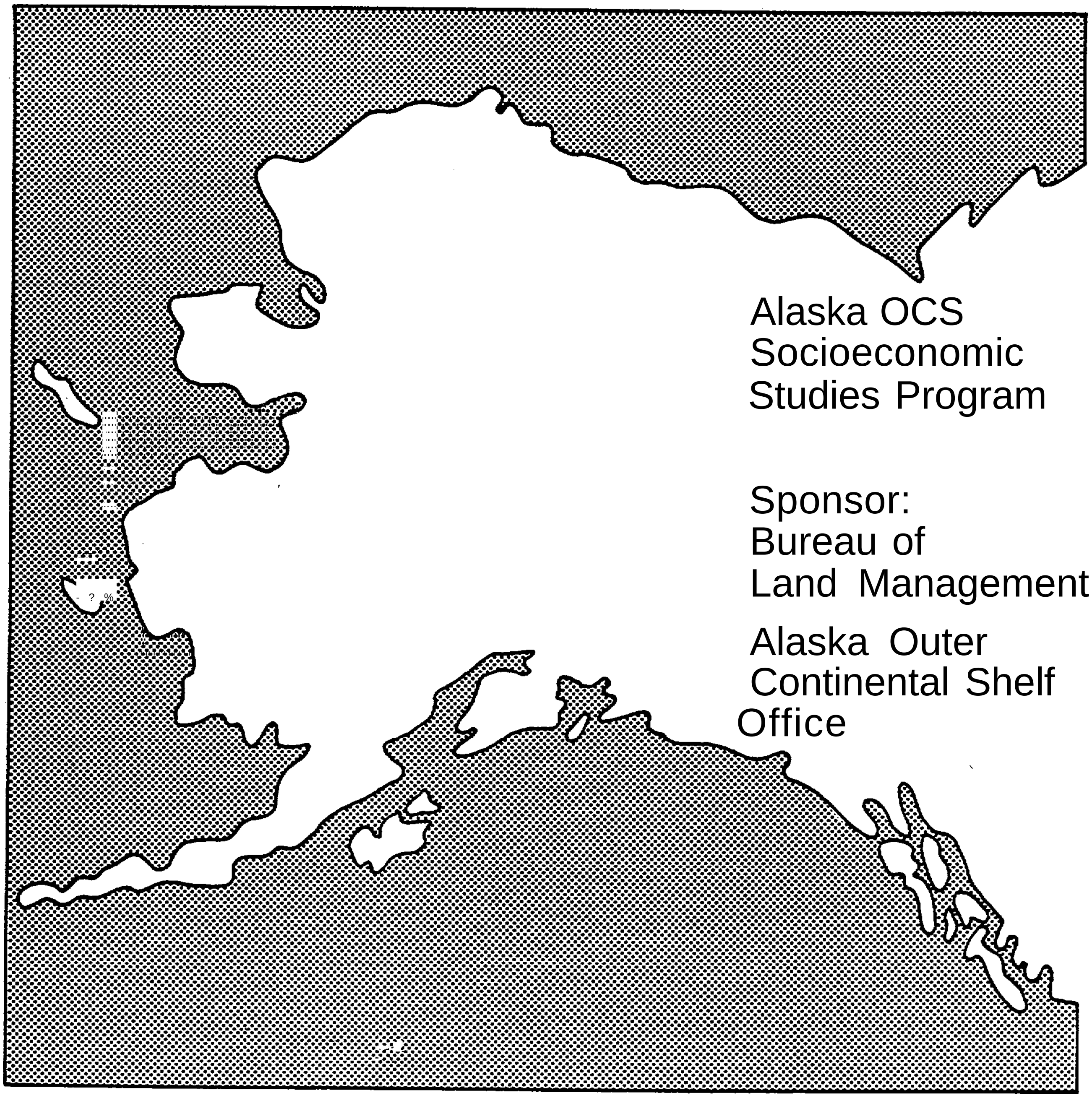
Technical Report
Number 31



Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of
Land Management

Alaska Outer
Continental Shelf
Office

Northern Gulf of Alaska
Petroleum Development Scenarios
Transportation Systems Impacts

The United States Department of the Interior was designated by the Outer Continental Shelf (OCS) Lands Act of 1953 to carry out the majority of the Act's provisions for administering the mineral leasing and development of offshore areas of the United States under federal jurisdiction. Within the Department, the Bureau of Land Management (BLM) has the responsibility to meet requirements of the National Environmental Policy Act of 1969 (NEPA) as well as other legislation and regulations dealing with the effects of offshore development. In Alaska, unique cultural differences and climatic conditions create a need for developing additional socioeconomic and environmental information to improve OCS decision making at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program (SESP).

The Alaska OCS Socioeconomic Studies Program is a multi-year research effort which attempts to predict and evaluate the effects of Alaska OCS Petroleum Development upon the physical, social, and economic environments within the state. The overall methodology is divided into three broad research components. The first component identifies an alternative set of assumptions regarding the location, the nature, and the timing of future petroleum events and related activities. In this component, the program takes into account the particular needs of the petroleum industry and projects the human, technological, economic, and environmental offshore and onshore development requirements of the regional petroleum industry.

The second component focuses on data gathering that identifies those quantifiable and qualifiable facts by which OCS-induced changes can be assessed. The critical community and regional components are identified and evaluated. Current endogenous and exogenous sources of change and functional organization among different sectors of community and regional life are analyzed. Susceptible community relationships, values, activities, and processes also are included;

The third research component focuses on an evaluation of the changes that could occur due to the potential oil and gas development. Impact evaluation concentrates on an analysis of the impacts at the statewide, regional, and local level.

In general, program products are sequentially arranged in accordance with BLM's proposed OCS lease sale schedule, so that information is timely to decisionmaking. Reports are available through the National Technical Information Service, and the BLM has a limited number of copies available through the Alaska OCS Office. Inquiries for information should be directed to: Program Coordinator (COAR), Socioeconomic Studies Program, Alaska OCS Office, P. O. Box 1159, Anchorage, Alaska 99510.

Technical Report No. 31 Contract No. AA550-CT6-61

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Alaska OCS Socioeconomic Studies Program

NORTHERN GULF OF ALASKA

PETROLEUM DEVELOPMENT SCENARIOS

TRANSPORTATION SYSTEMS ANALYSIS

Prepared for

Bureau of Land Management

Alaska Outer Continental Shelf Office

Prepared by

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April 1980

Document is available to the public through the
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NOTICE

Alaska OCS Socioeconomic Studies Program
Northern Gulf of Alaska
Petroleum Development Scenarios
Transportation Systems Analysis

Prepared by
Peter Eakland and Associates
for Peat, Marwick, Mitchell & Co.

April 1980

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1.0 INTRODUCTION

1.1 Purpose

Transportation has been selected by the Bureau of-Land Management as one of the principal areas of study in its Alaska Outer Continental Shelf (OCS) Socioeconomic Studies Program. This introductory chapter provides a statement of the subject matter that this study of transportation impacts addresses, a general discussion of transportation facilities and services, and an overview of the methodology used to generate transportation demands and associated impacts. A detailed discussion of the methodology, including assumptions, is contained in the Appendix.

The study is part of a multidisciplinary effort to analyze potential impacts of oil and gas development resulting from Lease Sale No. 55 which is proposed for the Northern Gulf of Alaska. The study relies extensively on the other elements of the socioeconomic Studies Program, both for this and preceding lease sales.

Chapter 2 summarizes the existing regional and statewide transportation systems within the study area. Chapter 3 contains an analysis of the three base cases, which include the low, mean, and high scenarios of the Beaufort Sea and Lower Cook Inlet (Sale No. CI). The five OCS cases are discussed in Chapter 4. A discussion of measures to ameliorate impacts does not fall under the purpose of this report. Such a discussion properly belongs in the Environmental Impact Statement.

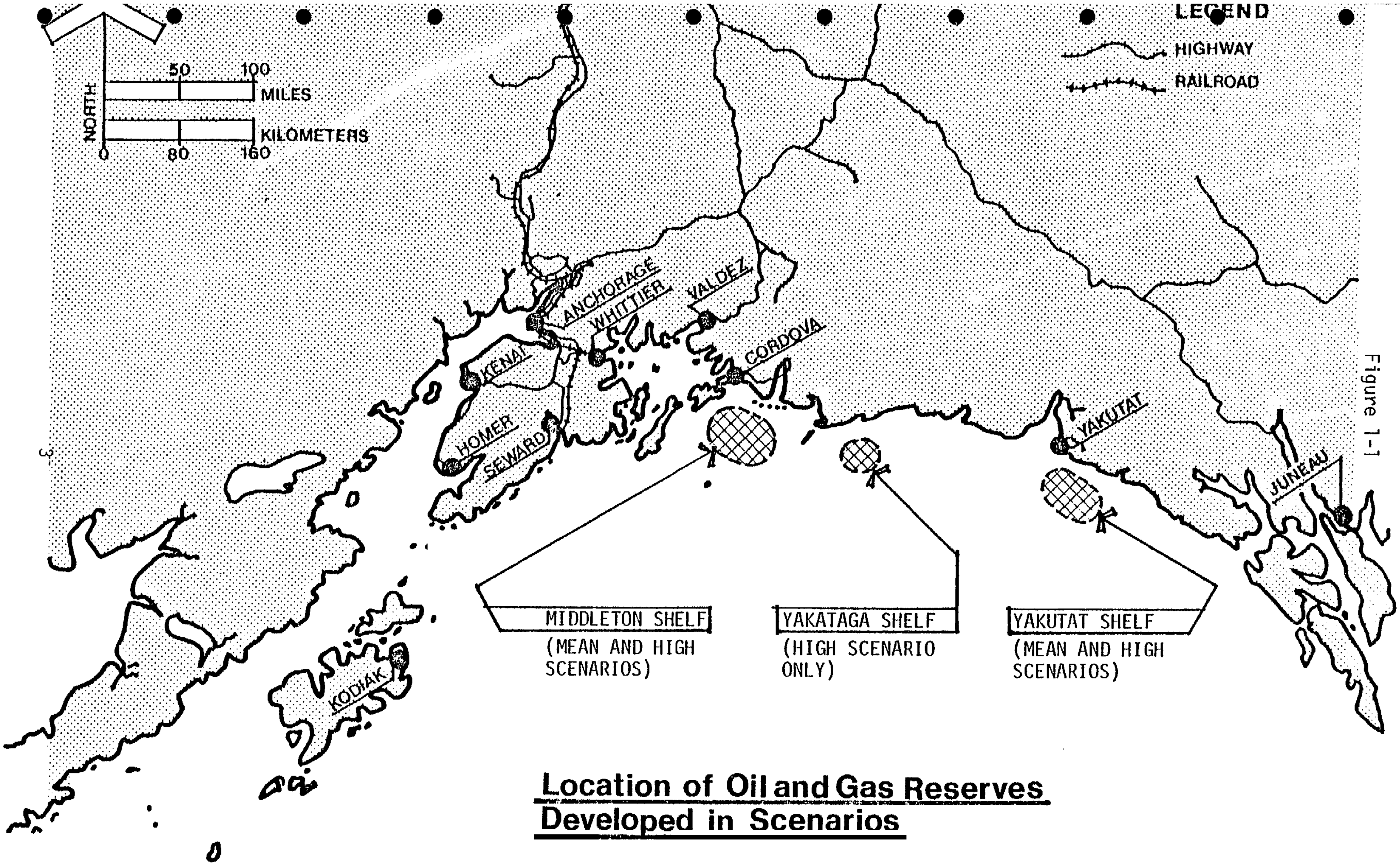
1.2 Study Area

The study of transportation impacts resulting from OCS development activities includes analysis at the local, regional, and statewide levels. Consequently, the study area varies depending upon the topic under consideration. The oil and gas scenarios establish the location and size of oil and gas discoveries and of shore facilities. Figure 1-1 shows the location of areas selected for development activities in the various scenarios on the basis of geology and economics. They include three areas --the Middleton Shelf, the Yakataga Shelf, and the Yakutat Shelf. The principal supply bases are expected to be located at Seward and Yakutat. The analysis of local and regional terminals and facilities is limited to Seward, Yakutat, Cordova, Valdez, Whittier, and Anchorage. Route analysis extends to the regional and even interstate levels. The data collection area for regional analysis, as shown in Figure 1-2, is divided into two regions. Anchorage is one of the regions and the Southcentral Region consists of the remaining census divisions.

1.3 Study Time Horizon

The study will examine OCS-related impacts on transportation systems beginning in 1981 when exploration drilling is expected to commence and extending 20 years to 2000. Impacts resulting from OCS activity will occur beyond this date, but peak periods of development and production will be captured.

Figure 1-1



Location of Oil and Gas Reserves Developed in Scenarios

Sour<e: Dames and Mcore, 1978.

General Data Collection Area*
Northern and Western Gulf of Alaska Lease Sales

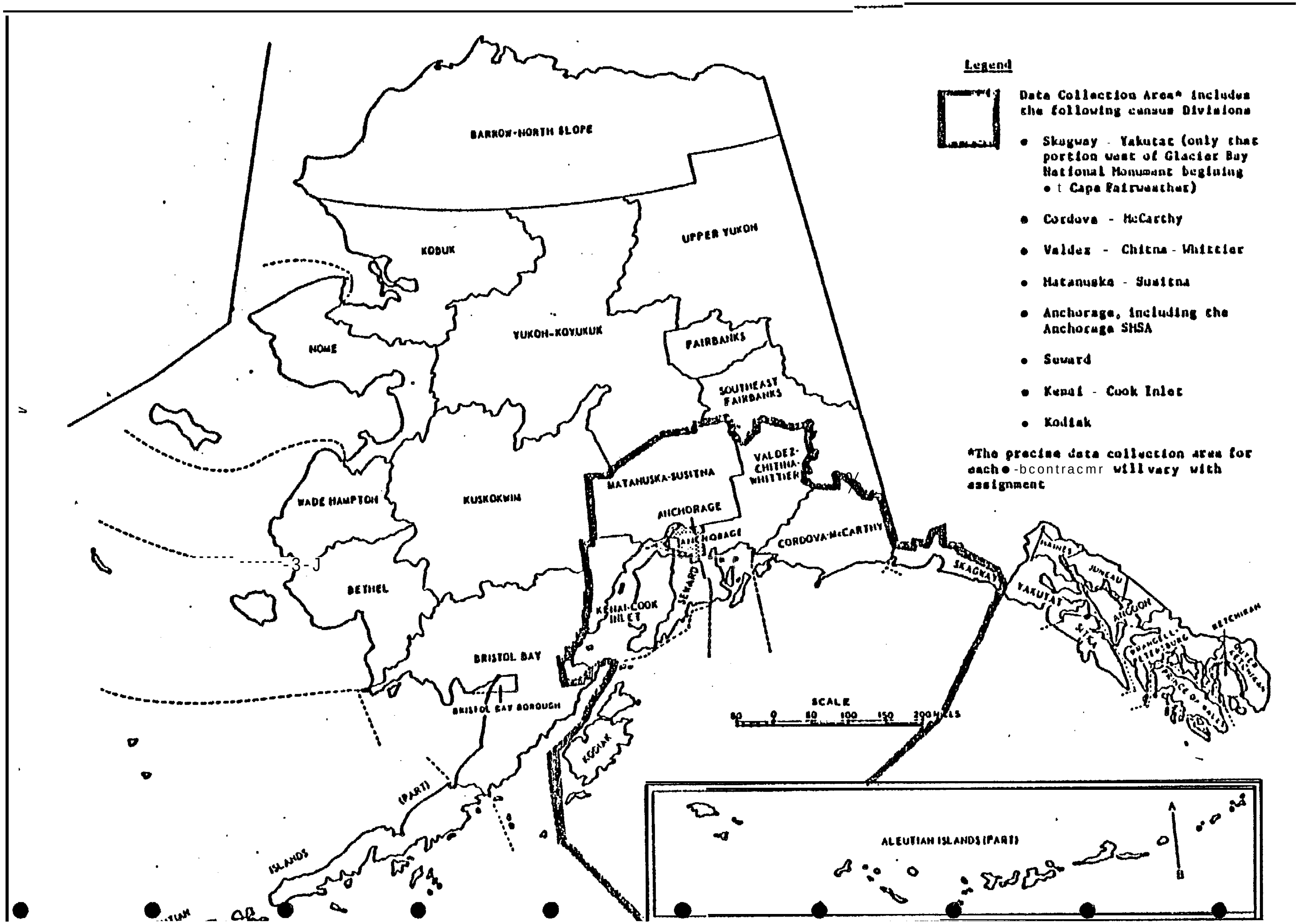


Figure 1-2

1.4 Regional and Statewide Transportation Systems

The report focuses on transportation facilities and services that are regional or statewide in nature. The facilities, by definition, predominately serve intercity traffic and include airports, ports, and intercity road links. Local roads and road networks are not included. Small boat harbors, which are used predominately by recreational and fishing boats, likewise have been excluded from consideration unless they are likely to be impacted by the movement of OCS goods.

1.5 The Nature of Transportation Systems

Transportation analysis introduces terms which might not be understood by all readers, and consequently, they will be briefly explained. A generated trip represents the demand for goods or passengers to move from a given origin to a given destination, irrespective of route or mode. Analysis and forecasting techniques may focus on vehicles and/or their contents, depending upon the purpose of the analysis and the available data. Examples of vehicles would be barges and planes; associated contents might be tons of dry goods and passengers. A travel link is uninterrupted travel on a single mode between two nodes, which can be terminals or, for land systems, intersections. At the former, changes of mode can occur; and at the latter, a change in routing is possible. A transportation route will be considered to be a series of travel links over which traffic would logically travel form an origin to a destination. An intermodal route would involve at least one transfer of goods or passengers from one mode to another. A multimodal route would be one where a choice of modes exists for the traveler or shipper. A route assignment should specify the mode and, to the extent possible, the type of carrier for each link.

Several examples will illustrate the relationship between these basic transportation terms. Consider a movementof 100 tons of related freight from Seattle to Anchorage, which will be assumed to be a single generated trip unit. The shipper can utilize several routes. Direct shipment from the Seattle area to Anchorage is available on container or roll-on, roll-off ships. This route would have a single link and two nodes, an origin and a destination. Another possible route would be a rail-barge shipment from Seattle to Whittier followed by movement to Anchorage by rail. This intermodal route would involve two links and three nodes.

Each transportation system consists of three distinct aspects--stationary facilities associated with nodes and links, vehicles or vessels that operate on the links between nodes and provide services, and the organizations, both public and private, that plan, construct, maintain, operate, and regulate the facilities and services.

The nature of facilities, services, and organizations and their interaction differs for each mode. For land modes, major investments are required for links because of the need for a permanent guideway structure. In Alaska, the state government has assumed the lead role. Terminals in the form of warehouses and vehicle storage are required for land modes but their flexibility in location and size and their low costs compared to those for link construction make them of lesser consideration in an impact study. The reverse is true for the water and air modes, as their facilities are limited to nodal locations. Link-related facilities for these modes are limited to navigational aids. Nodal facilities for the air mode include landing aids, runways, control towers, warehouses, and passenger terminals. Marine facilities at nodes include docks, transfer equipment, and storage space.

1.6 The Nature of Transportation Impacts

Impacts due to increases in transportation demand are created as volumes approach capacity levels. For each mode and type of carrier, the nature and extent of impacts must be known as capacity levels are approached. Some impacts can be quantitatively assessed, others must be assessed qualitatively. An ultimate or working capacity to which service demands are compared can be determined for different measures of transportation systems. Four primary types of measures will be used in this study to assess transportation impacts, as follows:

- Flow Rates. Expressed in vehicles per unit of time, e.g., average annual daily traffic and vehicles per hour, or contents per unit of time, e.g., passengers per day and tons per month. A maximum flow rate, or service volume, exists for a given set of traffic and facility characteristics. For highway links, these characteristics include lane width and terrain for the roadway and average travel speed and traffic mix for traffic. For terminals, the distribution of arrivals and service time establish service volumes. Once acceptable conditions have been adopted for planning purposes, a service volume is established. When this figure is reached, congestion or inefficiency becomes such that additional or improved facilities are considered feasible. The useof service volumes are used in preference to an ultimate capacity, which represents the lowest level of service and is rarely approached.

- Contents of individual vehicles or vessels. Each vessel or vehicle generally has a rated capacity, which for freight is usually expressed in terms of weight or volume, and for passengers in terms of number of seats. The term load factor is used to compare the measurement of contents atone time to the rated capacity.

- Loadings on fixed facilities. Roadways, runways, cranes, and decks are designed for specified loads. Measures generally used are pounds per square foot, pounds per axle, or gross weight. Because of safety factors usually applied in design, loadings at or slightly above the design loading will not produce sudden failure but frequent repetitions of such loadings will accelerate deterioration of the facility.

- Dimensional characteristics of facilities and vehicles or vessels. This measure in most cases establishes an all-or-nothing constraint.

Goods that exceed dimensional clearances cannot be carried on the particular vehicle or vessel. Others can be carried without substantial problems. For vehicles driving on roadways, length, width, and height requirements have been established which can be exceeded by obtaining an oversize permit, which specifies restrictions.

Three general categories of impacts will be discussed--decrease in service levels, accelerated deterioration, and non-transportation impacts.

1.6.1 SERVICE LEVELS

Three types of decreases in service can result from an increase in the ratio of demand to supply. The most obvious is the unavailability of services for those who would use them. This situation results either from a carrier decreasing service in one market area in order to accommodate traffic in a more prosperous market or from the inability of existing services to keep pace with increasing demand. A second impact relates to the cost of services. Rising demands without a concurrent increase in supply can cause transportation companies to charge what the traffic will bear.

The third type of service impact is reduction in performance measures for those vehicles that make trips. It is caused by capacity constraints introduced by demand that approaches maximum working levels. Aircraft and ships may have to wait en route before delivering traffic because of congestion at terminal facilities. On roadways, congestion may reach the point when average travel speed is reduced and total trip times increase. This study will concentrate on service capacities. Thus, when a port reaches high capacity, additional cargo can still be handled across its docks but ship waiting times likely will increase. Likewise, if the capacity for level of service B is reached on a roadway, additional traffic can still be accommodated, but at level of service C, or worse, because of lower average speeds.

The impact assessment will examine the likely response of users, transportation providers, and agencies as peak demands approach or exceed working capacities. Either peak demands can be reduced or the supply of transportation services increased. One way of reducing demand is to allow for a shift of traffic to other routes or terminals. Congestion costs at one terminal might allow previously marginal facilities to be more competitive. Another method of reducing peak demand on segments of the transportation systems would be to spread out the demand over a longer period of time. This, unfortunately, is unlikely once oil and gas companies enter the development phase. This phase places the greatest demands on the transportation systems.Companies move towards production as fast as possible so that they can begin to recover their significant investments. More important than the feasibility of reducing demands is that of increasing supply. To the extent that it can occur depends upon whether the critical aspect of the transportation is a terminal, a link facility, an inadequate number or size of vessels or vehicles, or inadequate operating rights. Adding trucks, vessels, or aircraft might be relatively simple, depending upon the availability of surplus equipment and the financial condition of the carriers involved. More difficult might be minor modifications to existing facilities, which would increase efficiency and safety. Most difficult would be construction of new facilities or major improvements. Ownership will play a factor in the response time or the likelihood of improvements being made. Government agencies face the problems of obtaining legislative approval of funding and generally require a long response time because projects must be justified and appraised through the capital budgeting process and because regulations restrict the manner in which projects can be constructed. The process of designing and constructing a major, new route on the Federal-aid highway system, for example, can take 10 years or longer, and the addition of a new vessel to the Marine Highway System would take at least three years.

1.6.2 ACCELERATED DETERIORATION

All transportation facilities have a design life which is reached only when design assumptions remain valid. Carrying capacities for land facilities will be reduced during winter months when temperature ranges produce freeze-thaw cycles. The maritime climate prevailing in the Gulf of Alaska makes roadways, runways, and rail beds particularly susceptible to freeze-thaw damage during the spring months. The State Department of Transportation and Public Facilities institutes 75% and 50% load limits for paved roads as appropriate to minimize damage to paved surfaces. The ability to impose load limits proved to be an inadequate control during construction of the trans-Alaska pipeline. Considerable damage occurred to the Richardson Highway, which is the primary route between Valdez and Fairbanks. The State's inability to enforce load limit regulations, particularly for short-hauls used in carrying gravel to work sites, was a major factor contributing to the extent of damage that occurred. Unfortunately, the load limits come at a critical time for construction activities, as contractors wish to have materials at work sites in late spring in order to complete as much outside work as possible during the summer and fall.

Accelerated deterioration is not expected to be a serious problem for exploration in the Northern Gulf of Alaska. An insignificant amount of heavy loads will occur between intermediate points on paved highways in Alaska which will be directly related to OCS activities.

Ports are not subject to damage from freeze-thaw cycles because none of the study area becomes frozen to the foot of dock pilings. Docks that are old and have had necessary improvements deferred could experience accelerated deterioration if OCS activities produce larger and more frequent loadings than would otherwise occur.

1.6.3 INDIRECT TRANSPORTATION IMPACTS

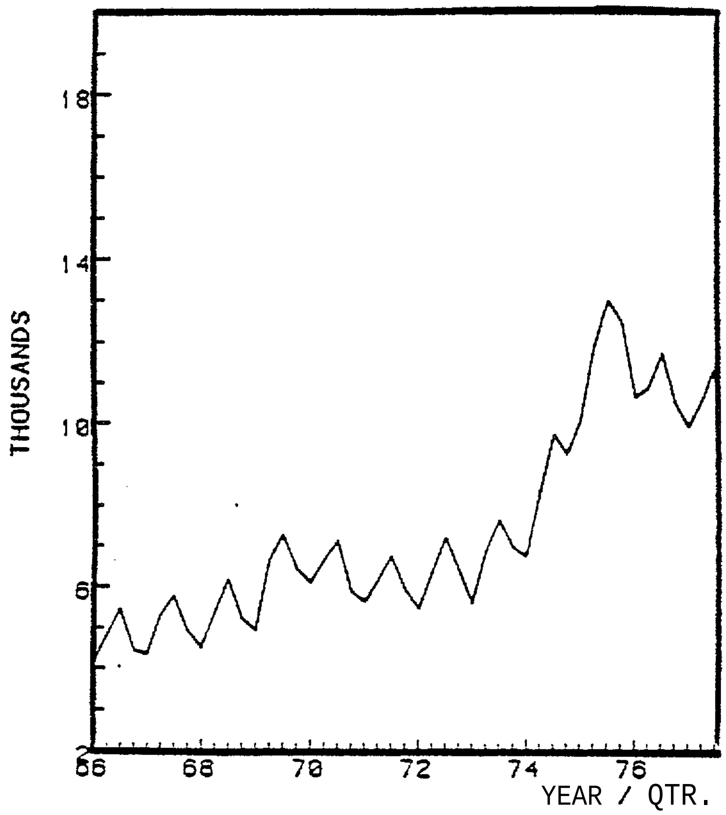
Increased usage of transportation routes can produce socioeconomic impacts beyond those of the transportation system. Such impacts will be studied to the extent that they produce feedback on the transportation systems. For example, existing marine transportation routes to Gulf of Alaska communities, particularly those segments close to shore, in many cases are prime fishing grounds. The use of large vessels and more frequent sailings could seriously interfere with fishing activities. Such interference produces impacts on the transportation system if shipping lanes are imposed or limits are placed on the size and frequency of vessels in order to minimize damage to fishing nets and crab pots. Similarly, restrictions might be imposed **due to the potential** adverse impacts of an oil spill rather than the amount of traffic. A similar situation exists for water and air pollution. Restrictions that have been considered include limiting the sizes of vessels that can enter Alaskan ports, establishing vessel separation schemes, requiring the use of certain safety equipment, and the use of low sulphur fuels.

