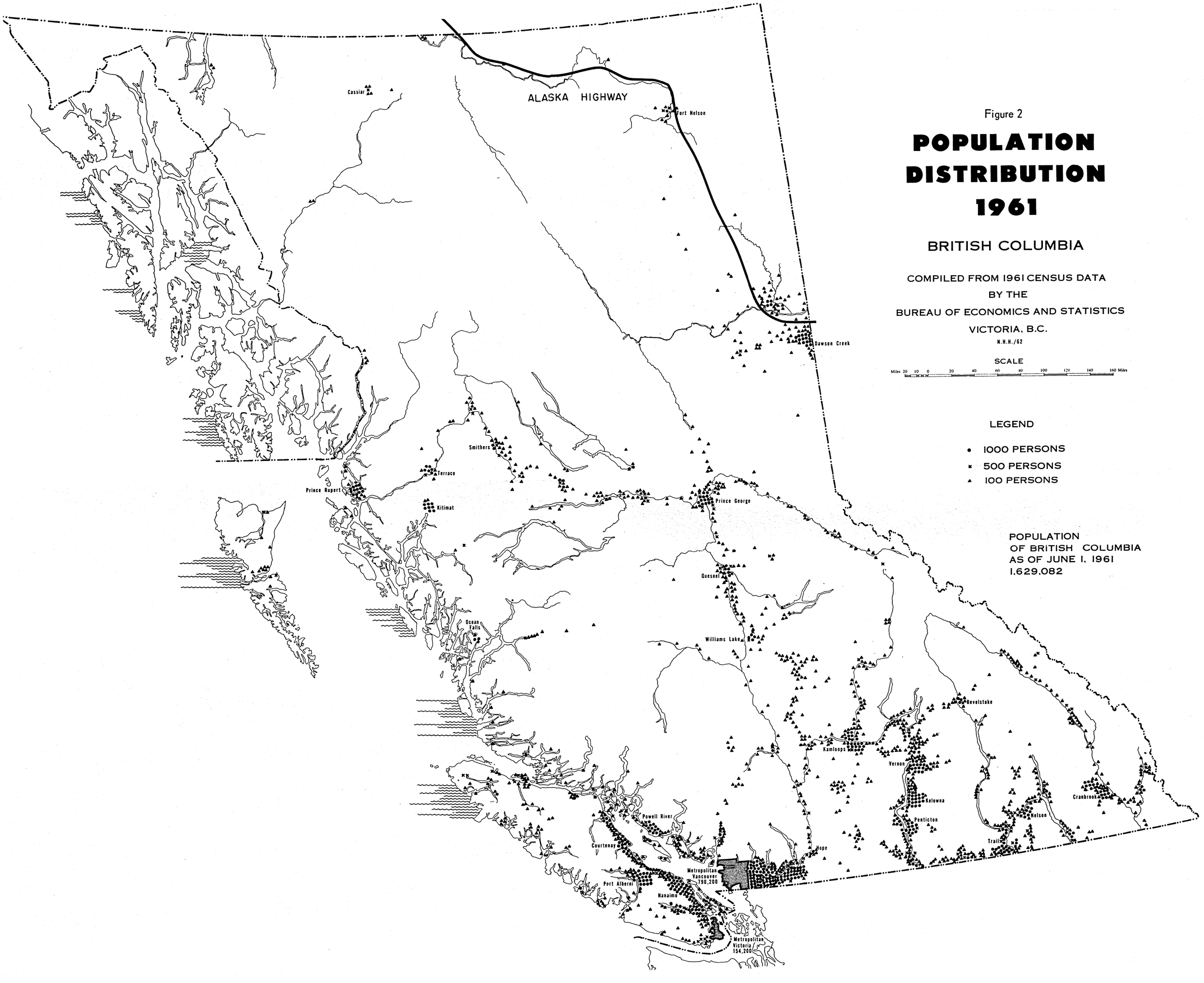
SCALE

Miles 20 10 0 20 40 60 80 100 120 140 160 Miles

LEGEND

- 1000 PERSONS
- 500 PERSONS
- 100 PERSONS

POPULATION
OF BRITISH COLUMBIA
AS OF JUNE 1, 1961
1,629,082



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Scale: 1 inch to 50 miles

Miles 25 0 25 50 75 100 125 150 Miles

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REFERENCE

- RAILWAY
- MOTOR ROAD
- WINTER ROAD
- HIGHWAY NUMBER (28)
- FERRY (Fy)
- SHIPPING SERVICE
- AIRPORT
- AIRFIELD
- SEAPLANE ANCHORAGE
- PROPOSED REVISIONS ROUTE "C" ALASKA HIGHWAY (R)
- POSSIBLE FLOODED AREA (HYDRO)
- PROPOSED ROUTE "E", ALASKA HIGHWAY

AIR DISTANCES BETWEEN MAIN CENTRES (in statute miles)

Edmonton (Intl) - Fort McMurray	249	Edmonton (Intl) - Grande Prairie	250
Fort McMurray - Fort Smith	234	Grande Prairie - Fort St John	103
Fort Smith - Hay River	142	Fort St John - Fort Nelson	192
Hay River - Fort Simpson	192	Fort Nelson - Watson Lake	236
Fort Simpson - Wrigley	122	Watson Lake - Whitehorse	217
Wrigley - Norman Wells	175	Whitehorse - Dawson	264
Norman Wells - Inuvik	277		
		Grande Prairie - Prince George	176
Fort Smith - Fort Resolution	99	Prince George - Smithers	193
Fort Resolution - Yellowknife	93	Smithers - Terrace	61
Yellowknife - Cambridge Bay	528	Terrace - Prince Rupert	76