1.7 Peaking of Transportation System Activity

Demand for transportation services is not distributed evenly over time, particularly in Alaska. At the regional level, seasonal and annual differences are of interest. Hourly distribution of traffic is of interest only at the local level. Figure 1-3 shows the peaking of transportation employment on a statewide basis by quarter since 1966. The first quarter traditionally has produced the lowest demand for transportation employment. The gap between first and third quarter employment is expected to remain at approximately 2,000 employees, which will become a smaller percentage of the average work force as time progresses. Figure 1-3 emphasizes the need for seasonal demands to be investigated particularly where large variations are expected due to climatic constraints or the- influence

Figure 1-3.

TRANSPORTATION EMPLOYMENT



Source: Teal, D., L. Piston, and S. Harrison, 1978. Alaska Department of Labor.

of seasonal industries. Annual traffic figures can obscure capacity problems that might exist on a seasonal basis.

Seasonal variations in construction activities and tourism account for much of the gap. Also, certain parts of the State are accessible by barge only during the summer, which means that many bulk items can only be delivered annually. Finally, fishing activities are considerably greater during the summer than the winter.

Freight that is population-related does not show the same seasonal variation as that related to construction and tourism and provides a constant base demand. For Anchorage, which has almost one-half of the state's population and serves as a freight distribution point, the level of service by major marine carriers is approximately the same during the winter as the summer. The proposed Northern Gulf of Alaska lease sale area and port and supply base sites are ice-free, which enables freight vessels to operate on an all-year round basis. In rough seas during the winter, tandem barge operations might be less frequent; and shipments of oversized freight--such as drilling platforms or oil terminal modules--would not be scheduled at this time. Otherwise, freight movements would provide shipments on an as-needed basis.

The extent of annual peak demands will depend upon the timing of oil and gas activities in the Western Gulf of Alaska, particularly the development phase and the timing and location of other development activities in the state.

Transportation facilities are not designed to provide for peak loads that do not consistently occur. Road designers in many states have adopted the 30th highest hour of traffic volume recorded in a given year as the design hourly volume (Highway Research Board, 1965). Useof this guideline eliminates the need to plan for isolated occurrences of large traffic volumes. Similarly, port designers adopt an acceptable ratio of waiting time to berth time. Carriers, on the other hand, have flexibility to adjust their capacity as demands change.

1.8 Relationship to Other Studies

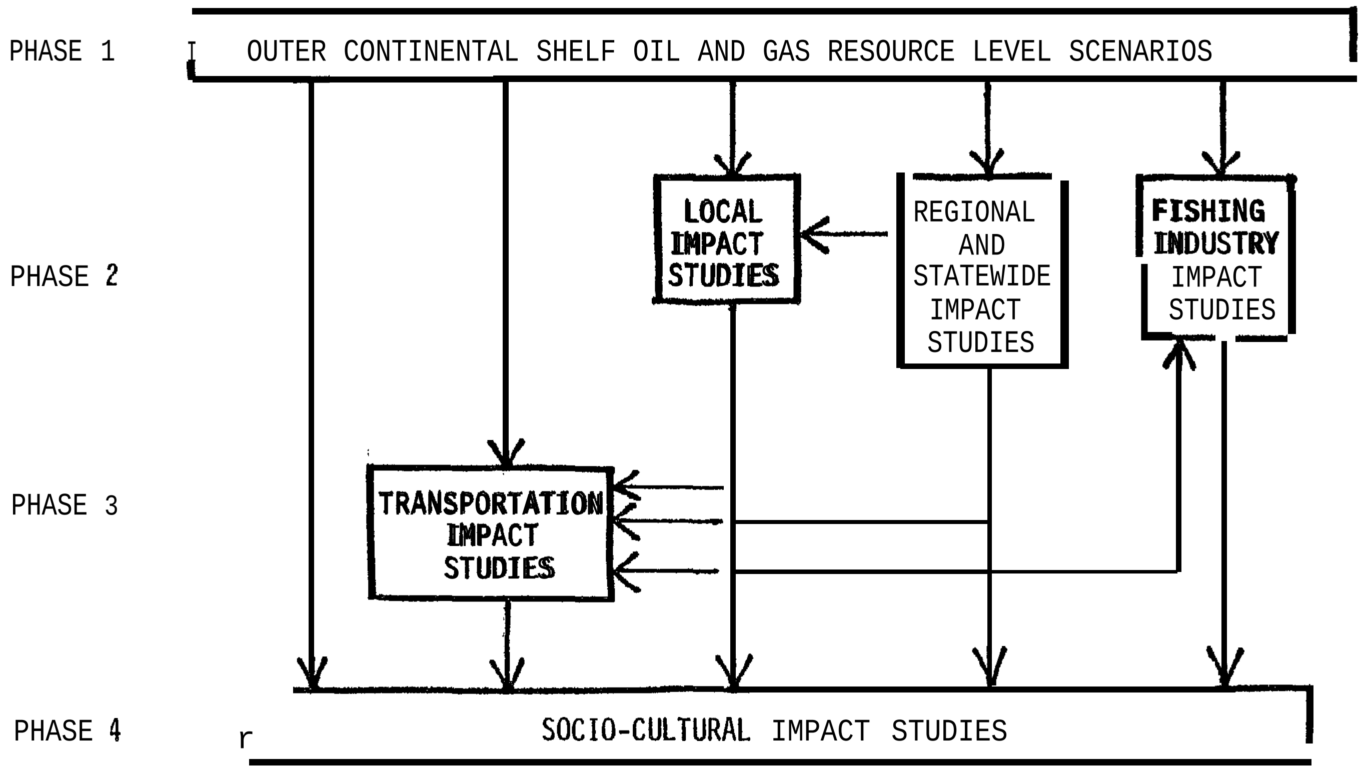
The Bureau of Land Management's Socioeconomic Studies Program for proposed oil and gas lease sales on Alaska's outer continental shelf assesses the broad range of impacts that might occur for a given scenario of exploration, development, and production activities. The multidisciplinary process that generates these impacts depends upon an integration of study efforts on two levels--first, between the lease sale and preceding lease sales and, second, within the lease sale. Efforts for an individual lease sale must consider impacts of previous lease sales so that cumulative OCS impacts can be assessed. Proposed lease sales in the Beaufort Sea will also cause population and employment increases in the Southcentral and Anchorage regions. Results of previous studies in the socioeconomic studies program for these lease sales can be carried forward. The base case assumes occurrence of the mean scenario for all previous OCS lease sales.

The second set of relationships involves all studies being conducted for a given lease sale. Four phases have been identified, as shown in Figure 1-4, phase three being the study of transportation impacts. Each phase generates information internally but also relies heavily on the work of all previous phases. Figure 1-4 emphasizes that transportation is a derived, or secondary, service. By itself, transportation does not have value. Its value derives from the importance of moving passengers or freight from one point to another. The development of OCS scenarios constitutes the first phase and is the cornerstone for later work. Phase 2 is the development of impacts resulting from population and employment forecasts at the local and regional levels and from fishing industry forecasts in the study area. Results of the Phase 1 and Phase 2 studies are used as input for the study of transportation impacts. Ideally, a flow of information exists in both directions between the fishing and transportation studies. The fishing studies are the only Phase 1 or Phase 2 studies which use information from the transportation studies. The sociocultural studies, which make up the last phase, integrate information gathered as part of the previous phases with a knowledge of local attitudes and history, particularly for native communities in the vicinity of offshore activities. Each of the boxes in Figure 1-4 exists as a separate, comprehensive analysis of a given subject but also serves as a building block for other analyses.

The flow diagram in Figure 1-5 goes beyond the relationships shown in Figure 1-4 and shows the relationship of major tasks in making transportation impact assessments for a given OCS lease sale. Two general points will

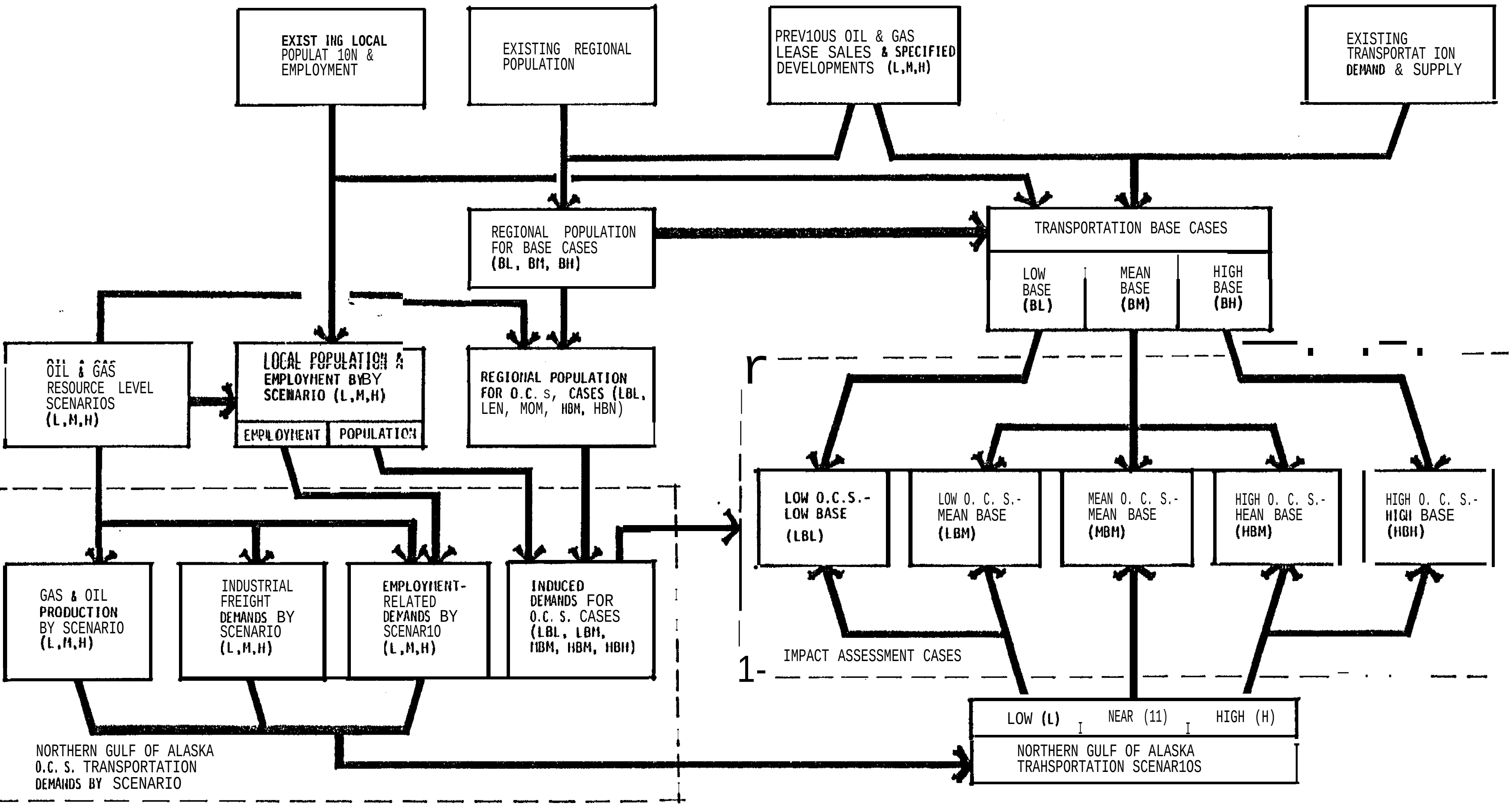
Figure 1-4

Relationship of Transportation Impact Studies to Other Studies in Socioeconomic Studies Program



Source: Peter Eakland and Associastes, 1979.

RELATIONSHIP OF TRANSPORTATION IMPACT ASSESSMENT TASKS FOR GULF OF ALASKA O.C.S. OIL AND GAS DEVELOPMENT



SOURCE: PETER EAKLAND & ASSOCIATES, 1979 assist in understanding detailed discussions of each task. First is the distinction between scenarios and cases. Three resource level scenarios were developed for each shelf in addition to the exploration only scenario. Since discoveries at the low resource level were uneconomic, the low (L) scenario represents both exploration and low discovery conditions. The medium (M) resource level scenario involves development and production activities in the Middleton and Yakutat Shelves. The high (H) resource level scenario involves development and production in all three shelves. Three base cases have been developed for analysis. They are based, respectively, on the cumulative transportation demands existing in the low OCS cases of previous lease sales. Five OCS cases are developed. Three of them represent demands of the low, medium, and high oil and gas scenarios of the Northern Gulf of Alaska (Sale No. 55) added separately to those of the mean base case. These OCS cases bracket the range of impacts that might occur given the most likely base conditions. The remaining two OCS. cases represent high and low extremes of possible transportation demands and impacts. One is a combination of the high OCS scenario and the high base case and the other is a combination of the low OCS scenario and the low base case. The scenarios are only one building block in the assessment process, whereas each case is an integrated set of building blocks. The second point is the difference between traffic demands that can be developed solely from scenario inputs and those that are interactive with base case conditions. Scenario demands are independent of conditions in the base cases, whereas induced demands depend upon them and, thus, are interactive in nature.

At the top of Figure 1-5 are the elements that are used to construct the base cases which cover the same period as the OCS cases, 1981-2000.

1.8.1 TRANSPORTATION BASE CASES

Three primary inputs are required to produce complete transportation forecasts for the transportation base cases: (1) demands related to regional population growth, (2) those related to local population growth, and (3) those related directly to development activities. Impacts occurring during the study period given base case assumptions provide a benchmark for measuring the incremental and cumulative impacts of different levels of resource discovery and recovery in the Northern Gulf of Alaska.

1.8.2 OIL AND GAS RESOURCE LEVEL SCENARIOS

This task is the cornerstone of all impact assessments, not only for transportation but for other areas of the Socioeconomic Studies Program. Two of the four principal categories of OCS-related transportation demands are developed directly from the scenarios. They are oil and gas production and industrial freight. Oil production is broken down into offshore and onshore loading because of the difference in impacts. Industrial freight includes materials for drilling and construction materials for pipelines and onshore supply bases and terminals.

As shown in Figure 1-5, scenario employment figures are fed into both local and regional analyses. The resulting breakdown of employment by community and residency leads to employment-related transportation demands, which completes the demands that can be developed on a scenario basis. This category includes passenger movements by helicopters and scheduled air services and freight to support employees (consumables). Population figures produced by the Iota? and regional analyses are used to forecast the induced demands for each of the OCS cases. Forecasts for induced transportation demands are shown going directly to the OCS cases because of their interactive nature with base case conditions rather than joining with the other three categories of OCS demands.

1.8.3 OCS CASES

The five OCS cases bracket the range of transportation demands and associated impacts that might occur. A three-letter system is used in this report to identify the cases. The first letter is the OCS scenario and the last two letters denote the base case. Thus, HBM is the case consisting of the high scenario and the mean base case.

2.0 EXISTING CONDITIONS OF LOCAL, REGIONAL, AND STATEWIDE TRANSPORTATION SYSTEMS

2.1 Purpose

The purpose of this chapter is to establish the current status of transportation facilities, services, routes, and regulations that affect the primary study area. The resulting baseline conditions will serve as the basis for forecasting transportation demands and impacts during the period 1981-2000 for the base cases and the OCS cases. Emphasis is placed on the communities of Seward, Cordova, Yakutat, and Anchorage; but the communities of Valdez and Whittier are also included. Seward, Cordova and Yakutat are the most likely locations for support bases. Valdez and Whittier are the other communities near the proposed lease sale areas that offer major transportation facilities. Anchorage transportation facilities receive additional traffic either directly or indirectly from all major development projects in the State of Alaska. Each mode is discussed separately.

2.2 Water Mode

The water mode in the study area dominates the movement of freight because of geographical considerations. No all-land rail route exists from the lower 48 states to Alaska, and the road distance from Seattle to Anchorage of 3,959 km (2,460 miles) is approximately 1,609 km (1,000 mi.) further than the distance by sea. Also, Cordova and Yakutat, in addition to numerous villages, do not have any land access. The water mode in

Southcentral Alaska has statewide as well as regional importance as several terminal points distribute considerable amounts of inbound freight to the Interior and Western Alaska.

Ports within the study area accounted for approximately 75% of the State's throughput tonnage in 1976 because of crude oil leaving Valdez and Cook Inlet, the location of 61% of the State's population in the immediate hinterland, and the distribution function of the larger ports, as mentioned above.

Despite the primary role of geography, the chronology of transportation decision-making within the region has influenced the present marine traffic patterns. The Alaska Central Railway chose Seward as its southern terminus in the early 1900's b'ut it went bankrupt after laying only 50 miles of track. The Alaska Railroad, its successor, was built by the Federal government and retained the choice of Seward as the major entry port. By 1923 it had extended the system as far as Fairbanks. Seward remained Southcentral Alaska's major port until World War II when Whittier was established as an alternate port to serve Anchorage and Fairbanks with petroleum products. The 1964 earthquake destroyed the railroad's facilities in Seward, and during the reconstruction period both Anchorage and Whittier significantly upgraded their port facilities and soon were able to dock, respectively, large container ships and rail-car barges. Since then, Seward has not been able to effectively compete with Anchorage or Whittier, except in times of high demand such as occurred during construction of the trans-Alaska pipeline.

2.2.1 TERMINALS

Port facilities within the study area can be divided into three types -- those that are experiencing a steady growth rate due to local population increases and their role as transshipment ports, those that experience dramatic fluctuations in traffic according to the level of major construction activities within the state, and those with a steady level of traffic.

Anchorage falls into the first category. The Port of Anchorage not only serves the local metropolitan area, which has approximately one-half of the state's total population but also receives freight which is distributed by land to the north (Fairbanks), south (Kenai Peninsula), and to the east (Valdez).

Seward and Whittier, and to a lesser extent Valdez, represent ports that experience large fluctuations in traffic. Both Seward and Whittier have adequate facilities at present but receive mostly uncontainerized freight that is unsuitable for delivery by TOTE or Sea-Land to Anchorage. Whittier's railcar barge facilities offer efficient cargo transfer operations, which places it at an advantage for small and medium sized breakbulk shipments compared to Seward. Seward in 1978 received several shipments of pipe from Japan and will continue to be the prime unloading point for pipe purchased in that country and destined for North Slope operations. The large throughput tonnage at Seward in 1975 resulted from the failure of the Prudhoe Bay sealift to traverse the Arctic Ocean because of atypical icing conditons. The Port of Seward served well the function of a safetyvalve, but if rail shipment had been planned initially much of the freight would have been routed through Whittier. Valdez currently lacks the port facilities for general freight found at Whittier and Seward, but local voters in 1979 approved a bond issue to build a facility for deep-draft vessels. Past development activities contributing. to marine traffic at Valdez were the trans-Alaska pipeline and the Valdez oil terminal, and future projects include the Northwest gas pipeline and the Alpetco refinery.

Other communities in the study area, particularly Cordova and Yakutat, are either unable to serve the function of providing entry points for major developments or their location does not provide them the opportunity to serve as transshipment ports. In such cases, water traffic is related primarily to local population.

Each marine terminal point needs to be examined from several viewpoints to determine its present role in the overall marine freight system and its future potential. They are as follows: (1) dock dimensions and unloading facilities, which determine the type of ships that can efficiently load and unload freight, and the port's capacity; (2) water depth and navigational conditions, which-determine the size of ships that can use the facilities; (3) tonnage by handling category commodity; and (4) tonnage by origin and destination.

Port capacity figures occasionally are based on a product of tonnage per berth and the number of berths, but more meaningful figures can be developed by considering average productivity measures for different handling categories and a range of waiting time to berth time ratios. A berth is defined as the maximum space needed for docking a vessel of the size and type for which transfer facilities are designed. This memorandum uses capacities developed by Frederic Harris for the Corps of Engineers' South-central Deep-Draft Navigation Study (Frederic Harris, 1978). Annual capacities for major handling categories were calculated as a product of four factors--a nationwide average productivity rate/day/berth, available days, berth occupancy percentage, and number of berths. Available days represent the number of days where climatic and sea conditions provide for safe maneuvering to and from docking areas. Berth occupancy percentage is a function of the number of berths and the ratio of ship waiting time to ship berth time. "The usual practice is to define an acceptable ratio of ship waiting time to ship berth time. ..Average acceptable ship waiting time must be determined for economic, political, and other competitive factors. . . Berth occupancy ratio generally falls between 10 and 25 percent for most ports." (Frederic Harris, 1979). Once a ratio has been chosen and the number of berths is known, an optimum berth occupancy percentage is established. High and low berth occupancy percentages for a given number of berths were developed using acceptable ratios of ship waiting time to ship berth time of 0.25 and 0.10, respectively, and produced high and low capacity figures. The calculations assume random arrival of vessels. A separate capacity is computed for each handling category. The actual mix of freight by handling category must be estimated before overall port capacities can be computed. The Appendix describes in detail the computation of these figures, and the results are shown on Table A-7.

Should the capacity figures be exceeded and the governing assumptions remain valid, additional waiting can be expected.

Six cargo handling categories were used by Frederic Harris, which are briefly described below:

- Breakbulk General: loose freight which requires manual manipulation.

- Neobulk: cargo which has been pre-loaded into boxes, crates, or slings, onto pallets, or strapped so that unloading by machinery is possible.

- Containerizable: cargo which can be shipped in standard containers or van-type trailers.

- Dry Bulk: bulks that can be moved by various types of conveyor systems.

- Liquid Bulk: cargo that can be off-loaded by pipeline.

- Special: materials, such as lumber or heavy machinery, which require special lifting equipment.

2.2.1.1 Port of Anchorage

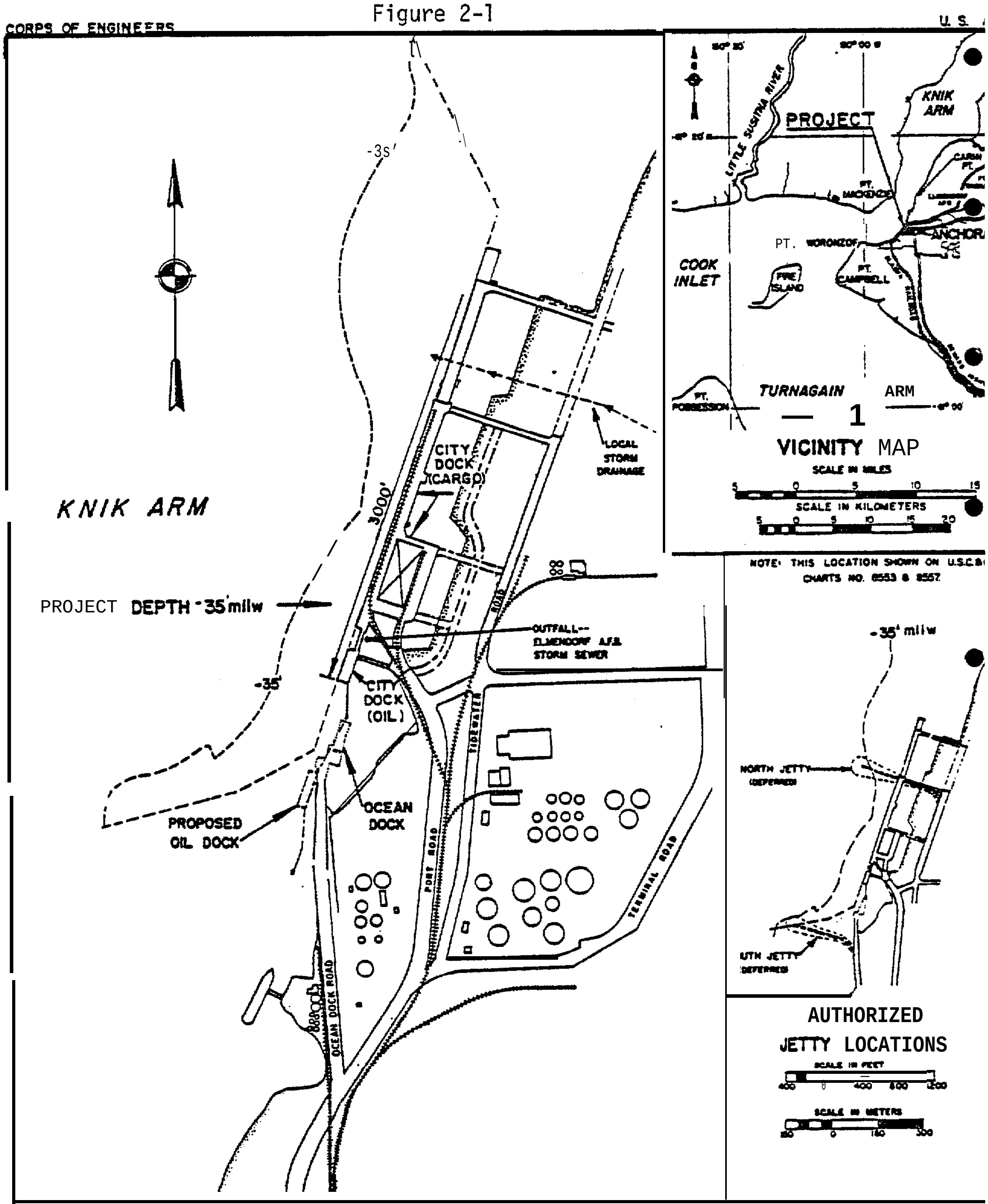
Facilities. The Port of Anchorage consists of four terminals owned and operated by the Municipality of Anchorage which serve deep-draft ships and six private docks which service specialized barge shipments. Figure 2-1 is a schematic layout of the port. Capabilities and dimensions of the Municipality's terminals are as follows:

- Terminal No. 1: 183 m (600 foot) whart, 14.3 m (47 feet) wide, constructed of concrete and steel. It can handle container, roll-on/roll-off, and general cargo ships and also serves as an alternate petroleum dock.

- Terminal No. 2: 186m (610 foot) whart, 21 m (69 feet) wide, same capabilities as Terminal No. 1.

- Terminal No. 3: 273.7 m (898 foot) whart, including a recent 55m (180 foot) extension which permits unloading of TOTE roll-on/roll-off ships which are 240.8 m (790 feet) long, 21 m (69 feet) wide, while leaving the other two terminals available for large ships.

- Petroleum Terminal: 186.5 m (612 feet) long, multiple petroleum headers and electric hose handling hoists.



NOTES

NORTH & SOUTH JETTY CONSTRUCTION IS INDEFINITLY DEFERRED. JETTIES HAVE BEEN OMITTED FROM MAIM PLAN FOR CLARITY. SOUNDINGS AND ELEVATIONS ARC IN FEET AND REFER TO NESS LOWER LOW WATER.

METRIC CONVERSIONS			
FEET	METERS	FEET	METERS
29	8.83	50	15.24
32	9.75	2070	630.93
35	10.66	2350	714.40
42	12.80		

NAVIGATION

ANCHORAGE HARBOR

ALASKA

REVISED 1978

SCALE IN FEET

400 0 400 800

SCALE IN METERS

150 0 150 300

Handling equipment available for the general cargo terminals includes two 24.9 metric ton (27.5 ton) container-handling cranes and four level-luffing gantries with 36.3 metric ton (40 ton) capacities. Two portable transfer ramps for roll-on/roll-off operations are also available.

Table 2-1 shows the capacities of the Portof Anchorage, taking into consideration both private and public terminals, and compares them to 1977 tonnages. The figures show that for dry cargo the Port of Anchorage serves predominantly specialized ships (container and roll-on/roll-off) and using conservative estimates can accommodate at least twice the present volumes. The combination of the Nikiski-Anchorage oil pipeline and the North Pole refinery in Fairbanks will substantially reduce the growth of liquid bulk tonnages received in Anchorage by the water mode. Considerable growth potential exists for barge commodities, but winter icing conditions limit barge operations to a May-November season.

Table 2-2 shows the annual throughput tonnages for the Port of Anchorage for the period 1967-1976. The trend has been a steady increase in throughput tonnage although small reductions from the previous year have occurred periodically. The reduction from 1976 to 1977 was 22.7% and was due principally to a downturn in construction activities for the Trans-Alaska Pipeline.

Table 2-1

Port of Anchorage (All Terminals) - 1977 Tonnage and Capacities
(Thousands of Short Tons)

Handling Category	In-bound	Out-bound	Total Through-put	Berth Occupancy High (1,4) Capacity	(2) v/c	Low (1,4) Capacity
Containerizable	897	101	998	1,530	37%	1,070 (3)
RO/RO				1,200		839
Breakbulk						
Neobulk				1,760		1,360
Special	96	0.5	97	4,280	2%	3,360
Dry Bulk				-	-	-
Bulk Cement	111	1	112	1,490	8%	870
Liquid Bulk	1,024	36	1,060	4,530	23%	2,180
Total	2,128 (94%)	139 (6%)	2,267 (100%)			

Notes: (1) Capacities based on 340 available days.
(2) v/c= volume (total throughput)/capacity.
(3) No capacity provided for low berth occupancy. Same proportion used f[illegible] containers.
(4) Each capacity for a handling category assumes only that category wil[illegible] handled during the available berth period. Thus, the total port capa[illegible] is not a sum of the individual capacities.

Source: Frederic R. Harris, 1978.

Table 2-2

Port of Anchorage-Historical Summary

Year	Metric Tons (Tons)	Year	Metric Tons (Tons)
1967	1,275,611 (1,406,128)	1972	1,867,157 (2,058,199
1968	1,189,296 (1,310,981)	1973	2,381,132 (2,624,763
1969	1,639,642 (1,807,405)	1974	2,122,965 (2,340,181
1970	1,757,186 (1,936,976)	1975	2,663,625 (2,936,15s
1971	1,616,653 (1,782,064)	1976	2,660,276 (2,932,,462

Source: Corps of Engineers, 1977.

Water Depth and Navigational Characteristics. The dock face of the public terminals is maintained to a depth of 10.7 m (35 ft.) mean lower low water (MLLW) by the Corps of Engineers. Statutory responsibilities of the Corps of Engineers usually are limited to channel dredging near ports, but the Port of Anchorage benefits from special Congressional legislation which enables dredging by the Corps alongside the dock. During 1978, three separate dredging operations were necessary to maintain adequate depth for deep-draft vessels (Associated Press, 1978). The private docks are limited to ships having a draft of 6.1 m (21 feet) or less.

The extreme tidal range of 12.7 m (40.7 feet) creates high mid-steam velocities and eddy currents along shore, but these conditons have little effect on deep-draft vessels. Shoaling occurs west of Point Woronzof near Fire Island and limits the channel width for deep-draft vessels to 2,000 feet. Four grounding occurred in this general area during the late 1960's. None produced serious consequences. The current policy of deep-draft operators is to have a minimum of 3 m (10 feet) of water below the keel at all times, which eliminates crossings of the shoal area at low tides. The channel's MLLW depth is 8.7 m (28.5 feet). Despite this problem, approximately 60% of the dry cargo traffic to the port in 1976 and 1977 consisted of vessels having drafts 7.6 m (25 ft.) or greater. Outbound 1976 traffic consisted of 792 vessels, of which 34%, or 271, had drafts greater than 6.1 m (20 feet).

Navigation in Upper Cook Inlet during the winter is complicated by the absence of buoys, which are removed by the Coast Guard when ice conditions commence.

Tonnage by Handling Category and Commodity Type. Except for liquid bulk commodities and bulk cement, no single commodity stands out. Shipments that can be containerized make up 42% of the inbound tonnage and 73% of the outbound tonnage. The Portof Anchorage is the State's major portof entry for containerized freight. The large ships that carry conatiners and trailer vans are able to operate to the port throughout the year unlike tugs and barges.

Tonnage by Origin and Destination. Of total inbound dry cargo, approximately 87% comes from the Seattle-Portland area (Frederic Harris, 1978). For liquid bulk, in 1977 there were three major suppliers to the Anchorage terminal--foreign ports (43%), California (22%), and Nikiski (22%) (Frederic Harris, 1978). Miscellaneous shipments occurred both inbound and outbound to other Alaskan ports. Anchorage serves more as a distribution center for traffic that completes its journey by truck or rail than by water. TOTE estimates that 80 percent of its total traffic is destined for the immediate Anchorage area, and of the remainder, 15% is for Fairbanks (Westerlin, 1979).

Inbound tonnage represented 94% of throughput in 1977. For containers and roll-on/roll-off vans, approximately nine tons arrived for every one that was outbound.

Summary. The Port of Anchorage's ability to attract frequent year-round service by two carriers handling containers and vans that can be efficiently loaded and unloaded has made it Alaska's premier port of entry. In 1976, it handled over three times as much tonnage as Whittier, over five times as much as Valdez, and over 13 times as much as Seward, despite weather and shoaling constraints. The port has adequate staging areas at present, but geographical constraints prevent a major site expansion. The additional 6.9 hectares (17 acres) which is available will require expensive site improvements because of drainage problems.

2.2.1.2 Port of Whittier

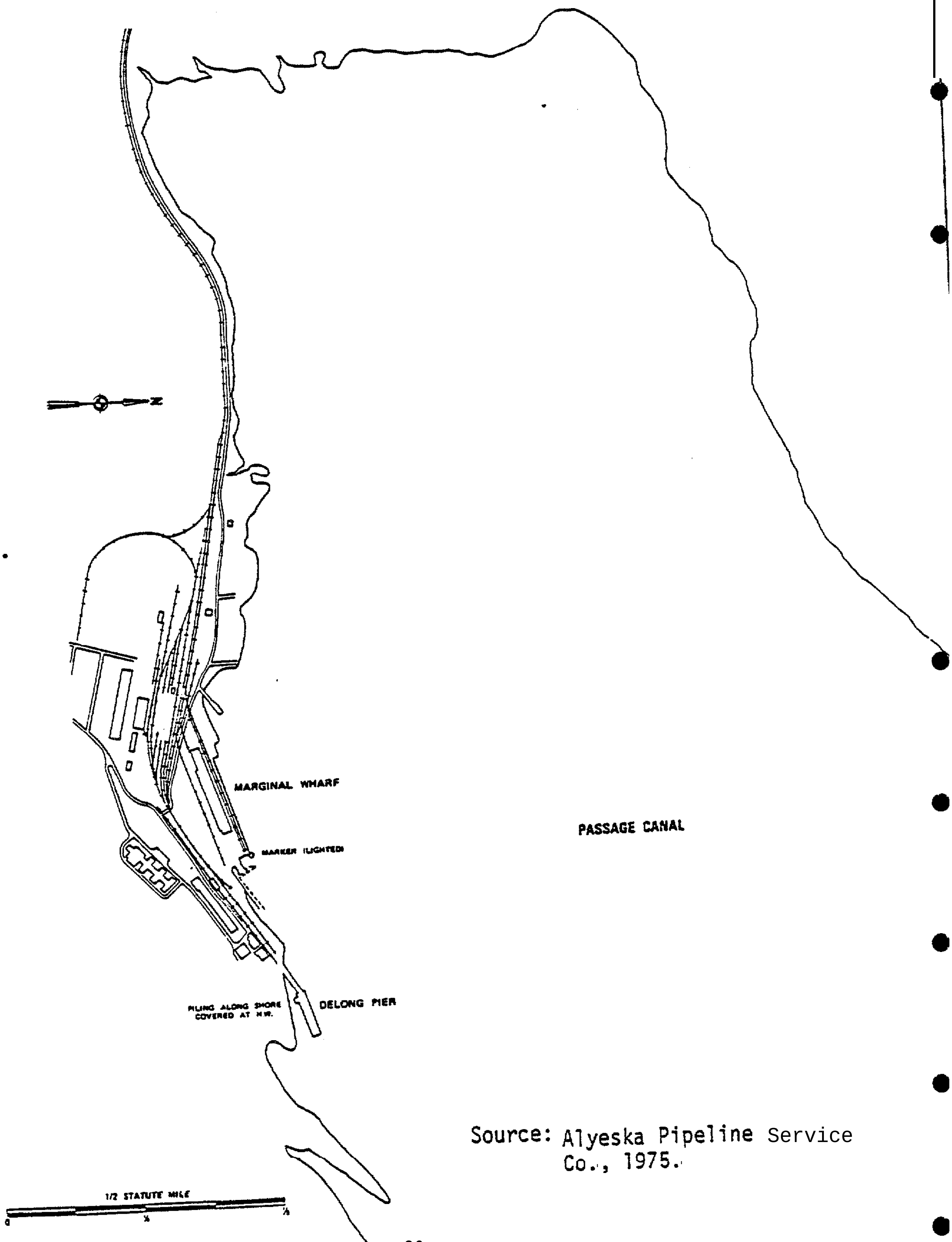
Facilities. The Port of Whittier can accommodate at one time two railcar-barges. The two slips provide for cargo transfer from the bow as opposed to dockside berths at which transfers occur across the sides of a vessel. The first was constructed in 1964 and the second in 1971. In addition, the Marginal Wharf, which is 304.8 m (1,000 ft.) long, has cranes for! handling breakbulk cargo, but these are infrequently used. The steel pilings supporting the wharf are seriously corroded and renovations are in progress. The 129.5 m (452 ft.) Delong pier is used for transferring military petroleum products into storage for eventual shipment by pipeline to Anchorage military bases. Besides these government owned facilities, a nearby state-owned dock serves the Marine Highway System during the summer months.

A schematic layout of facilities is shown in Figure 2-2. Table 2-3 shows average tonnage per railcar for the period 1972-1976. Table 2-4 shows the breakdown of 1977 tonnage by handling category and estimated high and low capacities by carload. Since all dry goods arrive on rail cars, no attempt has been made to provide capacities for individual handling capa-

Figure 2-2

PORT OF WHITTIER

Map of Whittier area showing dock and railroad yard.



Source: Alyeska Pipeline Service Co., 1975.

cities. Frederic Harris computed capacities based on 22.7 metric tons (25 tons) per carload but this has been increased to 50.3 metric tons (55.4 tons). Approximately 850,000 tons of rail tonnage passed through Whittier in 1972, the peak year for the movement of pipe for the trans-Alaska pipeline (DOTPF, 1978).

Table 2-3

Whittier Railcar Traffic

Year	Revenue Railcars	Revenue Tonnage	Tons per Railcar
1972	10,000	860,000	86
1973	8,000	320,000	40
1974	8,000	300,000	38
1975	10,000	520,000	52
1976	9,200	560,000	61

Average = 50.3 metric tons (55.4 tons).

Standard Deviation = 17.7 metric tons (19.5 tons).

Source: DOTPF, 1978.

Table 2-4

Port of Whittier - 1977 Tonnage
(Thousands of Short Tons)

Handling Category	Inbound	Outbound	Total Throughput
Container	185	29	214
Special	54	12	66
Dry Bulk	57		57
Liquid Bulk	45	33	78
Total	341 (82%)	74 (18%)	415 (loo%)

Capacity (1)

High Capacity (2)			Low Capacity (2)		
Carloads	Tons	V/C	Carloads	Tons	V/C
23,680	592,000	57%	16,640	416,000	81%

Notes: (1) Based on 296 available days.
(2) V/C = (1977 dry goods)/capacity. Capacity is based on an averag carload carrying capacity of 22,680 kg (50.3 metric tons, 55.4 t

Source: Frederic R. Harris, 1978.

Water Depth and Navigational Characteristics. The railcar-barge slips and the Marginal Wharf have depths alongside of 10.7 m (35 ft.). North and south faces of the Delong Pier have depths respectively of 13 m (45 ft.) and 9.1 m (30 ft.) The port is ice-free but weather constraints include local winds, fog, high precipitation, and the possibility of heavy seas at approaches and of williwaws at the entrance to Passage Canal. Tides, which are critical to railcar transfers, prohibit operations 10 hours a day. Delays can be as long as 16 hours.

Tonnage by Handling Category and Commodity Type. All dry cargo arrives either in boxcars or on flatcars. Dry cargo consists of containerized, special, and dry bulk sh· pments; but at Whittier they become a single handling category, which " cads to capacity figures in terms of railcars. Principal commodities carried are those that are more suited to boxcar or flatcar delivery thi n by containers or trailer vans. Included are lumber and fabricated metal products, particularly for customers who have railroad sidings. The combination of a comparable price structure, slower travel times, and less frequency makes it difficult for tug and barge service to Whittier to compete with Sea-Land and TOTE for Anchorage-bound freight.

The construction of the Kenai-Anchorage pipeline has reduced the quantity of jet fuel received at Whittier. A total of 86.5 thousand metric tons (95.3 thousand tons) was shipped through Whittier in 1976, but in 1977 jet fuel shipments through Whittier had declined to 70.8 thousand metric tons (78 thousand tons) (Corps of Engineers, 1977-78).

Tonnage by Origin and Destination. Except for fuel products, vessels arriving at Whittier originate at either Seattle (Alaska Hydro-Train) or Prince Rupert (Canadian National). The use of through-tariffs for the railcars means that this traffic could actually originate in the Midwest. Whittier is not a final destination for any of the inbound traffic, except for Alaska Railroad machinery. Although much of the traffic goes by land to Anchorage, Fairbanks and the Kenai Peninsula also receive sizable shipments through Whittier. Railcars can be distributed from Whittier to Valdez with smaller barges. This system was used during pipeline construction to transport materials requiring storage in Valdez.

Summary. The commodities best suited to use Whittier's facilities are those that are required during periods of economic expansion and for large development projects. This fact has created extreme fluctuations in traffic during the 1970's, much more so than routes that are more closely related to population. Table 2-5 shows approximate tonnages arriving on railcars at Whittier from 1969 to 1977.

2.2.1.3 Port of Seward

Facilities. A 224m (735 ft.) by 61 m (200 ft.) concrete and steel finger pier was constructed for the Alaska Railroad following the 1964 earthquake at a cost of $10 million. Berthing space along each side is 183m (600 ft.),. and each side is served by a rail spur. Two 41 metric ton (45 ton) gantry cranes for general cargo serve the east side berths. Smaller mobile cranes and a 32 metric ton (35 ton) forklift are available.

Table 2-5

Port of Whittier - 1969-1977 Tonnages

Year	Thousands of Metric Tons (Thousands of Short Tons)	Difference from Period Average
1969	227 (250)	-36%
1970	27 (30)	-92%
1971	270 (300)	-23%
1972	762 (840)	+114%
1973	290 (320)	-18%
1974	270 (300)	-23%
1975	500 (550)	+40%
1976	545 (600)	+53%
1977	308 (340)	-13%

Avg. = 356,000 metric tons (392,000 short tons).
St. Dev. = 214,000 metric tons (236,000 short tons).

Source: DOTPF, 1978.

A 2,230m^2 (24,000 sq. ft.) heated warehouse is located on the dock and serves one spur and three truck loading areas. The dock area is lighted. Adequate storage area is available on land. Despite its modern facilities, the dock does not have equipment to efficiently handle containers and cannot accommodate railcar barge or roll-on/roll-off traffic.

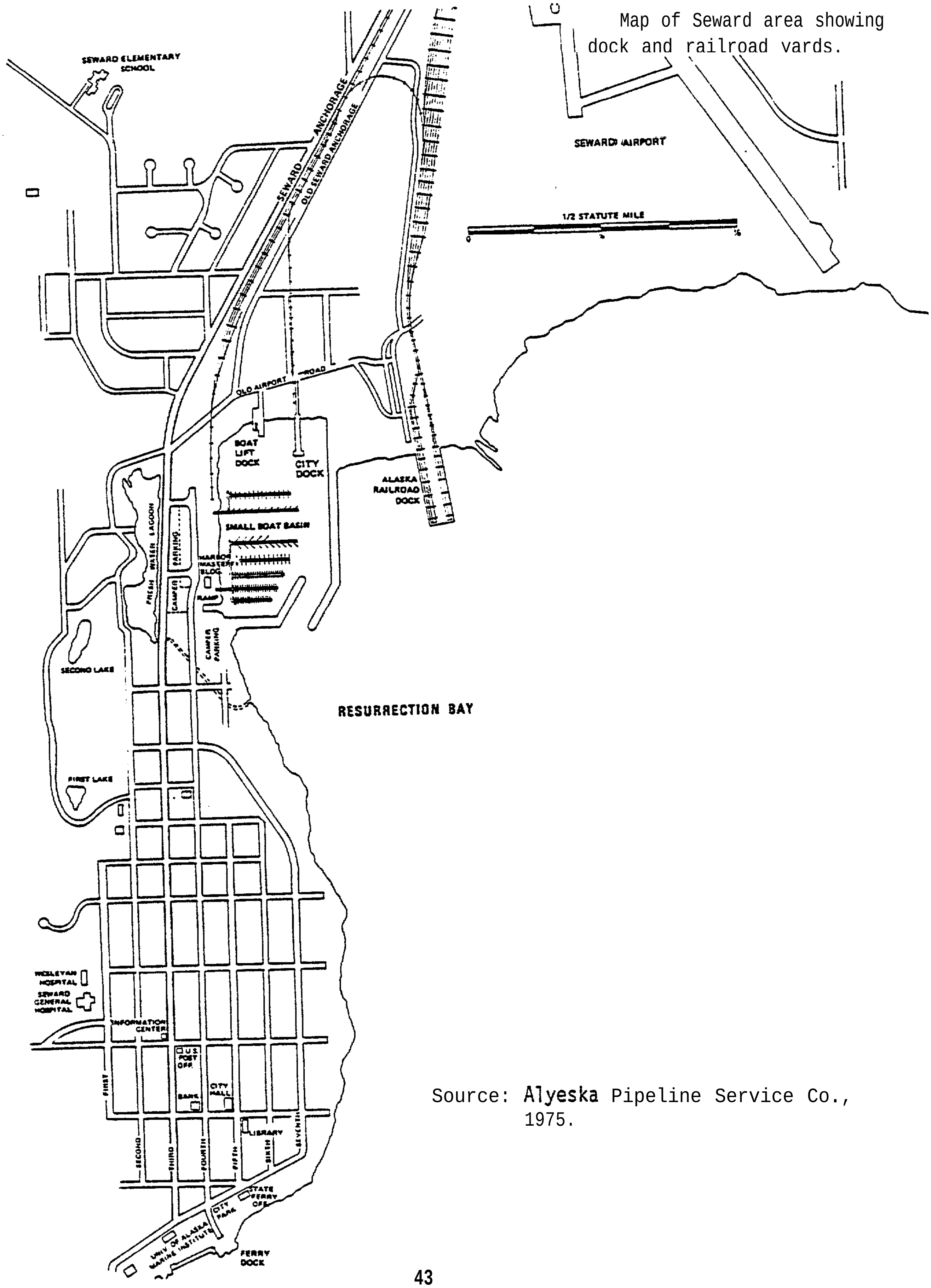
The dock serving the Marine Highway System is located at the south end of town and has a 58m (190 ft.) dock face. Figure 2-3 is a schematic layout of the Port and the Marine Highway System dock.

Water Depth and Navigation Characteristics. Depths at both the east and west dock faces are maintained at 10.7 m (35 ft.) with occasional dredging. Local weather conditions reduce the available berth days, but Resurrection Bay is ice free and has adequate depth and width to allow for safe maneuvering and anchoring during all weather conditions. During the summer, heavy swells enter Resurrection Bay and during the winter it experiences strong northerly winds. Various locations in the Bay have adequate space for large oil tankers to berth and turn around.

Tonnages by Handling Category. Table 2-6 presents the handling category capacities and inbound and outbound tonnages for 1977. A comparison of volumes to capacities shows the current underutilization of the port's facilities. In no handling category does the utilization exceed 10%, even for low capacities. Tonnage in 1975 was more than four times the 1977 figure, due principally to the unseasonal icing in the Arctic Ocean which caused shipments destined for Prudhoe Bay to be diverted to Seward.

Figure 2-3

ALASKA RAILROAD DOCK AT SEWARD



Map of Seward area showing dock and railroad vards.

Source: Alyeska Pipeline Service Co., 1975.

Table 2-6

Seward Port - 1977 Tonnage and Capacities
(Short Tons)

				Berth Occupancy			
				High		Low	
Freight Category	In-bound	Out-bound	Through-put	Capacity (1,2)	V/C (3)	Capacity (1,2)	V/C
Containerizable	21,953	2,684	24,637	15,700	3%	499,500	5%
Breakbulk				190,800		133,560	
Neobulk				381,600		266,400	
Special	14,255	28,047	42,302	795,000	5%	555,000	8%
Dry Bulk				474,000		333,000	[illegible]
Liquid Bulk	21,782	-	21,782	505,000	4%	355,000	6%
General Cargo				30,000		14,400	
Total	56,990 (64%)	30,731 (36%)	88,721 (100%)				

Notes: (1) Based on 318 available days.
(2) Each capacity for a handling category assumes only that category will be handled during the available berth period. The total port capacity is not a sum of the individual capacities.
(3) V/C based on 1977 throughput tonnage.

Source: Frederic R. Harris, 1978.

Tonnage by Commodities and Origin and Destination. Wood materials to and from the mill in Seward accounted for over 60% of the total tonnage in 1976. The decreasing availability of lumber and the depressed market for wood chips in Japan has substantially reduced the mill's output since then. A large fishing fleet operates out of Seward, and in 1976 fresh fish accounted for 5% of tonnage at 10,713 metric tons (11,809 tons), a figure which should increase if bottomfishing industry develops in the Gulf of Alaska. Seward's market area includes the entire Alaska Railroad system, but its penetration into the market is quite small. For example, Pacific-Alaska Line traffic going by rail from Seward to Anchorage in 1977 amounted to 7,077 metric tons (7,801 tons), only 4% of the total railroad tonnage to Anchorage. Seward commands a slightly higher percentage of total traffic when truck traffic from Seward to Anchorage is included. Truck traffic includes mobile homes too wide to go through the tunnels between Whittier and Portage. Through tariffs for railcars enable shippers to route materials to Seward through Whittier more cheaply than directly to Seward. In 1977, 21,575 metric tons (23,782 tons) moved to Seward through Whittier.

Table 2-7 contains throughput tonnages for Seward from 1968 to 1977 and shows the deviations from the average value for this period.

Summary. Marine traffic to and from Seward has experienced large fluctuations during the past decade. The port will remain an important port for breakbulk shipments but these occur in large tonnages only when capital intensive development activities occur, For shipments of materi-

Table 2-7

Seward 1968-1977 Throughput Tonnages

Year	Thousands of Metric Tons (Thousands of Tons)	Difference from Period Average
1968	107 (118)	-4%
1969	54 (60)	-51%
1970	26 (29)	-76%
1971	114 (126)	+3%
1972	55 (61)	-50%
1973	47 (52)	-58%
1974	65 (72)	-41 %
1975	347 (382)	+211%
1976	214 (236)	+92%
1977	82 (90)	-27%

Period Average = 111,220 metric tons (122,600 tons)
Standard Deviation = 98,000 metric tons (108,000 tons)

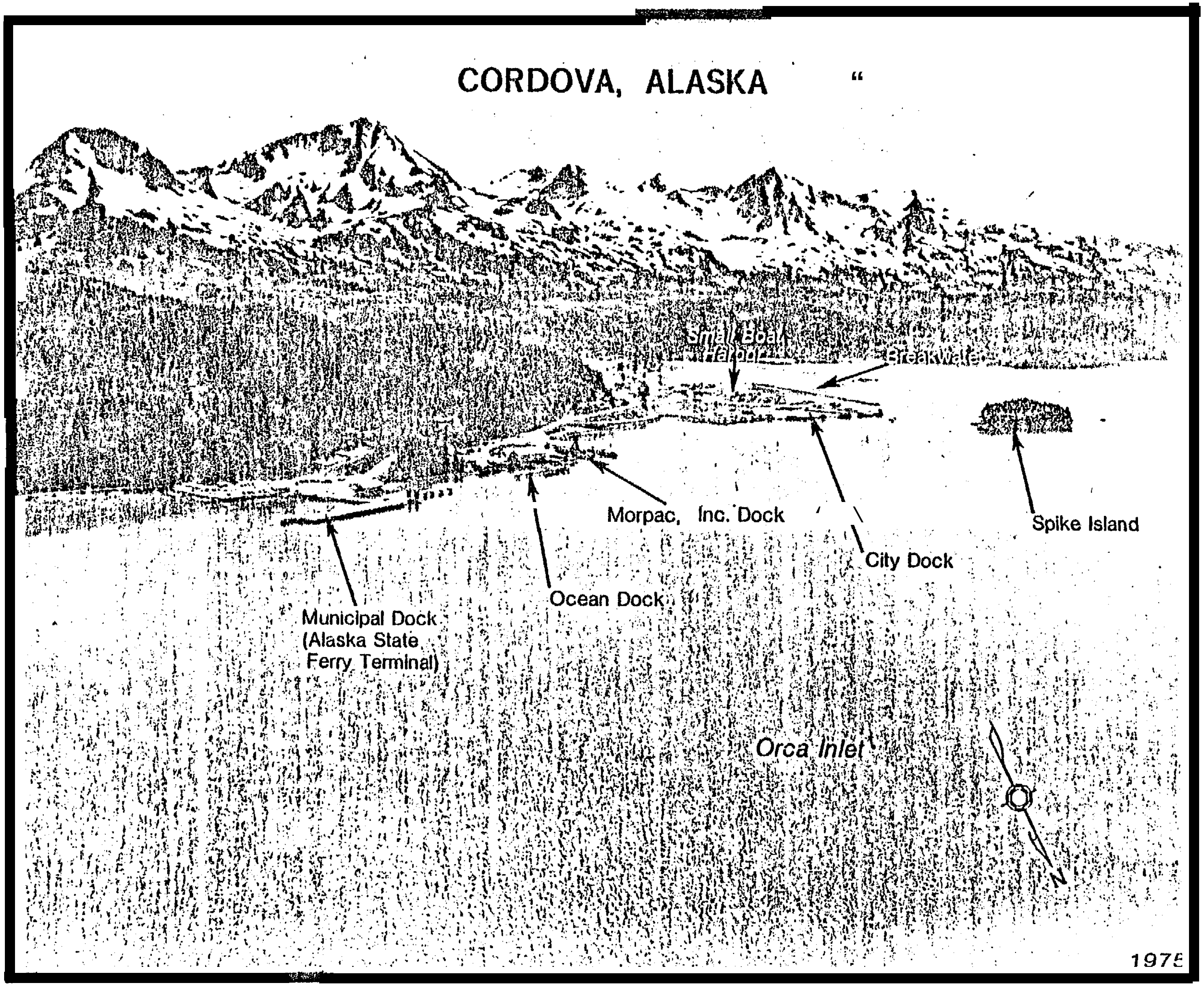
Source: Frederic Harris, 1978.

als such as drilling pipe that originate overseas, ships are preferable to barges for reliability reasons, and Seward is an ideal port for such operations.

Although cargo traffic currently is low, Seward's advantages of an ice-free bay suitable for navigation by deep-draft ships, road and rail connections to the State's two largest cities, and its proximity to potential oil and gas fields and bottomfish harvesting areas **could lead to greater** traffic in the future. A study in progress (Arctic Environmental Engineers, 1979) has established the engineering feasibility of a major industrial port north of Fourth of July Creek across the bay from the City of Seward. Preliminary development plans have been developed based on four separate uses of the port: (1) fish processing; (2) oil refinery; (3) materials handling; and (4) a smelter. Road and probably rail access would have to be constructed to the site.

2.2.1.4 Port of Cordova

Facilities. Two major dock facilities exist in Cordova, both of which are owned by the city. Figure 2-4 is an area map showing their locations. A T-shaped pier called the City Dock located just north of the small boat harbor has a 91.4 m (300 ft.) outer face. It has available an 18 metric ton (20 ton) mobile crane. Its principal users are the Coast Guard, which has a buoy tender stationed in Cordova, and fishing vessels. An estimated 80 daily arrivals of fishing boats in Cordova during the summer (ERCO, 1978) could result in delays at. this dock for



Source: National Ocean/c and Atmospheric Admini strati on. United States Coast Pilot 9

Figure 2-4
Location of Cordova Dock Facilities

other users. The municipal dock is located approximately 1 km (0.8 mi.) to the north and is an L-shaped pier with outer and inner face lengths of 122 m (400 ft.) and 76 m (250 ft.), respectively. A 127 metric ton (140 ton) mobile crane is located at this dock. It handles general cargo, petroleum products, and stops by Marine Highway System ferries.

Wharves of 61 m (200 ft.) and 30.5 m (100 ft.) serve two local canneries, and a dock site no longer in use exists near the municipal dock.

A historical summary of throughput traffic at the Port of Cordova is provided in Table 2-9 (Corps of Engineers, 1967 through 1976). The average throughput tonnage for the period 1967-1977 is 41,594 metric tons (46,348 tons). The high tonnage for the period was recorded in 1971 and the low one year earlier. Despite the relatively large range in annual tonnage figures, they are more closely grouped than those for Seward. In only one year does the difference from the average reach 50%, but for Seward it is reached six times for the same period.

Estimated port capacity is shown in Table 2-8. Multiple use of the available berths and preferential berthing for some users prompted the use of a single occupancy rate for containerizable goods. Adequate capacity exists to serve the community's normal requirements for many years.

Table 2-8

Cordova Port - 1977 Tonnage and Capacities
(Short Tons)

Handling Category	In-bound	Out-bound	Through-put	Berth Occupancy High Capacity (1,2)	High v/c (3)	Berth Occupancy Low Capacity (1,2)	Low v/c (3) 9
Containerizable	8,221	6,970	15,191			72,000	(21%) (
Neobulk	58	19	77				
Special	1,050	3	1,053	194,000	(1%)	136,800	(1%
Dry Bulk	59	2	61				
Liquid Bulk	18,764	0	18,764	253,000	(7%)	122,000	(15%)
Total	28,1.52 (80%)	6,994 (20%)	35,146 (100%)				

Notes: (1) Based on 325 available days.
(2) Port capacity is not a sum of capacities for each handling category. Each capacity assumes berths will be used only for that handling category.
(3) v/c = (1977 throughput tonnage)/capacity
(4) A single capacity was computed for containerizable freight.

Source: Frederic Harris, 1978.

Figure 2-9

Historical Summary for the Port of Cordova (1967-1976)

Year	Metric Tons (Tons)	Year	Metric Tons (Tons)
1967	46,370 (51,114)	1972	38,205 (42,114)
1968	39,613 (43,666)	1973	42,411 (46,750)
1969	42,098 (46,405)	1974	31,949 (35,218)
1970	31,257 (34,455)	1975	39,128 (43,132)
1971	62,190 (68,553)	1976	59,846 (65,969)

Source: Corps of Engineers, 1967 through 1976

Water Depth and Navigational Characteristics. The municipal, L-shaped pier has a depth of 7.6 m (25 ft.) on the outer face and 6.7 m (22 ft.) on the inner face. The city dock has a depth of 8.8 m (29 ft.). A bottom uplift of 1.9 m (6.3 ft.) resulted from the 1964 earthquake. Winds in Cordova for the most part are within an acceptable range, but occasionally strong winds from the north and west prevent operations. Rough seas in the Gulf of Alaska can delay scheduled arrivals and departures. Large vessels inbound to Cordova go north of North Island and then south along the east shore. The controlling depth of the buoyed channel is 5.8m (19 ft.). The southern approach through Orca Inlet is used by fishing boats but its use requires local knowledge. The north side of Orca Inlet has numerous shoaling areas, but adequate space exists for ships the size of supply boats - 61 m (200 ft.) - to turn around. No adequate space exists for vessels to wait for berthing spaces. Of the 176 outbound ships in 1976, all had drafts of 20 feet or less (Corps of Engineers, 1976).

Tonnage by Handling Category and Commodity. Inbound tonnage almost exclusively serves the needs of the Cordova area. Petroleum products in 1977 accounted for 64% of the inbound tonnage. They are used locally for heating, power generation, vehicles, and the fishing fleet. Of the outbound tonnage in 1977, 72%, or 4,569 metric tons (5,037 tons), were fresh or processed fish and shellfish. Fresh fish and shellfish was one-third of this total, processed two-thirds.

Tonnage by Origin and Destination. Cordova maintains a balanced trade with Kodiak using Sea-Land's scheduled freight service with a small container ship; the Aleutian Developer. In 1977, 7,136 metric tons (7,866 tons) were received from Kodiak and 5,895 metric tons (6,498 tons) sent there which represents a 55-45 split. The only other significant trading partner is Seward, which through the ferry system or barges can transship goods entering Whittier or Seward. Virtually all petroleum products are received from Valdez, which is Standard Oilis major distribution center for the Gulf of Alaska area.

Summary. No major changes in tonnage or shipping patterns has occurred in recent years that affect Cordova and none are imminent, although development prospects in bottomfishing and oil and gas development could lead to incremental improvements in existing facilities. At present, Cordova does not have an overland route connected to the State's major highway routes. The so-called Copper River Highway would provide such a connection and is under consideration, but funding for projects beyond Mile 52 has not been secured.

2.2.1.5 Port of Yakutat

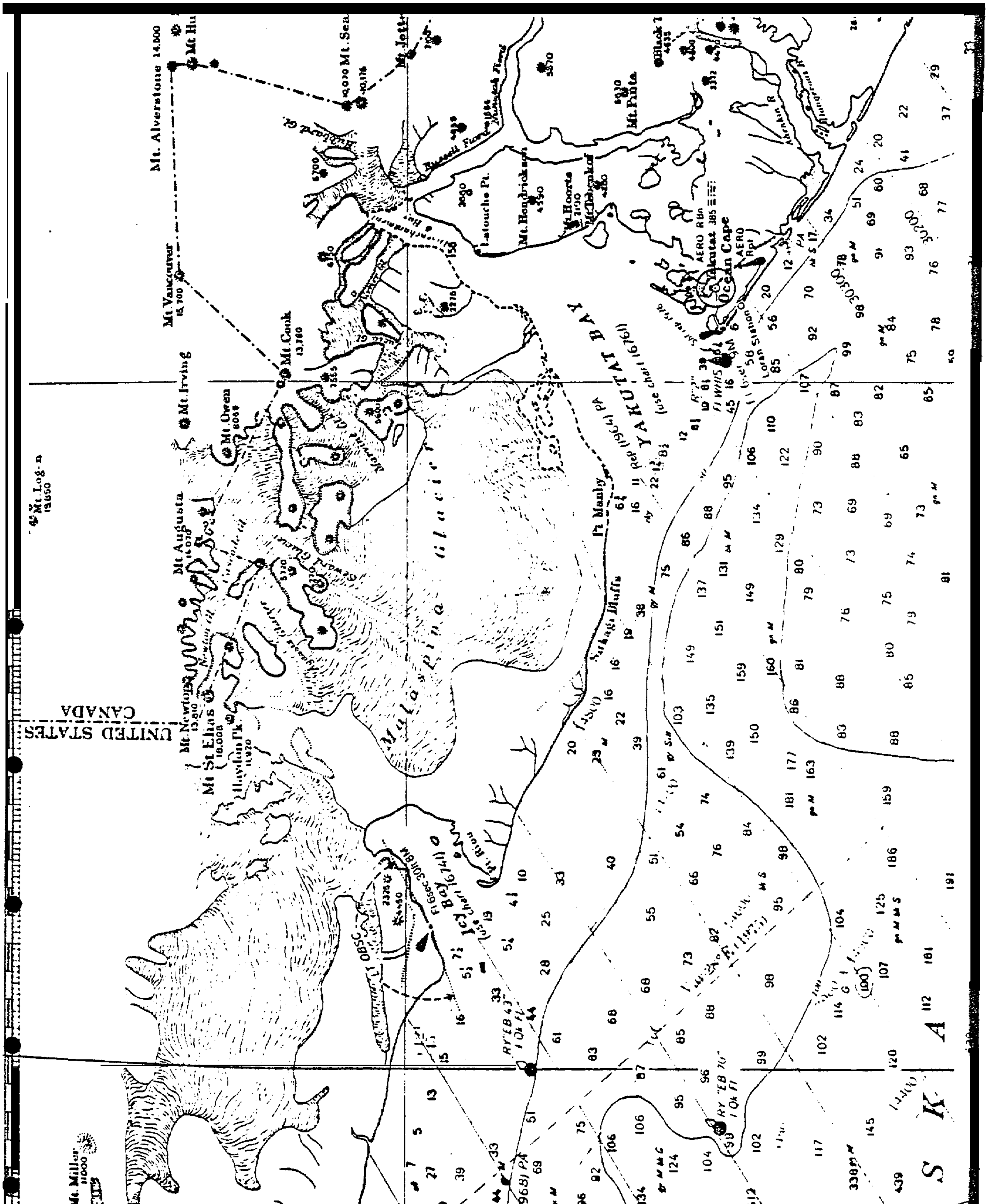
Facilities. Four principal docks serve freight destined for Yakutat. Two are under the jurisdiction of the city, and two are privately owned. The two city docks were originally oriented toward the use of canneries. Both are supported by timber piling which is in disrepair, and both have inadequate storage areas. The Ocean Cape Cannery dock is presently used for general cargo handling and for traffic related to fish processing activities. The Atlantic Richfield Company (ARCO) and the Shell Oil Company purchased the facility as a potential site for their service base site for oil and gas exploration but in 1977 sold it to the city, and ARCO developed a separate facility to the south. The Ocean Cape dock face is 81.7m (268 ft.). No significant cargo handling facilities are available, and the deterioration of the facility limits the load-carrying capacity. Dockside water depth is approximately 5.5m (18 ft.).

The finger pier which serves the Yakutat Cold Storage Facility has a length of 96.3m (316 ft.) but decreasing depths close to shore limit berthing to ship lengths of approximately 45.7m (150 ft.). A proposed wharf extension, which is the first priority of the community's overall economic development program, would create an L-shaped dock with a length of 73.8 m (242 ft.) and 1,208 m^2 (13,000 sq. ft.) of storage area. It would have a concrete deck and steel pipe piles. Water depth would be approximately 9.1 m (30 ft.). Standard Oil has a petroleum pier constructed of timber piling, and has recently the landside storage capacity. It has a 76.2m (250 ft.) face and can accommodate vessels with drafts up to 10.7 m (35 ft.).

To serve exploration activities on the Yakutat Shelf, ARCO and Shell Oil joined together to build a small supply base in Monti Bay. Dock facilities consist of a finger pier 35 m (115 ft.) long and 7.3 m (24 ft.) wide.

Figure 2-5

Navigational Characteristics in the Vicinity of Yakutat Bay



Source: U.S. Coast and Geodetic Survey

Table 2-10

Yakutat Port '- 1977 Tonnage and Capacities
[Short Tons)

Handling Category	In-bound	Out-bound	Through-put	Berth Occupancy High Capacity (1,2)	V/C (3)	Low Capacity (2)	V/C (3)
Containerizable	741	818	1,559	27,375	(6%)	13,125	(12%)
Liquid Bulk	9.931	-	9,931	203,000	(5%)	97,000	(lo%)
Total	10,672	897	11,490				
	(93%)	(7%)	(100%)				

Notes: (1) Based on 292 available days.
(2) Port capacity is not the sum of capacities for individual handling categories. Each capacity assumes dedicated use for the particular handling category.
(3) v/c = (1977 throughput tonnage)/capacity.

Source: Frederic Harris, 1978 (capacities); Corps of Engineers, 1977(tonnages).

Table 2-11

Historical Summary (Selected Years)

Year	Liquid Bulk	Other	Total Throughput Tonnage
1973	5,435	1,500	6,935
1974	5,741	1,077	6,819
1977	9,931	741	10,672

Source: Corps of Engineers, 1978.

Supply ships and barges dock perpendicular to the pier using four mooring dolphins placed 30.5 m (100 ft.) apart. The facility can accommodate two supply boats docked stern to stern.

Table 2-11 provides throughput tonnages for the years 1973, 1974, and 1977. Port capacities for handling categories are given in Table 2-10. The lack of transfer facilities for neobulk and special cargo limits dry freight to containerizable materials. The use of one berth and a maximum of 30 containers per day have been assumed. The present container capacity is approximately 38% of that computed for Cordova.

Water Depth and Navigational Characteristics. Figure 2-5 shows the navigational conditions in the vicinity of Yakutat Bay. Existing facilities do not allow use by deep-draft vessels, although water depth in Monti Bay reaches 36.6 to 73.2 m (20 to 40 fathoms). Adverse weather reduces the number of available days to 292. The area's maritime climate produces a narrow temperature range (monthly averages are between 26 and 53 degrees F.) and an average annual precipitation of 3.35 m (132 in.). Heavy fog occurs approximately 10% of the time and has greatest probability of occurrence during the late summer and mid-winter. Yakutat Bay provides the best anchorage between Cape Spencer to the south and Prince William Sound. It is mostly clear of islands and dangerous shoals and has depths ranging from 11.9 to 303.6 m (6½ to 166 fathoms). During very strong winds, the entrance to Yakutat Bay, which is 24.1 km (15 mi.) wide can be dangerous due to breakers or pronounced swelling that occurs across the entire entrance. Also, 3.2 to 4.8 km (2 to 3 mi.) before the entrance, there is a narrow submarine ridge which has a depth of 6.4 to 29.3 m (3.5 to 16 fathoms). The 9.1 m (5 fathom) contour within Yakutat Bay extends 0.4 km (¼ mi.) from shore. Icebergs are thick in the upper part of the Bay except in winter and commonly are found on the west side of the Bay.

Tonnage by Handling Category and Commodity. Dry cargo entering Yakutat is in containers carried on barges. Except for special items, food products represent the largest inbound commodity. Fish and fish products are exported mostly by air because of the infrequency of scheduled marine traffic. Petroleum products make up 94% of the inbound traffic and are used primarily for heating and electrical generation.

Commodities by Origin and Destination. Total throughput tonnage for Yakutat in 1977 was approximately 55% greater than the figures for 1973 and 1974, but the increase came exclusively from petroleum products. The 1977 level of dry freight represented a decline from previous years (Table 2-11)". Petroleum commodities come principally from Valdez but in 1977 approximately one-eighth of the community's supply came from Ketchikan, which is Standard Oil's other major distribution point. Commodities serving the everyday needs of the community come from the Seattle area. Seward was involved in shipment of special items to Yakutat in 1977 and Southeastern ports in similar shipments from Yakutat.

Summary. Existing marine freight almost exclusively serves the local population. Reconstruction of the city cannery, which was destroyed by fire in 1977, could help increase outbound traffic and lead to more frequent service. Western Pioneer Lines and Northland Marine previously have served Yakutat on a scheduled service. Northland Services, the successor to Northland Marine, now provides the only regular service to the community. The small demand by the community and the lack of an adjacent distribution point to serve the community requires shippers to gather goods in Seattle for. several locations. Yakutat will remain a possible stop on barge and small freighter routes from Seattle serving Prince William Sound communities, Kodiak, and Aleutian communities. Tonnage into the community can change dramatically as a result of local construction projects and development activities. Reconstruction of at least one of the two existing dock structures owned by the city is a short-term necessity.

2.2.1.6 Valdez

Facilities. Figure 2-6 shows the location of Valdez' dock facilities. The city dock, of timber construction, has a 182.8 m (600 ft.) face and a water depth of 10.0 m (33 ft.). It has available 1,858 m^2 (20,000sq. ft.) of heated warehouse space, forklift trucks, and cranes having capacities of 136 and 91 metric tons (150 and 100 tons). It handles general cargo, containers, and other handling categories entering Valdez. The *M.V. Tustumena,* a Marine Highway ferry, uses this dock for loading and unloading.

A rail transfer facility was constructed by Crowley Maritime Corp. to handle pipeline supplies. Barges are limited to tonnage which the barge structure can support becasuse only 1.5 m (5 ft.) of water is available. The facility accommodated transshipments from Whittier. Open storage of 2.8 hectares (7 acres) is available for railcar shipments.

A 91.4 m (300 ft.) dock on tidelands leased from the city handles general cargo and refined petroleum products for Tesoro-Alaskan Petroleum Company.

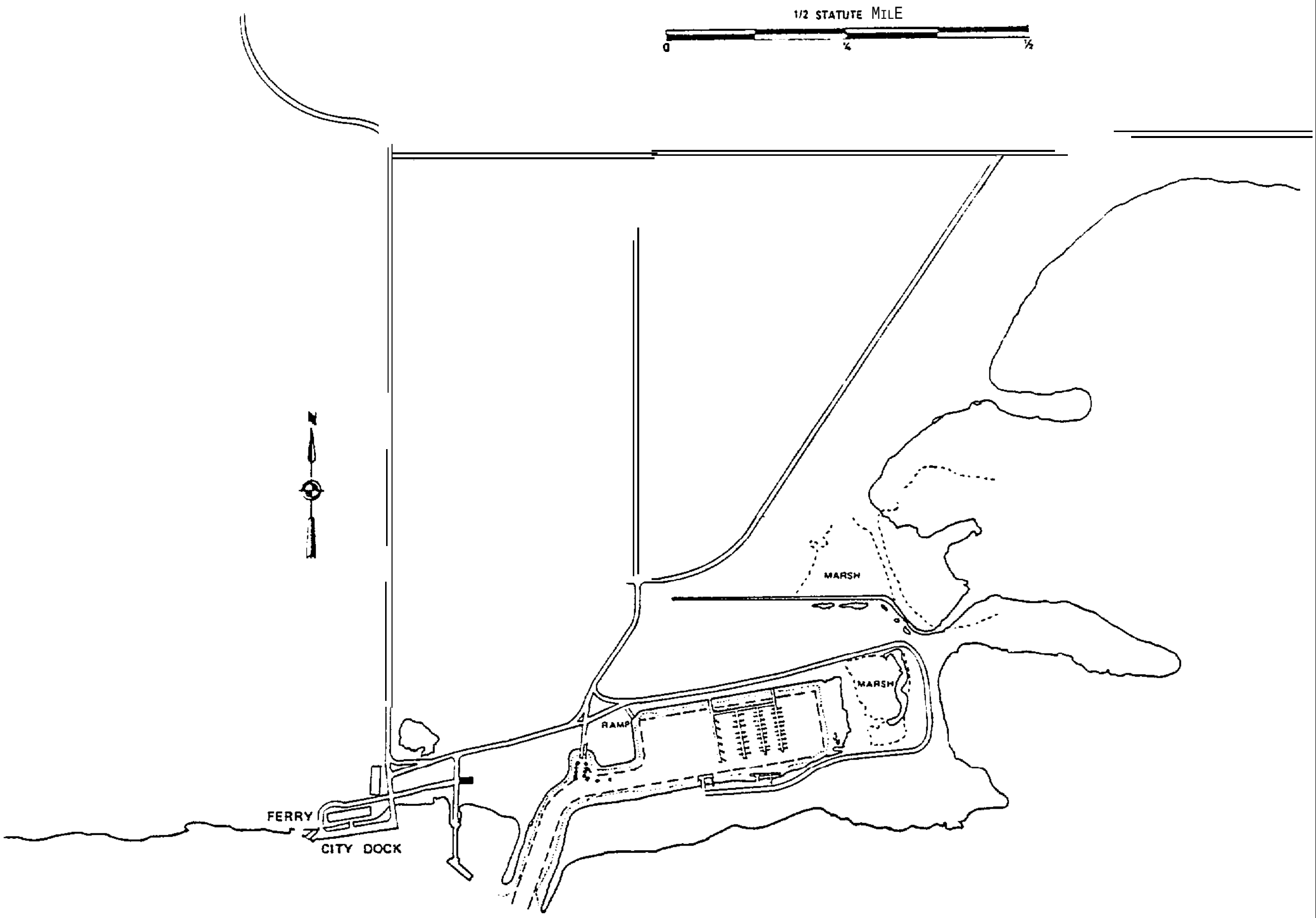
The transfer facility for refined petroleum products is located adjacent to the city dock. Also nearby the city dock is a ferry terminal which serves the *M.V. Bartlett.*

Table 2-12 presents the capacity by handling category of the port's facilities. Excluded are the berths serving the trans-Alaska pipeline's oil

Figure 2-6

PORT OF VALDEZ

Map of Valdez area showing dock facilities.



PORT VALDEZ

Source: Alyeska Pipeline Service Co., 1975.

terminal, which in early 1979 had a daily throughput of 1.2 billion bbls. per day. Since the Valdez railcar transfer facility depends on deliveries to Whittier, a comparison of railcar capacities for the two ports is instructive. Valdez' high capacity of 16,500 cars is 70% of that for Whittier and the low capacity 48% of Whittier's 16,640 cars.

Water Depth and Navigational Characteristics. The city dock has a water depth of 10 m (33 ft.) and the petroleum dock a depth ranging from 7.3 to 10.4 m (24 to 34 ft.). The railcar barge facility as noted has only 1.5 m (5 ft.) of available water. Weather constraints limit available berth days to 329. The port is ice-free.

Tonnages by Handling Category and Commodity. As shown in Table 2-12 liquid bulk, excluding crude oil, accounts for 96% of the port's throughput. Inbound tonnage arrives principally from Nikiski and California. An estimated 80% of the inbound liquid bulk is transshipped to other Alaskan communities as far south as Ketchikan and as far west as Kodiak. Existing capacities are sufficient to handle current traffic but would require expansion if the Alpetco refinery goes forward and if the existing petroleum facilities are used to load its products. Port congestion would occur prior to 1985 under these conditons (Frederic Harris, 1978).

Dry freight in 1977 included 6,813 metric tons (7,510 tons) of fabricated metal products from foreign ports, which presumably was related to oil pipelineor terminal activities, and 2,818 metric tons (3,106 tons) of petroleum products that was containerizable. The remaining tonnage of

Table 2-12

Valdez Port - 1977 Tonnage and Capacities
(Short Tons)

Handling Category	In-bound	Out-bound	Through-Put	Berth Occupancy High Capacity (1,2)	High V/C (3)	Low Capacity (1,2)	Low V/C (3)
Containerizable	15,704	1,494	17,198	965,250	(2%)	463,250	(4%)
Breakbulk				148,500		71,280	
Neobulk				297,000		142,560	
Special		-	-	618,750		297,000	
Liquid Bulk	218,165	172,945 (4)	391,110	2,510,500	(16%)	1,210,000	(32%)
Railroad Cars				412,250		198,000	
Total	233,869	174,439	408,308				

Notes: (1) Based on 329 available days.
(2) Port capacity is not a sum of capacities for each handling category. Each capacity assumes berths will be used **only** for that handling category.
(3) V/C = (1977 throughput tonnage)/capacity.
(4) Crude oil shipments to Nikiski and outside Alaska have been subtracted. This figure represents the amount of inbound liquid bulk shipments that are transshipped.

Source: Frederic Harris, 1978,

4,597 metric tons (5,067 tons) is approximately three-fifths of the containerized tonnage for Cordova, which has only one-third the population. This situation suggests that a large percentage of tonnage serving Valdez' residents arrives by truck, which can provide greater frequency. The narrow range of commodities inbound to Valdez strengthens this conclusion.

Except for crude oil and petroleum products, outbound tonnage is negligible at the present time.

Tonnages by Origin and Destination. Valdez is important as a distributor of oil products. Destinations, in descending order of tonnages, are as follows: Anchorage, Kodiak, Alaska Peninsula (southside), Seward, and Cordova. The range is 35,569 metric tons (39,208 tons) for Anchorage to 16,414 metric tons (18,093 tons) for Cordova. Kodiak, Seattle, and Cordova were the only U. S. ports to ship dry freight to Valdez in 1977.

Summary. As recently as 1959, the Port of Valdez had a throughput of 272,154 metric tons (300,000 tons) and handled the majority of freight destined for Interior Alaska. The 1964 earthquake caused a tidal wave which destroyed the existing port facilities. New facilities were constructed near the new townsite, but the port did not regain its previous stature. The opening in 1971 of the Parks Highway linking Anchorage and Fairbanks caused a drop in tonnage at Valdez from 454 thousand metric tons (500 thousand tons) in 1970 to 272 thousand metric tons (300 thousand tons) the following year. Not until 1974 did the port again exceed the 1959 level.

A $48 million bond proposal for expansion of existing port facilities passed overwhelmingly in April 1979. Proponents say the project will enable Valdez to become once again a major port of entry for the Interior. A state-funded agricultural project at Delta, south of Fairbanks, and the choice of Valdez as the site for a major refinery by Alpetco are promising signs that the project might produce adequate demand.

Most likely a major port expansion will not significantly change existing patterns but will enable Valdez to share in the growth that is expected in Interior Alaska.

2.2.2 MARINE CARRIERS

Marine freight carriers serving the study area can be divided into three general categories, as follows: (1) carriers providing scheduled service , on an all-year round basis; (2) carriers providing infrequent or seasonal service on established routes; and (3) contract carriers. The first two categories of carriers operate under tariffs filed with the Interstate Commerce Commission. Responses of carriers to the increased demand for freight to major population centers in Southcentral Alaska, particularly during the pipeline boom, have been consistent with the worldwide trend toward vessels with high productivity. Such vessels have large capacities and carry freight in containers or vans that can be efficiently transferred to shore. Breakbulk commodities are nearing elimination except where no other handling category is possible because of the weight or volume of freight involved.

Individual carriers will be discussed in each of the three categories.

2.2.2.1 Scheduled Carriers

Scheduled carriers are considered to be those that operate a route a minimum of once a month throughout the year. Major routes are shown on Figure 2-7.

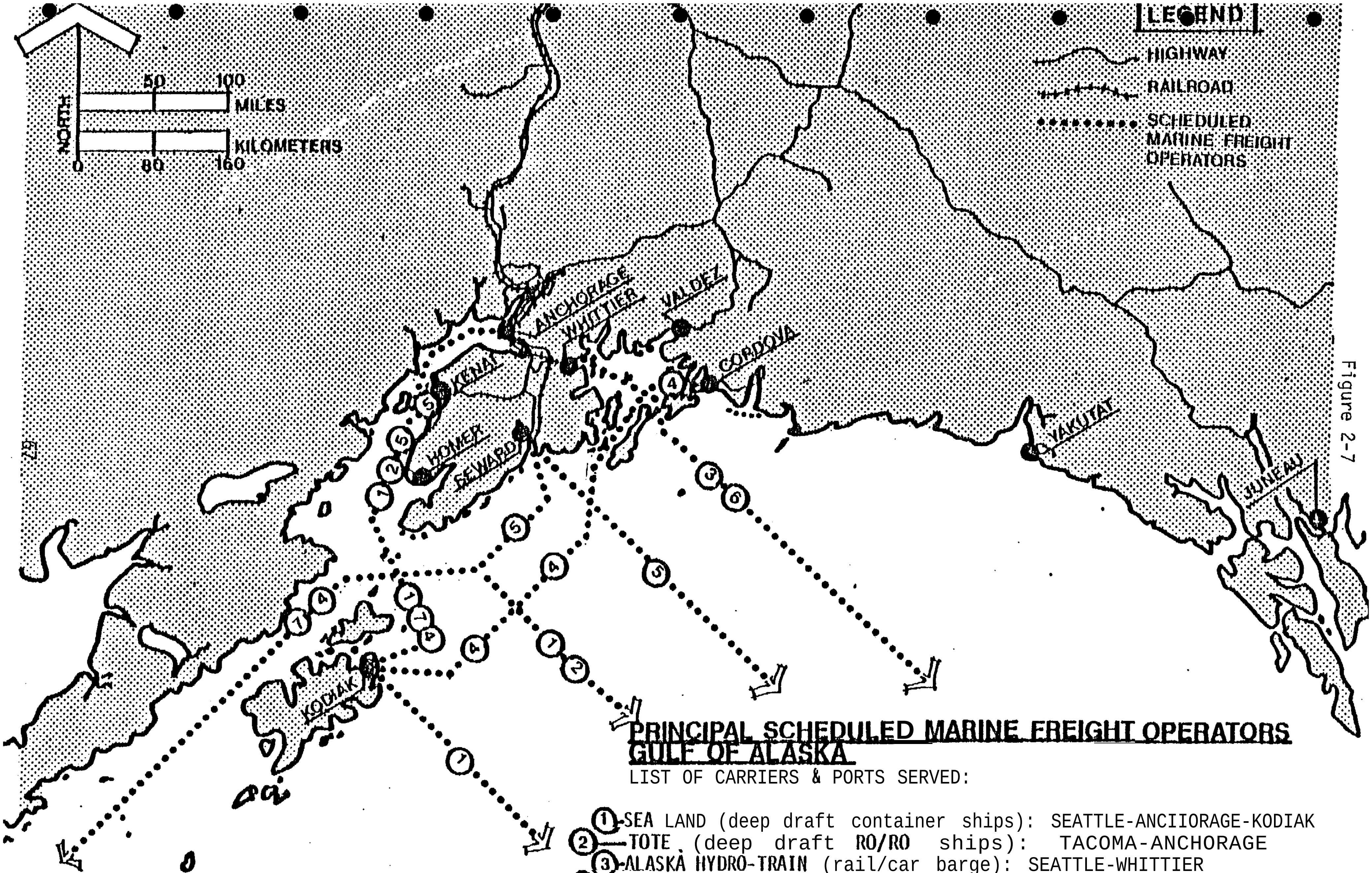


Figure 2-7

PRINCIPAL SCHEDULED MARINE FREIGHT OPERATORS GULF OF ALASKA

LIST OF CARRIERS & PORTS SERVED:

1. SEA LAND (deep draft container ships): SEATTLE-ANCIIORAGE-KODIAK
2. TOTE (deep draft RO/RO ships): TACOMA-ANCHORAGE
3. ALASKA HYDRO-TRAIN (rail/car barge): SEATTLE-WHITTIER
4. SEA LAND (feeder container ship): KODIAK-CORDOVA-ALEUTIANS
5. PACIFIC-ALASKA LINES (enclosed barge) : PORTLAND-SEWARD-NIKISKI
6. CANADIAN NATIONAL (rail car barges): PRINCE RUPERT-WHITTIER
7. SEA L A N D : KODIAK-JAPAN

SOURCE: PETER EAKLAND & ASSOC. 1978

Sea-Land. Sea-Land specializes in the shipment of 10.7 m (35 foot) containers initially overwater and then, if appropriate, over land to final destinations. It operates deep-draft, container steamships that deliver freight to Kodiak and Anchorage. From Kodiak, Sea-Land distributes freight to Cordova and communities in the Aleutians. For destinations other than Anchorage, freight is transshipped by either truck or rail. Sea-Land operates as a common motor carrier in the State of Alaska and can deliver freight using its own equipment.

Sea-Land's container service to Anchorage began in 1964 and Kodiak service was initiated a year later. During the 1976-1977 pipeline boom, the fleet size reached five vessels on the Seattle-Anchorage-Kodiak route which permitted four round trips a week between Seattle and Anchorage. The ships have a length of 159.4 m (523 feet), can accommodate 360 containers, and operate at 29.6 km/hr (16 knots). Fully loaded, their draft is 9.8m (32 feet). The hulls have been reinforced to permit operations during winter icing of Upper Cook Inlet. Loading and unloading a full ship can be accomplished in less than 24 hours. Ships stopping at Kodiak on the return leg generally leave Anchorage the same day that they arrive.

In 1979, Sea-Land provided twice weekly service to Anchorage with three steamships--the Newark, Portland, and the Philadelphia. The ship scheduled for a Sunday arrival in Anchorage stops at Kodiak enroute to Seattle to pick up processed seafoods and drop off cargo for Kodiak and transshipment to Cordova and the Aleutian Islands. In the past, the ship scheduled for a Wednesday arrival in Anchorage returned directly to Seattle. However, beginning in the summer of 1979, this ship also stopped at Kodiak enroute to Seattle. Sea-Land emphasizes adherence to schedules rather than maintenance of high load factors. In 1976, the company maintained an overall load factor of about 80 percent (Corps of Engineers, 1978). The stop at Kodiak enables Sea-Land to take advantage of a backhaul of processed seafood products to the Seattle area and to increase northbound load factors.

The Aleutian Developer is the feeder ship that distributes containers from Kodiak to Cordova and the Aleutians. Service to Cordova is twice monthly in the summer and once monthly during the winter. Cordova canneries provide a backhaul to Kodiak of fresh and canned fish and shellfish which helps justify the route. A similar backhaul occurs-from the Aleutians. The ship has a length of 109.7 m (360 feet) and a capacity of 91 containers. Assuming an average load of 13.6 metric tons (15 tons), the ship has a capacity of 1,238 metric tons (1 ,365 tons). An onboard crane is rated at 30.5 metric tons (30 long tons).

Sea-Land initiated *in* March 1979 container ship service between Alaska and Japan that is designed to handle seafood products. The ship to be used initially has a capacity of 177, 10.7 m (35 foot) temperature-controlled containers. Operating on a three-week schedule, the ship picks up seafood products in Kodiak and Unalaska/Dutch Harbor and delivers them to Yokohama and Kobe, Japan. Plans call for later use of a

281-container ship which will better suit the needs of users. The subsequent introduction of Unalaska/Dutch Harbor-Japan service by American President Lines, Ltd. using 740 container ships coul d hi rider the devel - opment of Sea-Land's routes (Anchorage Times, 1979).

TOTE. TOTE entered the Seattle-Anchorage marine freight market in September 1975 with roll-on/roll-off service and within a year was offering twice-weekly service comparable to Sea-Land's but carrying trailer vans rather than containers. TOTE's two ships, the Great Land and the Westward Venture, each have a capacityof 390, 12.2 m (40 foot) containers. Each ship has a length of 240.8 m (790 feet), a draft of approximately 9.1 m (30 feet), and a speed of 44.5 km/hr (24 knots), enabling a one-way trip *in* 2½ days. Because of a very short turn-around time at Anchorage (less than 12 hours], accomplished with a unique transfer bridge, each ship maintains a schedule of one round-trip per week. TOTE originally operated out of Seattle but now uses Tacoma as its southern terminus. TOTE has scheduled arrivals in Anchorage on Sunday and Tuesday to accommodate the preference of users.

Eighty percent of TOTE's cargo is in carlot shipments. Of its total traffic, the carrier estimates that 80% is destined for Anchorage, 15% for Fairbanks, and 5% for other locales (Westerlin, 1979).

Although TOTE owns trailer vans, it will accept any company's vans for shipment. Since it does not have any motive equipment, TOTE contracts with trucking companies to move shipments to destinations. Backhaul traffic is only 5% of its total traffic, which is less than that captured by Sea-Land, partially because TOTE does not have any intermediate stops on its return trip. TOTE and Sea-Land each capture an estimated 45% of marine traffic destined for Anchorage (Westerlin, 1979).

Alaska Hydro-Train (Crowley Maritime Corp.)-. Alaska Hydro-Train, a subsidiary of Crowley Maritime, ships railcar barges to Whittier, which are then carried by the Alaska Railroad to final destinations. Two sizes of barges are used--a 121.9 m by 30.5 m (400 foot by 100 fret) barge with a maximum capacity of 52 railcars and 11,340 metric tons (12,500 tons), and a 121.9 m by 18.3 m (400 foot by 60 foot) barge which can carry 40 railcars. Barges are towed in tandem when traffic demands and weather permits. Generally, the Seattle-Whittier run takes six to seven days; however, actual time depends on weather and the size of the tow.

Currently, an Alaska Hydro-Train tug and barge sail from Seattle once every five days. During pipeline construction, service reached three sailings per week during the winter.

The route benefits from preferential through rates for railcar shipments from the Midwest. Because of ice in Uppler Cook Inlet during the winter, Hydro-Train has been able to gain a dominant share of breakbulk shipments.

Crowley Maritime owns a railcar facility in Valdez, but it has not been used extensively in the past two years.

Through 1977, Crowley Maritime operated a 45-48 car trainship from Vancouver, B.C. to Whittier with a one-way travel time of three days. Its speed and enclosed space made it more competitive with TOTE and Sea-Land services than *barge service,* but high operating costs compared to the Hydro-Train led to the decision to terminate the service. Trainship tonnage to Whittier in 1977 was roughly 70% of that for Hydro-Train. Total tonnage for both services was 248,003 metric tons (273,378 tons).

<u>Aqua-Train (Canadian National).</u> The Canadian National operates a 21-car rail car barge service between Prince Rupert, B.C. and Whittier approximately once every 10 days. Tonnage for 1977 was 5,370 metric tons (5,9? 9 tons), or only 2% of that carried by Crowley. The route primarily serves shipments originating in the Midwestern United States.

<u>Pacific Alaska Lines(Crowley Maritime Corp.)</u>. Pacific Alaska Lines (PAL) began operating two barges in 1976 to meet specific markets at Seward and Nikiski but was forced to discontinue service to Seward in March, 1979 due to a lack of northbound cargo. This service was the only scheduled service into Seward. The 117.3 m(385 ft.) by 29.9 m(85 ft.) enclosed barges delivered freight in both 12.2 m(40 ft.) and 6.1 m(20 ft.) containers to Seward and then traveled to Nikiski to load up to 11,340 metric tons(12 ,500 tons) of bulk urea destined for Portland Sacramento. A rack on top of the barge was used to carry mobile home units to Seward could not be shipped via TOTE or trhough Whittier because of tunnel clearance problems. PAL

Table 2-13

Southwest Marine Highway System Ship Characteristics

	M.V. Bartlett	M.V. Tustumena
Length	58.8 m (193 feet)	90.2 m (296 feet)
Passenger Capacity	170	200
Staterooms/Berths	0	27/58
Vehicle Capacity (Standard Size)	38	50
Maximum Vehicle Length	18.3 m (60 feet)	12.2 m (40 feet)
Maximum Vehicle Gross Weight	31.8 metric tons (35 tons)	27.2 metric tons (30 tons)
Speed	22.5 km/hr (14 knots)	23.3 km/hr (14.5 knots)

Source: Alaska Northwest Publishing Co., 1978; DOTPF, 1978.

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service generally was operated twit monthly during the summer and once monthly during the winter.

PAL service to Seward offered the advantages of railroad service but for LCL(less than carload) shipments. An estimated 80% of the tonnage delivered to Seward is destined for Anchorage. PAL tonnage placed on the Alaska Railroad at Seward totaled 13,614 metric tons (15,007 tons) in 1977. Fifty-two percent of this was destined for Anchorage, 21% for Fairbanks, 14% for Kenai/Homer, and 9% for Wasilla and Palmer.

Marine Highway System (State of Alaska). The state operates two ferries in Southcentral Alaska. Service to the area began in 1963 with a small ferry serving only Valdez and Cordova. The M.V. Tustumena was acquired in 1964 and the M.V. Bartlett in 1969. Table 2-13 shows the characteristics of each vessel. Operational 1 y, the major difference between the two vessels is *that* the M.V. Bartlett permits ramp loadi ng of vehicles at the bow and stem while the M.V. Tustumena has a loading elevator, which is less efficient and limits the size of vehicles that can use the ship. On the other hand, the elevator system eliminates the need for construction of shoreside ramp structures, which is attractive for areas of large tidal *changes.*

The M.V. Bartlett, operates exclusive? y in Prince Wil 1 iam Sound. It provides twice-weekly service on the Valdez-Cordova route except for

Table 2-14

Marine Highway System - Southwest System

Major Links	Direction	Link Volumes: Passengers	Link Volumes: Vehicles	Trips	Average Load Factors (1): Passengers	Average Load Factors (1): Vehicles
M.V. Bartlett - July 1976						
Cordova-Valdez	EB	283	105	9	0.18	0.31
Valdez-Cordova	WB	300	101	8	0.22	0.33
Valdez-Whittier	EB	3,332	670	22	0.89	0.80
Whittier-Valdez	WB	3,166	636	22	0.85	0.76
M.V. Bartlett - January 1977						
Cordova-Valdez	EB	161	46	9	0.09	0.13
Valdez-Cordova	WB	242	57	9	0.16	0.17
Valdez-Whittier	EB	No winter service				
Whittier-Valdez	WB	No winter service				
M.V. Tustumena - July 1976						
Kodiak-Homer	EB	709	191	9	0.39	0.42
Homer-Kodiak	WB	775	203	8	0.48	0.51
Seward-Valdez	EB	685	69	5	0.69	0.28
Valdez-Seward	WB	747	71	5	0.75	0.28
Cordova-Valdez	EB	665	61	5	0.67	0.24
Valdez-Cordova	WB	664	71	5	0.66	0.28
Kodiak-Seward	EB	346	107	4	0.43	0.54

Notes: (1) Load Factor = (Monthly Volume)/(Trips/Month)/(Ship Capacity).
M.V. Bartlett capacity = 170 passengers, 38 standard vehicles.
M.V. Tustumena capacity = 200 passengers, 50 standard vehicles

Source: DOTPF, 1976 and 1977.

two months of winter lay-up time in October and November. The village of Ellamar is a flag stop for passengers only. Table 2-14 shows that the load factors for the Valdez-Cordova route are relatively low both during the summer and winter. From late May to mid-September, the M.V. Bartlett provides a day-time round-trip between Whittier and Valdez five times a week. The route is tourist-oriented and offers a view of the Columbia Glacier. The Alaska Railroad offers a" railroad shuttle to move passengers and vehicles between Whittier arid Portage, on the Seward Highway. The route essentially operates at full capacity, as the load factors indicate.

The M.V. Tustumena, which is based in Seward, principally serves the major communities in the western Gulf of Alaska. These include Homer, Seldovia, Port Lions (flag stop), Kodiak, and Seward. During summer weekends, a round-trip from Seward to Valdez and Cordova is scheduled. As the number of July 1976 trips indicates, the Kodiak-Homer route is the most heavily traveled. Interestingly, the load factors for summer trips between Cordova and Valdez are significantly higher for the M.V. Tustumena than for the M.V. Bartlett. Apparently, this occurs because the service occurs during the weekend, offers berths, and provides the only ferry connection westward to Seward and Kodiak. Ferry passenger fares for the system are priced somewhat below air fares for the same city pairs.

Table 2-15

Southwest Ferry System Annual System Usage, 1971-77

Year	Passengers (Thousands)	% Change	Vehicles (Thousands)	% Change
1971	3S		9.5	
1972	38	9%	10.2	7%
1973	42	10%	11.5	13%
1974	45	7%	12.3	?%
1975	46	2%	12.6	2%
1976	43	- 7%	12.1	-4%
1977	38 (1)	-12%	12.2	-1%

Note: (1) Low value is due to a summer strike by ferry employees.

Source: DOTPF, 1978.

The amount of freight hauled on the two Gulf of Alaska ferries is uncertain. Shipments on the Marine Highway System fall under the jurisdiction of the Alaska Transportation Commission, and companies loading trailers must have common carrier operating certifications. Sea-Land, on occasion, takes advantage of the weekly service from Kodiak to Seward, Valdez, and Cordova during summer and fall months if demand does not warrant service by the Aleutian Developer.

No additional ferries are planned to serve existing routes; however, there is some interest in establishing service from Kodiak to Alaska Peninsula and Aleutian villages. Demonstration voyages to Sand Point and King Cove were made from Kodiak in May, September, and October of 1978 and 1979. More regular service to these and similar communities west of Kodiak would require an additional ferry to maintain service t evels on existing routes.

Table 2-15 shows traffic trends for the Southwest Marine Highway System between 1971 and 1977. A steady increase occurred from 1971 to 1975, but traffic-appears to have leveled off despite available capacity on most links. Monthly patronage figures for the system show high peaking characteristics. Approximately 75% of the M.V. Bartlett's traffic *occurred* during the months of June, July, and August in 1976 (DOTPF, 1978). The M.V. Tustumena experiences similar but less pronounced peaking. Approximately 6,000 passengers used the vessel in August 1976 compared to less than 1,000 in October. Table 2-14 gives traffic data for the two vessels on major travel links.

Standard Oil. Standard Oil is a major supplier of petroleum products to communities in Alaska, using Valdez, Nikiski, and Ketchikan as major distribution points. The products come from Washington or from the company's refinery at Nikiski. An oil barge monthly serves a triangular route, first delivering fuel to Ketchikan and Valdez and then going to Nikiski to pick up diesel fuel which it delivers to Valdez and Ketchikan on the return trip. The Alaska Standard, a 73.1 m (240 foot) tanker distributes oil from Nikiski or Valdez weekly.

Foss Alaska (Dillingham Maritime). Foss Alaska serves Southeastern communities as far north as Haines. Although it does not serve any communities at present in the study area, scheduled service to Yukutat would be a logical extension of existing routes. Dillingham Maritime indicates such's move is likely should demand in Yakutat increase (Osborn, 1979).

2.2.2.2 Infrequent and Seasonal Carriers.

This category of carriers includes carriers that operate established "routes on a seasonal basis or according to traffic demands. They provide substantial movements of specialized goods, such as seafood products and construction equipment, as well as general commodities between Seattle and smaller communities.

Northland Services. This company operates tug and barge service between Seattle and the following Alaskan communities: Yakutat, Cordova, Valdez, Kenai, Kodiak, Dillingham, and Dutch Harbor. The services are similar to those previously offered by Northland Marine, except that no service is available in Southeast Alaska. Yakutat is usually the first stop on trips north. Barges then proceed to other ports as demand warrants. During the winter, the company leases two tugs and barges and makes trips along the route approximately every fourth month. During the summer, service is increased to once a month, and twice as much equipment is leased.

Coastal Barge Lines. The company operates two barges a month to Anchorage between mid-March and mid-November. Occasionally, Kenai, Cordova, and Kodiak receive shipments. The service specializes in the handling of breakbulk cargo that can be exposed without suffering damage, including mobile and modular homes, machinery, boats, lumber, and bulk cement. During the peak of pipeline construction activity, sailings occurred every five days.

Pacific Western Lines. Some of its service parallels that of Coastal Barge Lines. Tug and barge service to Anchorage is seasonal and concentrates on shipments that are non-containerizable. Frequency for this service is twice-monthly from Seattle. The company uses 4,536 metric ton (5,000 ton) barges. During the summer, one tug is based in Kodiak, and Kodiak-Seattle service is offered for the movement of seafood products. Intermittent service is also provided to Yakutat, Cordova and Valdez.

2.2.2.3 Contract Carriers.

Contract carriers are used by major shippers, such as timber and oil companies, to move specialized and over-sized cargo throughout Alaska as the need develops. The primary companies serving this market in Alaska are Crowley Maritime and Dillingham Maritime, Ocean Division. Worldwide tug and barge operators, they can draw on equipment to meet the needs of any shipper. In serving major points of entry, contract tug and barge carriers are competitive for major shipments except in two situations as noted by Dillingham Maritime, Ocean Division (Osborn, 1979). Where freight can be accommodated on rail cars and originates inland of the West Coast, through rates make railcar barge the cheapest means of transport. For example, drilling pipe can be delivered to Seward cheaper by rail through Whittier than by contract carriers. Also, commodities that originate overseas and can be accommodated in ships can often be delivered more cheaply because of higher insurance rates for barges operating ocean routes. BP-Alaska, for example, has moved pipe fabricated in Japan by pipeship to Seward rather than by barge. Both Crowley and Dillingham have participated in the movement of goods to Prudhoe Bay.

2.2.3 RATES

Marine shipping rates of scheduled carriers reflect the characteristics of routes between two given communities, the size of demand, and the degree of competition between carriers.

Table 2-16 shows Sea-Land tariffs for a variety of commodities from Seattle to Anchorage and major Eastern and Northern Gulf of Alaska communities. Rates to Anchorage are roughly identical for the three major marine operators--TOTE, Sea-Land, and Hydro-Train. This situation does not reflect the difference in service levels, as Hydro-Train currently offers slower travel times and less frequent sailings. Southbound freight rates to Seattle, designed to increase load factors in that direction, are approximately two-thirds of the northbound rates. From the information in Table 2-16, several general statements can be made. Prices per 100 pounds can be reduced significantly by shipping in large quantities. On the Anchorage-Seattle route, a 36% reduction is possible when shipping refrigerated meat in 13.6 metric ton (30,000 lb.) lots rather than in less-than-truckload (LTL) lots. For cement, on the same route, the reduction is 47% when going from 0.91 metric ton (2,000 lb.) to 40.8 metric ton (90,000 lb.) lots.

A comparison of the rates from Seattle to Anchorage, Seward, and Cordova illustrate the effects of such factors as competition, the level of demand, and the difference between transshipment by marine and highway routes.

Shipments from Seattle to Cordova on Sea-Land travel first to Kodiak on the same ships that carry cargo to Anchorage. Then, they are transferred from these larger ships to a smaller vessel, the Aleutian Developer, for delivery to Cordova. Route logistics and the geographical distance between origin and destination are competing factors that influence tariffs. The importance of the factors differs between categories of goods. On the basis of route mileage and materials handling, one would expect tariffs for Seattle-Cordova to be slightly higher than corresponding tariffs for both Seattle-Anchorage and Seattle-Kodiak routes. Indeed, Seattle-Cordova LTL shipments for four of the six categories listed in Table 2-16 are uniformly 6% higher than Seattle-Kodiak tariffs. for the same period. For groceries, the Seattle-Cordova tariff is lower but by less than 1%. A similar situation exists for truckload (TL) shipments of cement. Lower tariffs for iron/steel products and groceries on the Seattle-Anchorage route compared to the Seattle-Cordova route show the influence of additional route mileage and materials handling for the latter route. Strong competition for these goods by other carriers on the Anchorage route and an economy of scale for the Anchorage market also are contributing factors. For the other four categories, the shorter geographical distance from Seattle to Cordova than to Anchorage outweighs the influence of Sea-Land's route mileages. Cordova-bound LTL shipments of appliances, refrigerated meat, and construction machinery, respectively, are 13%, 5%, and 3%, less than tariffs for similar Anchorage-bound shipments.

LTL tariffs to Seward from Seattle in all cases are higher than those to Anchorage because of the need for transshipment, either by truck to

Table 2-16

Typical Freight Rates from Seattle

Transportation Cost per 100 Pounds in Dollars

Origin-Destination	Appliances Shipment Size	Appliances Tariff Type	Appliances Cost	Cement Shipment Size	Cement Tariff Type	Cement cost	Groceries Shipment Size	Groceries Tariff Type	Groceries cost
Seattle-Anchorage	2,000#(LTL)	CO	18.14	2,000#(LTL)	CO	8.07	LTL	CO	9.60
	12,000#(TL)	CO	9.75	90,000#(TL)	CO	4,27	24,000#(TL)	CO	5.83
Seattle-Kodiak	LTL	CL	14.82	40,000#(TL)	CO	3.37	LTL	CO	13.54
							24,000#(TL)	CO	11.35
Seattle-Cordova	LTL	CL	15.71	40,000#(TL)	CO	3.34	LTL	CO	13.46
							24,000#(TL)	CO	11.30
Seattle-Seward	12,000#(TL)	CO	13.09	LTL	CL	13.98	LTL	CO	11.13
				40,000#(TL)	CO	5.50	24,000#(TL)	CO	6.20
Seattle-Yakutat			19.80			2.50			4.04

Legend: LTL = less-than-truckload lots; TL = truckload lots; CO = commodity tariff; CL = class tariff; # = pounds (pounds can be converted to kilograms using a conversion factor of 0.4536).

Source: Sea-Land Tariff Schedules as of December 1978 except Seattle-Yakutat tariffs from Transportation Inventory Report, Southeastern Alaska Transportation Study, Alaska Department of Transportation and Public Facilties, 1978.

" Table 2-16(Continued)

Transportation Cost per 100 Pounds in Dollars

Origin-Destination	Refrigerated Meat Shipment Size	Refrigerated Meat Tariff Type	Refrigerated Meat Cost	Iron/Steel Products Shipment Size	Iron/Steel Products Tariff Type	Iron/Steel Products Cost	Construction Machinerv Shipment Size	Construction Machinerv Tariff Type	Construction Machinerv Cost
Seattle-Anchorage	LTL	co	15.18	LTL	co	8.07	2,000#(LTL)	co	14.06
	30,000#(TL)	co	9.66	32,000#(TL)	co	4.94	30,000#(TL)	CO	6.20
Seattle-Kodiak	LTL	co	13.54	LTL	CL	12.81	LTL	CL	12.81
	16,000#(TL)	co	11.35	30,000#(TL)	CL	4.16	30,000#(TL)	co	4.51
Seattle-Cordova	LTL	co	14.36	LTL	CL	13.58	LTL	CL	13.58
	24,000#(TL)	co	12.12	30,000#(TL)	co	4.56	30,000#(TL)	CO	4.92
Seattle-Seward	LTL	co	17.12	LTL	CL	18.04	LTL	CL	18.04
				32,000#(TL)	co	4.94	30,000#(TL)	CO	8.68
Seattle-Yakutat			11.17			4.06			19.81

Legend: LTL = less-than-truckload lots; TL = truckoad lots; CO = commodity tariff; CL = class tariff; # = pounds (pounds can be converted to kilograms using a conversion factor of 0.4536).

Source: Sea-Land Tariff Schedules as of December 1978 except Seattle-Yakutat tariffs from Transportation Inventory Report, Southeastern Alaska Transportation Study, Alaska Department of Transportation and Public Facilities, 1978.

Seward from Anchorage or by the Marine Highway System from Kodiak to Seward. Seward is not an intermediate port on scheduled marine services originating in Seattle. For some goods, the increases are modest, being 16% and 13%, respectively, for LTL shipments of groceries and refrigerated meat. On the other hand, the increase for cement is 73% and 124% for iron/steel products. For truck load shipments, increases are smaller, and in fact the same tariff exists for truck load shipments of iron/steel products to both Seward and Anchorage, $4.94 per 45.4 Kg (100 lbs).

2.2.4 REGULATIONS

For marine freight operations, most regulatory functions are handled by Federal agencies. The Corps of Engineers handles the permit process for channel and harbor improvements. The Corps, with the participation of local and State agencies, funds the construction of breakwaters and channel improvements. The U.S. Coast Guard has multiple sea-oriented missions, including the establishment and maintenance of navigational aids, carrying out of search and rescue missions, policing fishing treaties and the 200-mile limit, enforcing water pollution laws, and conducting marine inspections. It operates the Prince William Sound Vessel Traffic System (VTS) and coordinated the development of the volunteer vessel traffic lanes (VVTL) in Kachemak Bay near Homer.

The Jones Act prevents foreign-bu·lt ships from carrying freight or passengers between U.S. ports. In authorizing construction of the Trans-Alaska pipeline, Congress mandated that none of the oil could be exported. This legislat·on affects the size of tankers now serving the Alaska trade. If shipments cou’d be made to Japan, larger foreign-bottom ships could be used.

2.3 Air Mode

The air mode has played an increasing role in the transportation of freight and persons since World War II. The need to ferry aircraft to Russia by way of Alaska and provide defense for Alaska contributed to the development of airports in the Gulf of Alaska area. Cordova and Yakutat owe the existence of excellent. ground facilities to World War II construction. Long distances between Alaska and lower 48 cities and between cities in Alaska, the difficulties and in many cases the lack of intercity land transportation, and the infrequency of marine freight service have made air transportation a necessity to the economic welfare of Alaska and its citizens. For example, freight enplaned in Yakutat by Alaska Airlines during the period July 1, 1976 to June 30, 1977 was 15% of recorded throughput tonnage of dry commodities for 1977.

Anchorage serves as the State's hub for air transportation. Commuter and air taxi operations emanate from airports in the Anchorage area, and major domestic scheduled airlines have non-stop service from Anchorage International Airport to major cities in Alaska as well as Honolulu, the Midwest, the Pacific Northwest, and California. In recent years, the airport has become a major international airport, serving polar routes between the Far East and Europe. Development activities and increased tourism have caused the growth rate of aviation in the State to be higher than that for population. The introduction of more efficient and productive aircraft in coming years and the phased deregulation of the air carrier industry now in progress in most cases will increase the level of service to communities and contribute to the mode's continued growth.

2.3.1 TERMINALS

Terminals serving air traffic in the study area range from basic seaplane bases and unattended gravel runways to the highly developed Anchorage International Airport where, except for construction of a new North-South runway to accommodate traffic during cross-winds, improvements are primarily related to installing state-of-the-art technology. Description of existing facilities will focus on the major facilities and examine four categories of data as follows: (1) ground facilities over which aircraft operate, including runways, taxiways, and aprons for loading and unloading freight and passengers; (2) visual and instrument landing aids; (3) personnel -related activities such as control towers, terminals, fuel and maintenance, and weather reporting; and (4) passenger and freight-handling facilities.

Two measures of capacity exist for airports--the size and type of aircraft that can be accommodated and the numbers of operations (take-offs and landings) that can take place. The first measure relates to ground facilities and the second to all four categories listed above. Once ground facilities are in place, introduction of additional landing aids and services can increase the number of possible operations. For each runway, the governing constraint should be recognized. In some cases, the runway itself will govern and new runways will be required to increase capacity. In other cases, the landing aids and facilities may limit operations. Finally, geographical constraints in the form of obstructions or lack of level land for development can be the ultimate constraint.

The Federal Aviation Administration has established three major categories of airports. International airports provide the interface between combinations of international, interstate, and intrastate service. Trunk airports, which are usually served by jet aircraft, are used for the distribution of goods and passengers to outerlying secondary airports approximately 805 km (500 miles) to 2,414 km (1,500 miles) away. The designation represents the highest use of the airport. Commuter airlines and air taxi operators *co-exist* with jet aircraft at trunk and international airports. Some communities, including Kodiak and Anchorage, have at least two airports, with each emphasizing service to different categories of users.

International and trunk airports as a general rule have a runway length of at least 1,524 m (5,000 feet), which enables them to serve jet aircraft and Lockheed Hercules cargo planes. Actual length of runway needed by planes for landing or taking off depends on several factors, including the aircraft's gross weight, wind speed and direction, temperature, elevation of the runway, and its slope, if any.

The main airports in Cordova, Yakutat, and Anchorage are international-type airports. Each has a runway over 2,134 m (7,000 feet) long. Seward and Valdez do not serve as intermediate points on intrastate routes or as distribution points and have service levels of GA (General Aviation) and CS (Commuter Service), respectively. During the pipeline boom Alaska Airlines' 727 jets provided service to Valdez, but the combination of adverse weather and the lack of an instrument landing system produced a high rate of cancelled flights.

For each airport, minimum visibility and ceiling guidelines are established for different types of aircraft based on available landing aids and nearby obstructions. These guidelines and local prevailing weather conditions affect the reliability of opeations which in turn affect the capacity. Table 2-17 gives the percentages of scheduled departures completed at Anchorage and Gulf of Alaska airports serving carriers certificated by the Civil Aeronautics Board. Of these airports, Valdez had the lowest percentage. For the remaining three airports, certificated carriers completed over 90% of their scheduled departures. This situation results from high minimum ceiling and visibility guidelines necessitated by nearby mountains.

Each of the area's facilities will be examined from the point of both facilities and traffic. Tables 2-18 and 2-19 list principal runway and navigation facilities.

2.3.1.1 Anchorage International Airport.

This facility handled 236,000 operations (landings and take-offs) in 1976 which is 77% of the capacity estimated in the 1971 Master Plan (Quinton-

Table 2-17

Traffic Data for Certificated Carriers - July 1, 1976 to June 30, 1977

Airport	Enplaned Passengers (1)	Freight (Revenue Tons)	Mail (Revenue Tons)	Departures Scheduled	Scheduled Departures Completed	Domestic Carriers Included
Anchorage[2]	888,004	34,639	11,309	15,460	93.20%	Alaska, Northwest, Reeve Aleutian, Western, Wien
Cordova	11,453	253	71	709	98.02%	Alaska
Valdez [3]	5,286	25	8	145	79.31%	Alaska
Yakutat	9,149	208	24	744	97.31%	Alaska

Notes: (1) Enplaned passengers are defined as boarding or departing passengers.
(2) Includes domestic and international traffic.
(3) Alaska Airlines operated into Valdez only during peak construction activities related to the trans-Alaska pipeline and oil terminal.

Source: Federal Aviation Administration and Civil Aeronautics Board, 1977,

Table 2-18

Gulf of Alaska Principal Airports - Runways and Ground Facilities

Community	Location	Owner	Runway Heading	Length Metere (ft)	Width Meters (ft)	Surface Type	Heliport	Terminal Building	Hangars	Fuel	Main-tenance
Yakutat	4.8 km (3 mi) E of town	State of Alaska	11-29 2-20	2,361 (7,747) 2,381 (7,813)	46 (150) 46 (150)	Concrete Concrete	Yes	Yee	Yes	Yes	Yes
Cordova	17.7 km (11 mi) ESE of town	State of Alaska	9-27	2,2136 (7,499)	46 (150)	Asphalt	No	Yes	Yes	Yes	Yes
Cordova (Municipal)	1.4 km (0.9 mi) E of town	State of Alaska	16-34	579 (1,900)	9 (30)	Gravel	Yes	Yes	Yes	Yes	Yes
Valdez	6.4 km (4 mi) E of new townsite	State of Alaska	6-24	1,524 (5,000)	30 (loo)	Asphalt-treated	No	Yes	Yes	Yes	Yes
Seward	2.7 km (1.7 mi) NE of town	State of Alaska	12-30	1,390 (4,560)	30 (loo)	Asphalt-treated	No	No	Yes	Yes	Yes
			15-33	701 (2.300)	23 (75)	Asphalt-treated	No	No	Yes	Yes	No

Sources: FAA, 1977; DOTPF, 1978.

Table 2-19

Gulf of Alaska Principal Airports - Operations and Aids

Community	Service Level (1)	Design Type (2)	Total 1976 Operations	Based Aircraft (1976)	Scheduled Airlines	Based Air Taxis (3)	Control Tower	Taxiways	Runway Heading	Navig./Landing Aids (?) Lighting	Radio	Other
Yakutat	AC	AC	1',000	18	1	1 FW	No	Yes	11 29	MALSR VASI	DF, VORTAC, NDB LOC, GS	FSS, RCAG ON, MM
Cordova	AC	AC	7,000	15	1	o	No	No	9 27 9-27	REIL MALSR VASI RVR	lot, DME DF, NDB	FSS
Cordova (Municipal)	GA	SP GU	3,000 (1974)(5) 6,500 (1974)(5)	10	1	2 FW	No	No		Runway Lights		
Valdez	CS	BT	21,000	6	3	2 FW, 1 RW	Yes	Yes	6	REIL, VASI	NOR, SFO	
Seward	GA	GU	5,000	21	1	1 FW	No	Yes		Runway Lights, Rotating Beacon	SFO	

Notes: See following page.

Table 2-19 (cent'd)

Notes: (1) Service Level

AC = Air Carrier (Certificated Service)
AL = Air Carrier (Intrastate Qualifications)
CS = Commuter Service
GA = General Aviation

(2) Design Type

AC = Air Carrier (Certificated Service)
AL = Air Carrier (Intrastate Qualifications)
GU = General Utility
BT = Basic Transport
SP = Seaplane Base

(3) FW = Fixed Wing; RW = Rotary Wing.

(4) Lighting: MALSR = Medium intensity approach lights with RAIL; REIL = Runway end identification lights; RVR = Runway visual range; VASI = Visual approach slope indicator.

Radio: ASR = Airport surveillance radar; DF = Direction finder; DME = Distance measuring equipment; GS = Glide slope; LOC = Localizer; NDB = Non-directional radio beacon; PAR = Precision approach radar; SFO = Single frequency outlet; VORTAC = Combined VOR and TACAN (TACR).

Other: ATCT = Air traffic controltower; FSS = Flight service station; MM = Middle marker; 064 = Outer marker; RCAG = Remote control air ground facility; RCO = Remote communications outlet (FSS).

(5) Estimates for 1976 were unavailable. Estimates from the 1975 FAA Ten-Year Plan are provided.

Source: FAA, 1977 and 1975. DOTPF, 1978.

Budlong, 1971). The new North-South runway under construction will add only an additional 10% capacity to the airport. Its primary purpose is to alleviate operational problems caused by occasional strong cross-winds. The three existing asphalt runways include two that are greater than 3,048m (10,000 feet) in length.

During 1976, enplaned (boarding) passengers totaled 944,467. Certificated air carriers accounted for 86.4%, commuter services for 10.2%, and international carriers for the remaining 3.4% (Moore, 1978 . The number of enplaning passengers doubled between 1972 and 1976, and in recent years the growth rate has consistently exceeded that of the population of the Municipality of Anchorage.

The facility serves an important role in freight transportation to and within Alaska as well as in passenger movements. In 1976, throughput tonnage of the airport amounted to 107.8 thousand metric tons (118.8 tons), which was 11.1% of the Port of Anchorage's throughput for general cargo in that year. Transshipment by Mien and to a lesser extent by Northern Air Cargo, Alaska International Air, and Great Northern of goods arriving in Anchorage by the water mode to remote Alaskan communities accounts for outbound tonnage being 50% greater than inbound tonnage at the airport (Moore, 1978).

2.3.1.2 Seward

Seward is not as dependent upon air service as other communities because of adequate road access to Anchorage, which is 204 km (127 miles) away. Seward currently is served by a single carrier, AAI. The level of service and estimated traffic is shown on Tables 2-20 and 2-21. Incremental improvements in lighting and approach aids have been programmed, but the current level of usage does not make such improvements critical at this time.

2.3.1.3 Yakutat

The airport offers excellent facilities for the size of the community. The runway was constructed in World War II and remains in good shape, although an asphalt overlay is needed. Facility characteristics are shown in Tables 2-18 and 2-19. Without any road access and receiving marine freight service on an infrequent basis, the community depends on the daily jet service provided by Alaska Airlines. In August 1977, the community received 38.8 metric tons (42.8 tons) of freight on northbound flights and an additional 12.9 metric tons (14.2 tons) on southbound flights (Table 2-22). Juneau, which is the closest large city, was the origin for 21.3 metric tons (23.5 tons), which suggests transshipment of goods received by tug and barge from Seattle.

August 1977 passenger figures (Figure 2-8) show that on the average 22.8 passengers traveled daily to Yakutat from the south and 15.4 from the north. Anchorage and Seattle are the two largest single origins for Yakutat-bound passengers and are of the same magnitude, 14.3 and 13.3 passengers per day, respectively. These data show that service to Yaku-

Table 2-20
Operating Statistics of Intrastate Scheduled Carriers

Route [1]	Carrier	Month, Year	Actual Flights	Seats per Flight [2]	Total Seats	Passengers	Load Factor
Anchorage-Seward	AAI	January, 1978	31 [3]	19	589	353 [4]	0.60 [5]
		July, 1978	88 [3]	19	1,672	1,003 [4]	0.60 [5]
Anchorage-Cordova	AAI	January, 1976	31 [3]	19	589	353 [4]	0.60 [5]
		July, 1978	62 [3]	19	1,178	707 [4]	0.60 [5]
Anchorage-Valdez	Kennedy (now Valdez Airlines)	January, 1977 [6]	63	5	315	202	0.64
		July, 1977 [6]	131	5	655	355	0.54
	Polar	January, 1978	119	9	1,071	636	0.59
		July, 1978	158	9	1,422	875	0.62
	AAI [7]	January, 1978	31 [3]	19	589	353 [4]	0.60 [5]
		July, 1978	62 [3]	19	1,178	707 [4]	0.60 [5]
	Totals	January, 1978	213		1,975	1,191	0.60
		July, 1978	351		3,255	1,937	0.60
Valdez-Cordova	AAI	January, 1978	31 [3]	19	589	353 [4]	0.60 [5]
		July, 1978	62 [3]	19	1,178	707 [4]	0.60 [5]

Notes: See following page.

Table 2-20 (cent'd)

Notes: (1) Only one **direction of routes have been included. Statistics in the other direction are comparable.**

(2) Seats per flight based on predominant aircraft used by companies:

DHC-6 = 19 passengers (AAI).
Piper Navajo Chieftain = 9 passengers (Polar).
Piper Aztec 31 = 5 passengers (Kennedy, 1977).

(3) For AAI, scheduled flights were used since actual was unavailable.

(4) An assumed load factor of 0.60, comparable to that of other carriers, was used in the absence of actual data for AAI.

(5) AAI **is required to stop first at** Cordova **on flights having** Valdez **as a destination.**

(6) A change in management of Kennedy in the summer of 1978 produced misleading data for several month. Data from 1977 was thought to be more representative.

(7) Passenger volumes for AAI computed using assumed load factor of 0.60.

Source: Airline Schedules and Operational Data; Peter Eakland and Associates.

Table 2-21

Passenger Service Provided by Scheduled Carriers

Scheduled Carrier	Route	Minimum Required Service (1)	Summer 1978 Service	Winter 1978-79 Service
AAI	Anchorage-Cordova	6 fits./week	2 fits./day	1 flt./day
	Cordova-Valdez	1 flt./week	2 fits./day	1 flt./day
	Anchorage-Seward	3 fits./week	3 fits./day (exe. Sunday)	1 flt./day
Polar	Anchorage-Valdez	1 flt./week	6 fits.\day min. (exe. Sunday)	5 fits./day (exe. Sunday)
Kennedy	Valdez-Anchorage	(Unspecified)	3 fits./day	3 fits./day
Western	Anchorage-Seattle	--	9 fits./day	5 fits./day
	Anchorage-Portland	--		1 flt./day
Northwest	Anchorage-Minn./St. Paul	--		1 flt./day
	Anchorage-Chicago	--	1 flt./day	2 fits./week (none after Dec. 14)
	Anchorage-Seattle	--	3 fits./day	2 fits./day
Alaska	Anchorage-Seattle	--	6 fits./day (exe. Sunday)	5 fits./day (exe. Sunday)
	Anchorage-Cordova-Yakutat	--	1 flt./day	1 flt./day

Note: (1) As listed in the Alaska Transportation Commission's Scope of Operating Rights.

Source: Alaska Transportation Commission, 1978; Carriers' Schedules.

Table 2-22

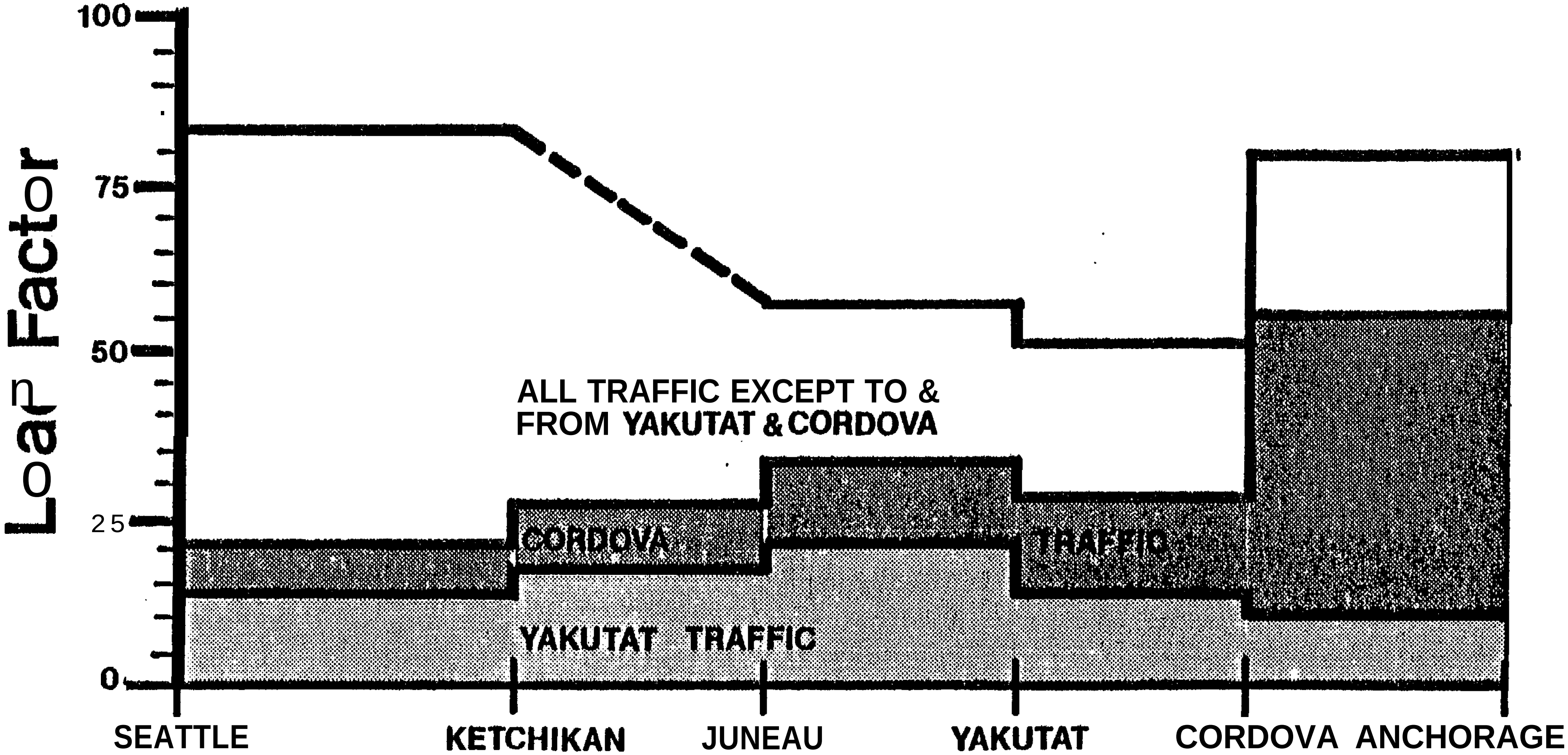
Alaska Airlines Traffic to and from Yakutat

Trip Link	Total Yakutat Passengers	Average Pass./Day (1)	Yakutat Load Factor (2)	Overall Load Factor (3)	Total Yakutat Freight (Pounds)	Average Frt./Day (4) (Pounds)	Total Mail (Pounds)	Average Mail/Day (5) (Pounds)
Northbound - August 1977								
SEA-KTN	427	13.8	13.3	82.1	37,638	1,214	2,669	86
KTN-SIT	460	14.8	14.2	N/A	37,638	1,214	2,720	88
SIT-JNU	507	16.4	15.8	N/A	38,601	1,245	2,949	95
JNU-YAK	706	22.8	21.9	53.2	85,631	2,762	5,693	184
YAK-CDV	476	15.4	14.8	52.6	55,652	1,795	5,167	167
CDV-ANC	467	15.1	14.5	80.2	55,652	1,795	905	29
Southbound - August 1977								
ANC-CDV	461	14.9	14.3	59.3	27,055	873	13,444	434
CDV-YAK	478	15.4	14.8	52.0	28,455	918	13,527	436
YAK-JNU	753	24.3	23.4	60.6	48,850	1,576	3,131	101
JNU-SEA	475	15.3	14.7	69.7	45,399	1,464	606	20

Notes: (1) Average Pass./Day = Total Passengers/31.
(2) Yakutat Load Factor = Average Pass./Day/104, where 104 is seating capacity of B-727-100.
(3) Overall Load Factor = Load factor for all traffic on flights scheduled to stop at Yakutat.
(4) Average Frt./Day = Total Freight/31.
(5) Average Mail/Day = Total Mail/31.

Source: Exhibits BOR-IR-1 and BOR-IR-2, Southeast Alaska Service Investigation, Docket 31570 before the Civil Aeronautics Board.

Figure 2-8 "August 1977 Traffic Mix Northbound Flight 65



(NOTE : INTERCITY DISTANCES NOT TO SCALE)

Source: Alaska Airlines, 1978(raw data); Peter Eakland and Associates.

Table 2-23

Annual Origin and Destination Data - Yakutat, 1977

Link	Direction	Flights Operated	Revenue Cargo Metric Tons (Tons)	Pet. of Total	Revenue Passengers	Pet. of Total
		TO YAKUTAT				
JNU-YAK	NB	320	147.7 (162.8)	24%	1,901	19%
KTN-YAK	NB	205	0.5 (0.5)	0%	111	1%
SEA-YAK	NB	364	210.9 (232.5)	34%	3,863	39%
SIT-YAK	NB	40	5.5 (6.1)	1%	205	2%
ANC-YAK	SB	328	239.9 (264.5)	39%	3,706	38%
CDV-YAK	SB	318	7.2 (7.9)	1%	122	1%
			611'.7 (674.3)		9,908	1 00%
		FROM YAKUTAT				
YAK-JNU	SB	321	23.9 (26.4)	9%	2,087	21%
YAK-KTN	SB		No Scheduled Service			
YAK-SEA	SB	308	128.2 (141.3)	46%	3,869	39%
YAK-SIT	SB		No Scheduled Service			
YAK-ANC	NB	364	121.2 (133.6)	43%	3,876	39%
YAK-CDV	NB	288	8.2 (9.0)	3%	125	1%
			281.5 (310.4)		9,957	1 00%

Source: Civil Aeronautics Board, 1978,

tat solely from either the north or the south would not meet the community's needs.

Table 2-24 shows annual cargo and passenger data for the year 1977. The August, 1977 inbound passengers to Yakutat represented 12% of the annual total of 9,908. Yakutat imports more than twice as much air cargo as it exports on an annual basis. Seattle and Anchorage receive from and send to Yakutat approximately the same amount of freight. For inbound freight, Anchorage has a slight edge and for outbound freight a slight edge exists for Seattle. Juneau, on the other hand, sends approximately six times as much freight to Yakutat as it receives.

Alaska Airlines constructed a new airlines terminal in 1976 at a cost of $440,000.

2.3.1.4 Cordova

The Cordova area is served by two airport facilities, one near town which is a combined seaplane and general utility airport and a more distant facility that serves Alaska" Airlines' northbound and southbound jet flights on a daily basis. The carrier constructed a new terminal in 1976 at a cost of $323,000. The facility was originally constructed in World War II and its asphalt surface has been kept in good condition. The current number of operations at this facility is relatively low because the other scheduled carrier, Alaska Aeronautical Industries (AAI), and the two air taxi operators based in the community use Cordova Municipal Airport. The total operations at Cordova Municipal and the adjacent seaplane base together probably have a larger number of annual operations than the out-of-town facility.

Available data suggests that Alaska Airlines has approximately 60% of the Anchorage-Cordova market and AAI the rest. In August 1977 Alaska Airlines carried 1,024 passengers on this route compared to an estimate of 707 for AAI (Tables 2-18 and 2-24).

Unlike Yakutat, traffic data shows a dominance of Anchorage over souther- 9
ly cities as an origin for Cordova trips. An average of 33.0 persons came from Anchorage to Cordova in August 1977, and only 12.7 from points to the south. Of the 12,080 total passengers traveling to Cordova by Alaska Airlines in 1977, 73% came from Anchorage. Air freight is important to the community. In 1977, 1,054 metric tons (1,161 tons) arrived in Cordova via Alaska Airlines (Table 2-24) which was 14% of the inbound containerizable marine freight received. Like Yakutat, Cordova, too, does not have land access to other parts of Alaska but does have better marine freight connections. Almost 56.2 metric tons (62 tons) were received in August 1977. Outbound freight on Alaska Airlines was even greater during this month and almost certainly consisted of seafood products.

Except for construction of taxiways and an expanded apron, no major improvements are being considered for the major airport.

Table 2-24

Alaska Airlines Traffic to and From Cordova

Trip Link	Total Cordova Passengers	Average Pass./Day (1)	Cordova Load Factor (2)	Overall Load Factor (3)	Total Cordova Freight (Pounds)	Average Frt./Day (4) (Pounds)	Total Mail (Pounds)	Average Mail/Day (5) (Pounds)
Northbound - August 1977								
SEA-KTN	174	5.6	5.4	82.1	3,285	106	7,225	233
KTN-JNU	215	6.9	6.6	N/A	3,385	109	7,272	235
JUN-YAK	384	12.4	11.9	53.2	51,352	1,657	8,060	260
YAK-CDV	393	12.7	12.2	52.6	51,352	1,657	12,322	397
CDV-ANC	1,284	41.4	39.8	80.2	141,420	4,562	16,896	545
Southbound - August 1977								
ANC-CDV	1,024	33.0	31.7	59.3	72,609	2,342	41,577	1,341
CDV-YAK	758	24.4	23.5	52.0	46,124	1,488	1,677	54
YAK-JNU	741	23.9	23.0	60,6	44,724	1,443	1,594	51
JNU-SEA	515	16.6	16.0	69.7	44,198	1,426	878	28

Notes: (1) Average Pass./Day = Total Passengers/31.
(2) Cordova Load Factor = Average Pass./Day/104, where 104 is seating capacity of B-727-100.
(3) Overall Load Factor = Load factor for all traffic on flights scheduled to stop at Cordova.
(4) Average Frt./Day = Total Freight/31.
(5) Average Mail/Day = Total Mail/31.

Source: Exhibits BOR-IR-1 and BOR-IR-2, Southeast Alaska Service Investigation, Docket 31570 before the Civil Aeronautics Board.

Table 2-25

Annual Origin and Destination Data - Cordova, 1977

Link	Direction	Flights Operated	Revenue Cargo Metric Tons (Tons)	Pet. of Total	Revenue Passengers	Pet. of Total
		TO CORDOVA				
SEA-CDV	NB	329	169.3 (186.6)	16%	1,795	15%
KTN-CDV	NB	240	1.2 (1.2)	0%	133	1%
SIT-CDV	NB		No Scheduled Service			
JNU-CDV	NB	320	98.5 (108.6)	9%	1,165	1 0%
YAK-CDV	NB	288	8.2 (9.0)	1%	125	1%
ANC-CDV	SB	365	776.5 (856.0)	74%	8,862	73%
			1,053.7 (1,161.4)	1 00%	12,080	1 00%
		FROM CORDOVA				
CDV-SEA	SB	306	115.3 (127.1)	26%	2,193	18%
CDV-KTN	SB		No Scheduled Service			
CDV-SIT	SB		No Scheduled Service			
CDV-JNU	SB	341	6.8 (7.5)	2%	1,219	10%
CDV-YAK	SB	318	7.2 (7.9)	2%	122	1%
CDV-ANC	NB	340	310.4 (342.2)	70%	8,714	71%
			439.7 (484.7)	1 00%	12,248	1 00%

Source: Civil Aeronautics Board, 1978,

The Coast Guard began construction in 1978 of Phase I of an Air Station at the major Cordova airport. It will be unmanned initially, but the agency hopes to eventually have two helicopters and support personnel stationed there.

2.3.1.5 Valdez

The Valdez airport has experienced a rapid growth in operations because of pipeline-related construction activities and the growing population of Valdez. During the height of construction, Valdez had as many as 15 flights a day by four carriers. Alaska Airlines subsequently ceased operations into the community. Total operations were 21,000 in 1976 and increased to 28,000 the following year. The local government has constructed a terminal and leases space to carriers.

Surrounding terrain has hindered the deve" opment of instrument approach procedures. Except for minor paving and nstallation of some visual landing aids, no improvements are anticipated at the airport. The asphalt-treated runway has performed well and no upgrading appears to be necessary. A master plan for the airport was begun in 1979.

Three commuter airlines serve Valdez at the present time--Polar, Kennedy, and Alaska Aeronautical Industries (AAI). AAI must travel to Valdez by way of Cordova. Kennedy is principally an air taxi operator, and Anchorage-Valdez is its only route. Polar operates additional routes as far north as Fairbanks. Tables 2-20 and 2-21 show the levels of service to

Valdez for the three operators and traffic levels.

e

2.3.2 CARRIERS

The Alaska Transportation Commission (ATC) regulates all common air carriers operating wholly within the Stateof Alaska and with the Civil Aeronautics Board (CAB) jointly regulates those carriers that operate intrastate routes. The ATC issues permits in three categories--air taxi operators, scheduled carriers, and contract carriers. Scheduled carriers currently operate only fixed-wing aircraft, while both rotary and fixed-wing aircraft are available from contract and air taxi operators.

2.3.2.1 Air Taxi Operators

Air taxi carriers operate from fixed bases of operation specified in their operating rights. Although most operate aircraft with certified gross take-off weights less than 5,670 kg (12,500 lbs.), the ATC has authority to grant air taxi certificates to operators having larger aircraft. The only carriers with such authority within the study area have Anchorage bases. The other major division is between fixed-wing and rotary-wing (helicopter) operations. Table 2-26 shows the breakdown of air taxi operators by community within the study area. Names of carriers have been provided for all communities except Anchorage. In some cases, the same operator has rights in an area for both fixed-wing and rotary-wing operations. Operators must provide "safe, adequate, efficient, and continuous service from and maintain bases of operation at listed locations (in their

Table 2-26

Study Area Air Taxi Operators

Number of Operations

Base of Operations	Fixed Wing: Less than 5,670 kg (12,500 lbs)	Fixed Wing: Greater than 5,670 kg (12,500 lbs)	Rotary Wing: Less than 5,670 kg (12,500 lbs)	Rotary Wing: Greater than 5,670 kg (12,500 lbs)	Selected List of Operators
Anchorage	40	4	1	6	
Yakutat	1	0	0	0	Gulf Air
Cordova	2	0	0	0	Kennedy Air Service, Chitina Air Service
Seward	1	0	0	0	Harbor Air Service
Valdez	2	0	1	0	Kennedy Air Service, Sportsman's Flying Service

Source: Alaska Transportation Commission, 1978, operating rights)" (Alaska Transportation Commission).

Aircraft approaching a weight of 5,670 kg (12,500 lbs.) are the Twin Otter, Trislander, and the Lear Jet, which have seating capacities as high as 17 persons.

Air taxi operators specialize in serving remote locations inaccessible by highway. Many operators are subcontractors to larger carriers for mail routes. Passenger flights serve established villages, canneries, and logging camps as well as recreation and mineral exploration sites.

2.3.2.2 Contract Carriers

Contract carriers generally are not restricted by location in their operating authorities. Principal contract carriers within the State of Alaska include Cocal Aviation, Inc., Northern Air Cargo, Inc., Munz Northern Airlines, Inc., and Alaska International Air, Inc. All are currently involved in service to Western and Interior Alaska. Scheduled carriers have the right to engage in contract operations where the origin is on a scheduled route.

Alaska International Air (AIA) has a fleet of five Hercules cargo planes, each with a maximum capacity of 22,680 kg (50,000 lbs.). AIA operates worldwide, but generally maintains four craft in Alaska. Distinctive summer and winter freight markets have developed. Historically, in the winter, AIA has supported oil exploration and development activities, partitularly moving oil rigs from one location to another, but this work is declining. Summer operations involve the movement of dry cargo to Interior Alaskan communities from Anchorage and of fish to processing plants. In 1976, AIA carried 9.7%, 6,285 metric tons (6,928 tons), of the air cargo outbound from Anchorage International Airport (Moore, 1978).

During the summer of 1978, a severe imbalance occurred between the location of salmon catches and processing facilities, and AIA provided extensive fishlifts for 12 fish companies. Fish caught in Western Alaska and small communities in other parts of the state were delivered to Anchorage, Kodiak, Homer, Cordova, Petersburg, Ketchikan, Seattle, and Bellingham for processing (Anchorage Times, 1978).

The company's maintenance facilities are in Fairbanks but two mechanics are based in Anchorage to perform routine servicing.

2.3.2.3 Scheduled Carriers

The Alaska Transportation Commission has only one category of scheduled carriers, but the CAB makes a distinction between major trunk airlines and commuter services. Commuter services are considered to fly aircraft with gross weights less than 5,670 kg (12,500 lbs.), and trunk airlines are those that offer flights greater than 500 miles, usually with jet service. Figure 2-9 shows routes for carriers that operate jet and prop service.

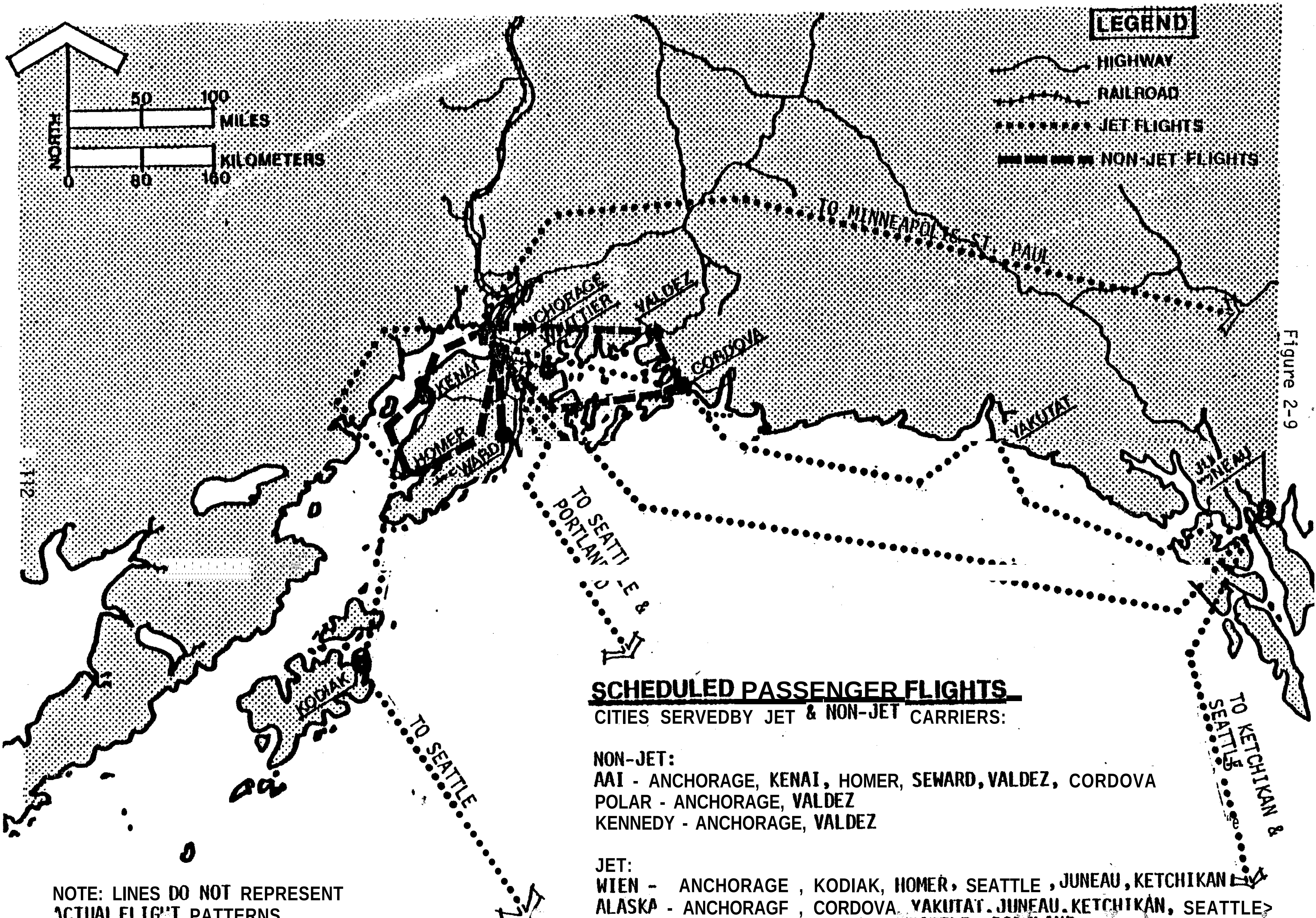


Figure 2-9

SCHEDULED PASSENGER FLIGHTS

CITIES SERVED BY JET & NON-JET CARRIERS:

NON-JET:
AAI - ANCHORAGE, KENAI, HOMER, SEWARD, VALDEZ, CORDOVA
POLAR - ANCHORAGE, VALDEZ
KENNEDY - ANCHORAGE, VALDEZ

JET:
WIEN - ANCHORAGE, KODIAK, HOMER, SEATTLE, JUNEAU, KETCHIKAN
ALASKA - ANCHORAGE, CORDOVA, YAKUTAT, JUNEAU, KETCHIKAN, SEATTLE
WESTERN - ANCHORAGE, KODIAK, SEATTLE, PORTLAND

NOTE: LINES DO NOT REPRESENT ACTUAL FLIGHT PATTERNS

2.3.2 .3.1 Trunk Airlines. Federal deregulation of interstate passenger operations, which will be phased in over the next five years, has already had impacts in Alaska and more are expected within the next yea r. Wien in 1979 initiated service to Seattle from Anchorage via Juneau and Ketchikan. Previously, freight service was deregulated completely. As a result, Wien began Anchorage-Seattle service and Flying Tiger greatly expanded its operations in Anchorage. One expected result of deregulation is that Alaska travelers will be offered direct and non-stop flights to a greater variety of lower 48 cities and that connections to other major U. S. cities will be improved.

In addition to deregulation, decisions on several service investigations that were in progress before deregulation have been issued by the CAB. They include Southeastern,West Coast, and Denver service. It is unlikely that all carriers granted new authorities in these market areas will choose to operate.

- Alaska Airlines. Alaska Airlines concentrates on routes linking Anchorage and Seattle but also serves Fairbanks nonstop from Seattle and Anchorage and Portland from Seattle. Current nonstop frequency between Seattle and Anchorage in the winter is five flights per day except Sunday and six flights during the summer. During the winter, three round-trips per day serve Southeastern Alaska's major communities and four during the summer. One of these flights in each direction stops at Yakutat and Cordova. The carrier is able to offer daily jet service to these communities because of traffic carried that is unrelated to the two communities. Alaska Airlines in its 1978 presentation to the CAB regarding the Southeast Alaska Service Investigation states its position as follows:

> Not only do the Juneau-Anchorage traffic volumes support the service to Yakutat and Cordova but the combined traffic including volumes generated by the smaller cities in fact provide travelers from Juneau to Anchorage with a broader pattern of scheduled service than they would otherwise receive. . . Clearly, consolidation of traffic between the smaller and larger cities along with integration of schedules produces a superior level of service for all cities in Southeast Alaska. This traffic consolidation is of even greater importance during the winter months to maintain essential levels of service (Alaska Airlines, 1978).

Figure 2-10 shows that the monthly fluctuation of revenue is greater for Alaska's Southeast service than for the nationwide average for trunk carriers.

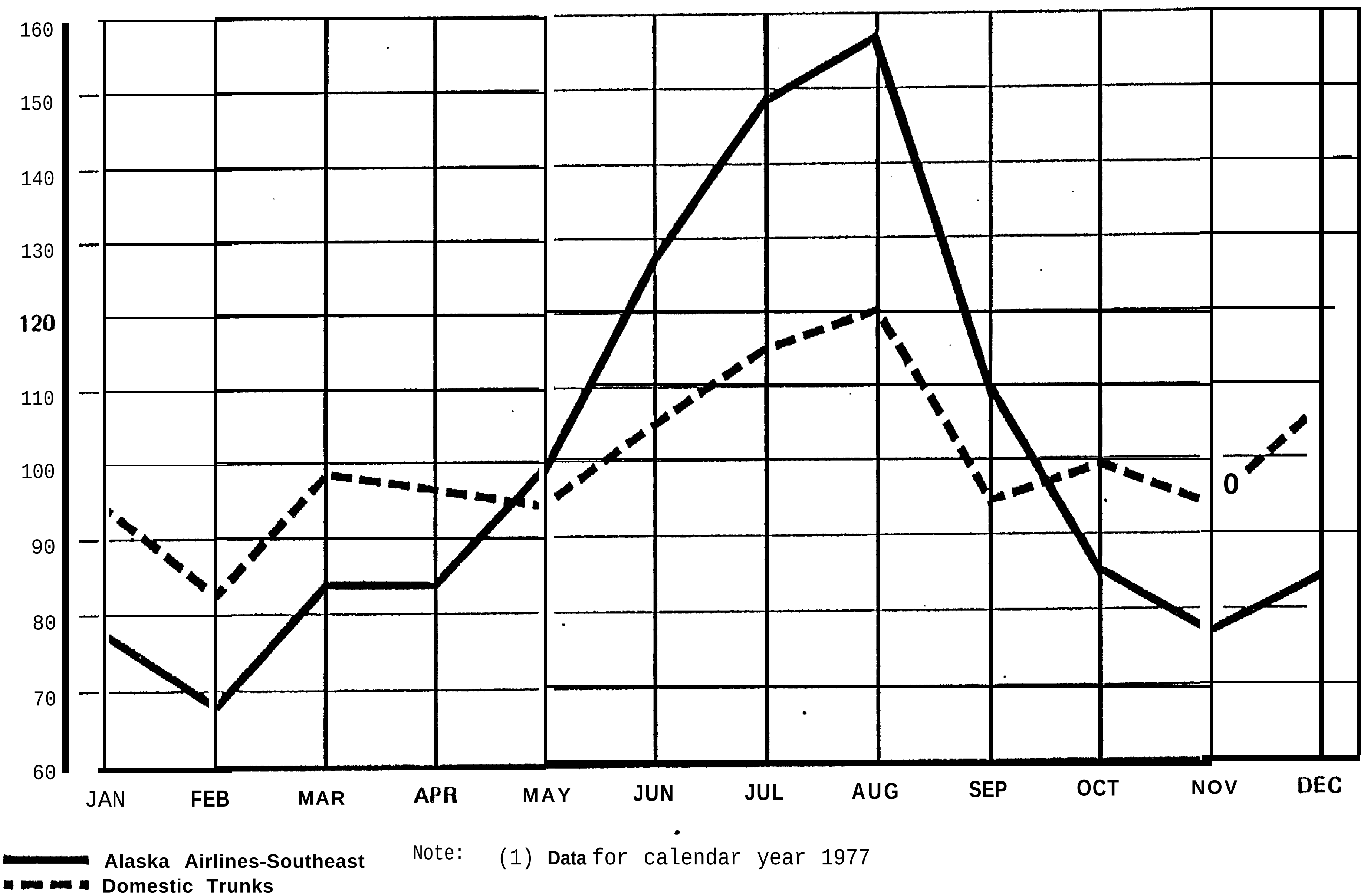
Alaska became an all-jet airline in 1976 and has a fleet of 727-100 and 727-200 aircraft. It currently has two 727-200 planes, each with a seating capacity of 136, and has plans to purchase at least one more.

The carrier initiated service to Portland and San Francisco in 1979. It also received authority to operate to Denver and Minneapolis-St. Paul via Montana cities.

- Wien Alaska. Wien until 1979 offered service only within Alaska, with the exception of service to Whitehorse in the Canadian Yukon Territory. Wien received authority to provide

Figure 2 - 10

INDEX OF MONTHLY REVENUE PASSENGER MILES (1)



Note: (1) Data for calendar year 1977

Source: E R-586 Service Segment; C. A.B. Air Carrier Traffic Statistics service from Anchorage to Seattle directly as a result of the CAB's West Coast Service Investigation and via Juneau and Ketchikan as part of the Southeast Service Investigation. It initiated these routes as well as service to Seattle from Kenai and Kodiak. The CAB also granted it permission to operate from Anchorage to Chicago, but by the end of 1979, it had not decided if it would exercise this authority. The carrier operates 737 jet aircraft in both all-passenger and mixed passenger-cargo modes depending upon traffic demand.

- Northwest Orient Airlines. Service levels to Anchorage by Northwest Orient Airlines are shown on Table 2-21. It does not offer as many flights between Anchorage and Seattle as either Western or Alaska Airlines but flies DC-10 aircraft, which have a capacity of 270 passengers, or approximately twice that of a 727-200. The company recently changed its Midwest service from Anchorage to serve Minneapolis-St. Paul rather than Chicago in order to provide better connections to other parts of its system. The airline received authority to provide nonstop flights between Anchorage and San Francisco in April, 1979, as part of the CAB's West Coast Service Investigation award.

The company plays a significant role in air freight movements to Anchorage with its triangular freight-only service between Seattle, Anchorage, and Tokyo using a 747 freighter. The route is operated only in a counter-clockwise direction. In effect, Anchorage has been added as an intermediate stop on the eastbound leg of Seattle-Tokyo service. The Anchorage stop permits a higher load factor on the eastbound leg. Frequency is at least weekly and if traffic permits twice weekly. In calendar year 1976, Northwest Orient's freight operations delivered 43,000 metric tons (47,408 tons) to Anchorage International Airport, which was 44.6% of the year's total (Moore, 1978). Its outbound percentage was only 2.4%.

- Western Airlines. Western Airlines in 1978 offered flights from Seattle to Anchorage year-round and to Kodiak on a seasonal basis. Decisions in the West Coast and Southeast Service Investigations now permit Western to operate direct flights to San Francisco and operate into Juneau and Ketchikan on flights between Anchorage and Seattle. The CAB had suspended its Southeast authority in 1971.

On its service to Anchorage from Portland and Seattle, the carrier uses a mixture of aircraft. During the summer, when nine daily round trips are made, six are made with 727's, two with DC-10'S, and one with a 707 in a mixed cargo-passenger configuration having 79 seats.

On its Kodiak-Seattle route, which it operates from April to October three or four times a week, Western uses a 727 jet. Tourist traffic and travel related to the fishing industry provide high load factors for the flight. On its service to Anchorage from Portland and Seattle, the carrier uses a mixture of aircraft. During the summer, when nine daily round trips are made, six are made with 727's, two with DC-10'S, and one with a 707 in a mixed cargo-passenger configuration having 79 seats.

Western trails only Northwest Orient in the movement of air freight to Anchorage International Airport, handling 26.9% of the tonnage in 1976.

2.3.2.3.2 Commuter Airlines. Three commuter airlines link Anchorage with communities in Pr· nce William Sound and on the Kenai Peninsula. The communities within the primary study area that are served--Seward, Valdez, and Cordova--are a" 1 within 241 km (150 miles) of Anchorage and are reached with a maximum of one intermediate stop. Only one of these communities, Cordova, is currently served by a trunk carrier, and that service never exceeds one per day in each direction. Commuter carriers operating aircraft with 5-19 passenger seats to these communities can offer greater frequency than trunk carriers at comparable rates for a given demand. Only through the use of commuter carriers are persons able to make a round-trip to or from Anchorage and the communities listed above on the same day. Service characteristics for commuter airlines are listed on Tables 2-20 and 2-21.

- Alaska Aeronautical Industries (AAI). Alaska Aeronautical Industries offers two routes within the study area using DHC-6 (Twin

Otter) aircraft. All routes begin at Anchorage. One goes directly to Seward, and the other goes to Cordova and Valdez. Only to Seward does it operate without competition. It must compete with Alaska Airlines on its Cordova service, and with Kennedy and Polar on its Valdez service. All service between Anchorage and Valdez is required to make an intermediate stop at Cordova. The company concentrates its equipment on service to Kenai Peninsula communities of Kenai, Soldotna, and Homer.

- Polar Airlines. The Anchorage-Valdez route is the only one that Polar Airlines offers completely within the study area, but the carrier provides additional service to the north from both communities. From Anchorage, it serves Tok via Palmer and Gulkana, and from Valdez it serves Fairbanks via Gulkana and Big Delta. Table 20 indicates that this carrier has the largest share of the Anchorage-Valdez market. It operates nine-passenger Piper Navajo Chieftains on its routes.

  Polar in the past year has operated alternately at Anchorage International Airport and Merrill Field. When at Merrill Field, it provided a shuttle bus service between the two airports. Early in 1980, it moved its operations back to International Airport once again.

- Valdez Airlines (formerly Kennedy Air Service). In addition to its air taxi services, Kennedy Air Service operated scheduled service between Anchorage and Valdez with its Piper Aztec (five-passenger capacity) and Piper Navajo Chieftain (nine-passenger capacity) aircraft. In 1979, the air taxi and scheduled services became separate companies. Kennedy Air Service retained air taxi operations, and the scheduled service became Valdez Airlines. During July 1977, Kennedy flew 131 scheduled flights between Anchorage and Valdez. The number dropped to 68 the following July when demand dropped and a sudden change in management occurred. The number of flights was increased to 108 by September which provided an estimated 680 seats. In November, flights were reduced to 67 which produced a higher load factor.

2.3.2.4 Rotary Wing (Helicopter) Carriers.

Rotary wing aircraft have been used extensively in Alaska by companies engaged in resource exploration. They permit quick access to remote areas by personnel and equipment without the need to construct airstrips. Among the major rotary-wing carriers with bases in Anchorage are Evergreen and ERA Helicopters. They are among six air taxi operators who have authority to operate rotary-wing aircraft with gross weights above 5,670 kg (12,500 lbs.). The others are Alaska Helicopters, Air Logistics, Trans-Alaska Helicopters, and Arctic Air Service. Twin-engine helicopters such as the Sikorsky 61, which has a seating capacity of 22, are favored because of the safety factor.

2.3.3 REGULATIONS

The Federal Aviation Administration within the U. S. Department of

Transportation through its flight standards program “promotes safety of flight of civil aircraft in air commerce by assuring the airworthiness of aircraft, the competence of airmen, the accuracy of navigation aids and the adequacy of flight procedures in air operations” (Federal Aviation Administration, 1977). To accomplish these goals, its personnel inspect, evaluate, review, and certify, as appropriate, aircraft, air carriers, general aviation activities, and navigational aids. Also, FAA provides a large percentage of funds used in Alaska to upgrade runways and landing aids at airports. Grants can be provided to either the State of Alaska or local governments, depending upon ownership of the airport.

The State of Alaska Departmentof Transportation has jurisdiction over many of the state’s airports. Of those terminal facilities analyzed in this report, only Cordova Municipal Airport is locally owned.

Fares and routes fall under the jurisdiction of the Civil Aeronautics Board for interstate carriers and of the Alaska Transportation Commission for intrastate carriers. The Board’s policy of deregulation is designed to increase service while at the same time maintaining acceptable profits for the carriers. Guidelines are being established to guarantee essential service to small communities. Communities served by none or one certified air carrier would be eligible for subsidies. For planning purposes, the CAB recognizes Anchorage, Fairbanks, and Juneau as the state’s transportation hubs. At the next level of importance are twelve regional centers, of which Kodiak is an example.

Interstate air freight transportation has been completely deregulated by the CAB; deregulation of interstate air passenger transportation is proceeding on a five-year timetable.

2.3.4 TECHNOLOGY

Table 2-27 shows the service characteristics of scheduled carriers serving the study area. The data show the impact of technology on the level of service as distance increases. For the Anchorage-Cordova link, elapsed times are comparable, and fares for travel by Alaska Airlines and AAI are virtually identical. As distances increase, unit costs drop markedly. Northwest Orient's fare to Chicago represents a cost of 4.7¢/km (7.5¢/mi.) which is approximately a third of that for Alaska Airlines' Cordova-Anchorage trip. Jet aircraft, with their large capacities and efficiency at high altitudes, provide fast and economical service for long distances. Aircraft used by commuter airlines are unable to compete economically at medium or long distances when adequate demands exist. Commuter airlines, for example, currently do not serve Kodiak, which is 399 km (248 miles) from Anchorage. The trend followed first by Alaska Airlines and now by Wien of reducing fleets to all-jet aircraft will continue for carriers that primarily serve links greater than 402 km (250 miles).

Because of the long distances they serve, major trunk air carriers can benefit from new generations of aircraft that have increased performance and will purchase them as their financing capabilities permit.

Table 2-27

Service Characteristics for Scheduled Service in Southcentral Alaska

Link	Carrier	Kilometers (Statute Miles)	One-Way Coach Fare	cost ¢/km (¢/mi)	Elapsed Time	Avg. Speed km/hr (mph)
Seattle-Anchorage	**Alaska**	2,750(1,709)	$123.08	4.5 (7.2)	**3:15**	846(526)
Seattle-Kodiak	**Western**	2,306 (1,433)	$126.53	5.5 (8.8)	**3:12**	721 (448)
Anchorage-Yakutat	**Alaska**	597 (371)	$ 59.96	10.1 (16.2)	**1:45** (1 stop)	341 (212)
Anchorage-Cordova	**Alaska**	241 (150)	$ 32.12	13.3 (21.4)	**0:40**	362 (225
	AAI	241 (150)	31.50	(21.0)	**1:10**	208 (129
Anchorage-Seward	AAI	121 (75)	$ 22.00	13.0 (29.3)	**0:35**	208 (129
Cordova-Valdez	AAI	71 (44)	$ 23.00	32.5 (52.3)	0:30	**142 (88)**
Anchorage-Valdez	**Polar**	201 (125)	$ 45.00	22.4 (36.0)	1:00	**201 (125)**
Seattle-Yakutat	**Alaska**	1,782 (1,107)	$121.14	6.8 (10.9)	3:35 **(1 stop)**	**497 (309)**
Anchorage-Chicago	**Northwest**	4,569 (2,839)′	$211.64	4.7 (7.5)	5:37 **(747)**	**813 (505)**

Source: Airline Tariff Schedules and Tariffs, 1979.

Technology improvements are occurring in rotary-wing as well as fixed-wing aircraft. Boeing-Vertol is marketing the commercial version of its Chinook helicopter developed originally for the military. Fitted for passenger use, it has a capacity of44 passengers and a range of 982 km (600 miles). Firm orders have already been received for use in transporting personnel to and from platforms in the North Sea. The cargo version has a shorter range but a lifting capability of up to 12.7 metric tons (14 tons) (Boeing-Vertrol, 1979).

2.4 Land Modes

Although the water and air modes dominate the movement of intercity freight and passengers in the study area, land modes provide important complementary roles. Three modes will be considered--highways, railroads, and oil pipelines.

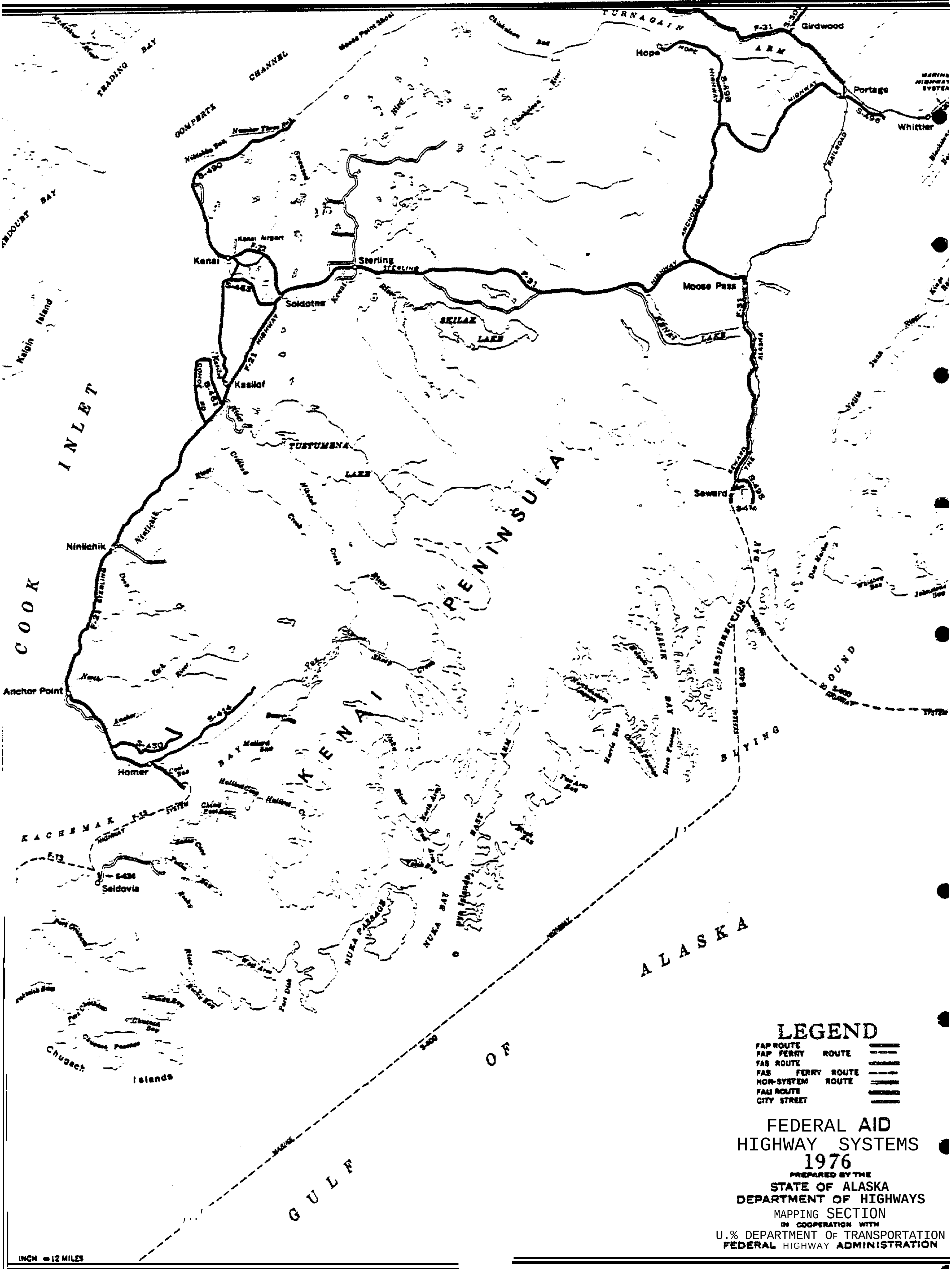
2.4.1 HIGHWAYS

2.4.1.1 Terminals

Unlike the air and water modes, the highway mode does not require large investments in terminal facilities. They are limited to freight storage yards near ports and warehouses for storage or sorting truckload into less-than-truckload (LTL) shipments. The former are considered in discussions of other modes and the latter are not considered to be constraining factors as demand increases.

2.4.1.2 Seward and Sterling Highways

The Seward Highway runs 204 km (127 miles) from Seward to Anchorage and the Sterling Highway runs 222 km (138 miles) from Homer to join the Seward Highway several miles north of Moose Pass (See Figure 2-111.). The two highways have both been designated Federal-aid Primary routes. The Sterling Highway is F-21 and the Seward Highway F-31.


TURNAGAIN ARM
Girdwood
Hope
Portage
Whittier
Kenai
Sterling
Soldotna
Moose Pass
Kasilof
Ninilchik
Anchor Point
Homer
Seldovia
Seward
Kalgin Island
COOK INLET
KENAI PENINSULA
SKILAK LAKE
KENAI LAKE
TUSTUMENA LAKE
KACHEMAK BAY
GULF OF ALASKA
Chugach Islands
INCH = 12 MILES
LEGEND
FAP ROUTE
FAP FERRY ROUTE
FAS ROUTE
FAS FERRY ROUTE
NON-SYSTEM ROUTE
FAU ROUTE
CITY STREET
FEDERAL AID
HIGHWAY SYSTEMS
1976
PREPARED BY THE
STATE OF ALASKA
DEPARTMENT OF HIGHWAYS
MAPPING SECTION
IN COOPERATION WITH
U.% DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION

The adequacy of the Sterling and Seward Highways on the basis of their capacity and condition has been evaluated using data collected annually by the State of Alaska. Road capacities are expressed in vehicles per hour. The maximum practical capacity for a rural two-lane road is 900 vehicles per hour in both directions (Highway Research Board, 1965). Practical capacity represents a stable free-flowing condition of traffic at high speeds and is designated level of service "B" by traffic engineers. Thus, a given rural road could accommodate more cars than 900 during a given hour but congestion would produce a lower level of service. Reductions in the practical capacity occur because of reduced lane and shoulder widths, sight-distance restrictions that limit passing, and the occurrence of trucks and buses in traffic. Factors have been established for a wide range of conditions based on extensive data collection.

The Alaska Department of Highways in 1972 computed practical capacities for road segments ranging from less than one mile to over ten miles (DOH, 1972). Table 2-28 shows the weighted capacities for major route segments of both the Seward and Sterling Highways. These capacities are compared to the 1977 30th highest hour, which is commonly referred to as the design hourly volume, in the last column of the table.

Table 2-29 shows a seven-year history of annual average daily traffic (ADDT) at the Ninilchik, Moose Pass, and Silvertip traffic recording stations and of population increaes for the adjacent census divisions. The Kenai Peninsula has increasingly become an important recreational

Table 2-28

Traffic Conditions for Kenai Peninsula Primary Routes

Highway	Route Segment	Distance km (mi.)	Capacity (Vehicles/Hour)[2]	1977 Traffic[1] AADT[3]	30th Highest Hour	Peak-Hr. Factor[4]	Volume/Capacity[5]
Seward Highway (FAB-31)	Seward (Bear Lake Rd.) - Sterling Hwy. Jct.	47.6 (29.6)	398	808	149	0.18	0.37
	Sterling Hwy. Jct.- Girdwood	84.7 (52.6)	495	1,453	360	0.25	0,73
Sterling Highway' (FAP-21)	Homer (West End Rd.)-Ninilchik	56.6 (35.2)	730	1,278	260	0.21	0.37
	Ninilchik-Soldotna	60.0 (37.3)	766	1,278	268	0.21	0.35
	Soldotna-Sterling Hwy. Jct.	94.3 (58.6)	484	2,519	316	0.13	0,65

Notes: (1) Traffic figures from fixed traffic recorder stations within or near route Segments.

(2) Capacity derived from "1972 Sufficiency Rating Report," Alaska Department of Highways. Level of service B, stable flow, was assumed. A weighted value was computed from smaller route segments used in the report.

(3) AADT = average annual daily traffic.

(4) Peak Hr. Factor = (30th Highest Hour)/AADT.

(5) Volume/Capacity = (30th Highest Hour)/Capacity.

Source: DON, 1973, DOTPF, 1978; Peter Eakland and Associates.

Table 2-29

Traffic and Population Growth - Kenai Peninsula

	Annual Average Daily Traffic						Census Division Population					
Year	Ninilchik AADT(1)	%	Moose Pass AADT(2)	%	Silvertip AADT(3)	%	Anchorage	% Change	Kenai	% Change	Seward	% Change
1970	169	-	650	.	924	-	126,333	.	14,250	-	2,336	
1971	674	-0,11	548	-0. 4%	971	5. 7%	135,777	7.5%	14,289	0.3%	?,s93	11.0%
1972	767	13.8%	554	1.1%	1,088	11.4%	144,215	6.2S	13,923	-2.6X	2,386	-8. 0X
1973	861	12.3%	552	-0.4%	1,222	12.3%	149,440	3.6X	13,808	-0.8%	2,446	2.5x
1974	1,095	27.2%	613	11.1%	1,422	16.4%	163,112	2,s1	13,962	1.1%	2,683	9.7%
1975	1,179	7.7%	693	13.1%	1,594	12.1%	177,814	16.1%	15,621	11.9%	3,149	17.4%
1916	1,285	9.0s	771	11.3%	1,552	-2.6x	185,179	4.1%	16,753	7.2%	3,395	7.8%
Annual Growth Rate		11.2%		5.8%		9.0%		6.6%		2.7%		6.4%

Notes:
1 Fixed Recorder F-2-21 located between Homer and Kenai)
2 Fixed Recorder F-3-31 located between Seward and Sterling Highway Jet.)
3 Fixed Recorder F-2-31 located between Sterling Highway Jet. and Girdwood)

Source: DOTPF, 1978; Alaska Department of Commerce and Economic Development. Division of Economic Enterprise, 1978, for census division population figures.

destination for Anchorage residents which accounts for some of the traffic growth. In addition, the census districts of Kenai and Seward have shown steady growth, although less than that of Anchorage during the 1970-1976 period. No clear relationship between changes in AADT and population is evident. Other factors such as tourism from outside of Southcentral Alaska, summer weather conditions, and availability of berths in small boat harbors are likely contributors to the annual average daily traffic figures. Generally, from 1972-1974, annual traffic growth exceeded population growth while figures for 1975 and 1976 show a reverse situation. The leveling off of demand at the Silvertip traffic recording station suggests more traffic is being generated within the Kenai Peninsula.

Growth in Anchorage will cause continued traffic growth on the Kenai Peninsula road system. The Girdwood-Sterling Highway Jet. route segment, which already has the highest volumes, will be the most impacted because it is the only road leading to major Kenae Peninsula communities from Anchorage.

Road condition information was obtained from surveys contained in 1972, 1975, and 1976 by the Department of Highways. For each year, ratings for individual route segments were weighted to produce an overall rating and the percentage of deficient miles was computed. This information is shown on Table 2.-30.

The Sterling Highway from Homer to Ninilchik does not present problems either because of capacity or condition. The 30th highest hour is only 37% of the service capacity and no deficient miles occurred for either

Table 2-30

Results of Condition Surveys for Kenai Peninsula Primary Routes

Highway	Route Segment	1972[1] Deficiency/Par Rating[2]	1972[1] Weighted Factor[3]	1972[1] % Deficient Miles	1975[1] Deficiency/Par Rating[2]	1975[1] Weighted Factor[3]	1975[1] % Deficient Miles	1976[1] Deficiency/Par Rating[2]	1976[1] Weighted Factor[3]	1976[1] % Deficient Miles
Seward Highway (FAP-31)	Seward (Bear Lake Rd.) -Sterling Hwy. Jct.	18/30	12.3	100%	17/25	16.6	100%	17/25	16.1	100%
	Sterling Hwy. Jct. - Girdwood	113/30	14.6	100%	37/25	36.3	72%	17/25	16.3	72%
Sterling Highway (FAP-21)	Homer (West End Rd.)-Ninilchik	18/30	10.0	12%	17/25	19.5	0%	17/25	19.6	0%
	Ninilchik-Soldotna	18/30	10.0	58%	17/25	19.5	0%	i 1/15	20.0	0%
	Soldotna-Sterling Hwy. Jct.	18/30	14.6	100%	17/25	35.8	100%	17/35	16.8	70%

Notes: (1) The methodology for the 1972 report differed from that of the two later reports, which mean the values are not completely comparable.
(2) Deficiency is the rating value established by the state at the point at which improvements should be considered. Par rating is the maximum rating established for the condition category. Values have been used before traffic adjustments have been considered.
(3) Ratings for sections within the route segment have been weighted by mileage.

Source: DON. 1973, 1976, 1977.

the 1975 or 1976 surveys. The next route segment from Ninilchik to Soldotna produced a similar finding, although an inconsistency exists in the number of deficient miles between 1972 and the later surveys. The weighted factor in 1972 was equal to the rating established for deficiency, which shows that only marginal deficiencies occurred.

The last major segment indicates potential problems caused by both capacity and condition limitations. The volume-to-capacity ratio was 0.65 and deficient miles in 1976 stood at 70%.

The monthly variation of traffic on the Sterling Highway between Homer and Ninilchik has been consistent over the past five years. Highest volumes occur in July when the monthly average daily traffic (MADT) is 1 50% of the annual average daily traffic (AADT). The MADT-to-AADT ratio decreases to almost 50% in December and January. The route segment between Soldotna and the Seward Highway Junction shows a similar pattern, except that the peaking is more pronounced in July. The MADT then reached 170% of the AADT in 1977.

The Seward Highway was divided into two route segments, the first stretching from Seward to the Sterling Highway Junction and the second from there to Girdwood. The analysis stopped at Girdwood for several reasons. First, the segment from there to Anchorage is heavily used for commuter other local trips. Second, major improvements have been made to this route segment since 1972 and more are in progress at this time.

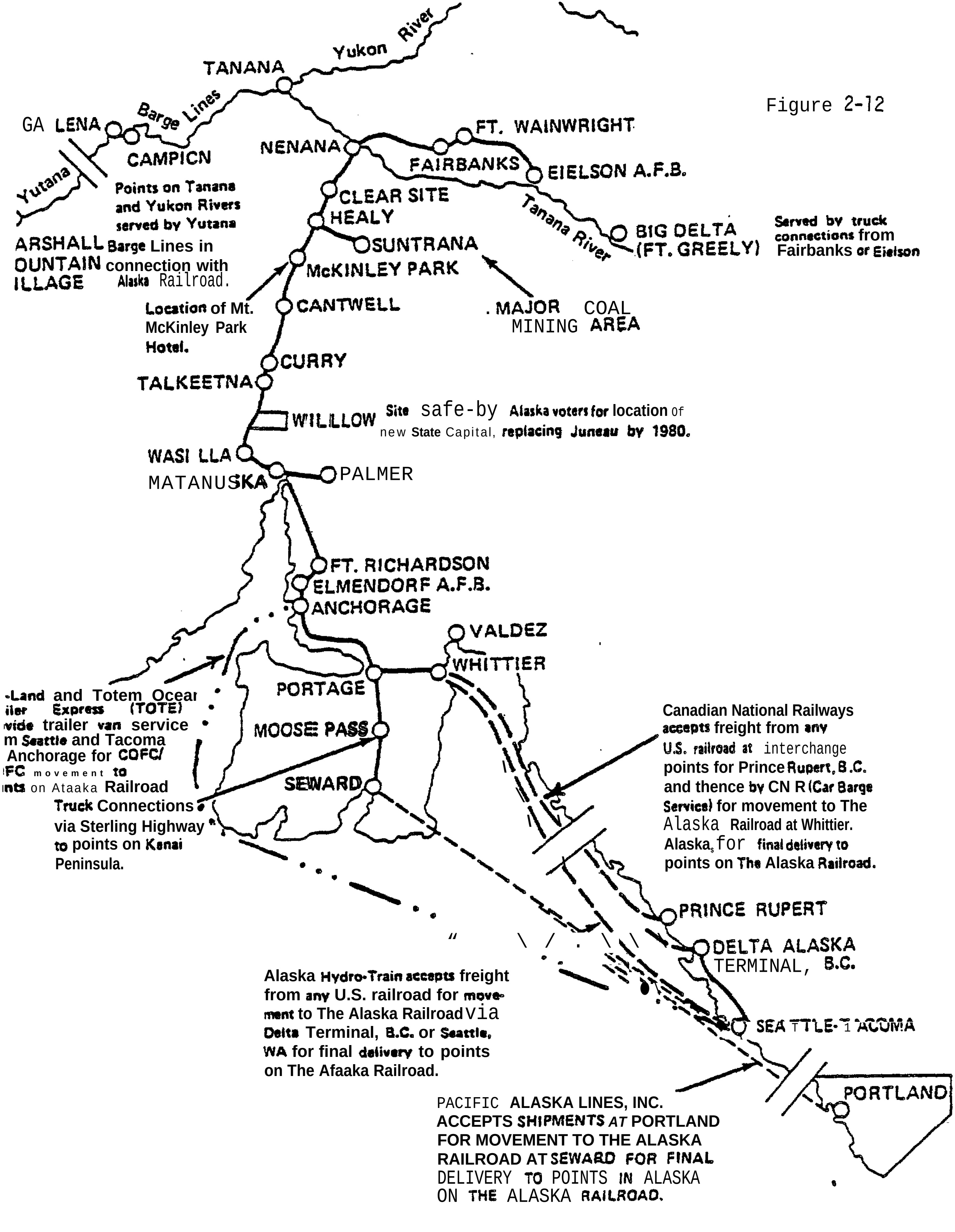
The southerly route segment has a low capacity (37%) and a low AADT. Monthly traffic figures show high fluctuations, ranging from an MADT-to-AADT ratio of 200% in July to less than 50% in the winter months. Although capacity is currently not a problem, this route segment produced the lowest ratings in both the 1972 and 1976 surveys. Deficient miles were 100% in all three years. The northerly route segment perspective has the greatest deficiencies. Its volume in percentage terms is the closest to capacity and its weighted condition rating in 1976 was second lowest.

Traffic growth has leveled off on all of the routes except the one between Soldotna and the Seward Highway Junction, which increased 17% from 1976 to 1977. This increase results partially from the close proximity of Soldotna (9.7 km/6.0 miles) to the fixed traffic recorder. Traffic on the Seward Highway segment north of the Junction decreased from 1976 to 1977.

2.4.2 RAILROAD

The Alaska Railroad serves three ports of entry--Whittier, Seward, and Anchorage. Figure 2-12 shows the existing system and connecting marine services. Most of the railroad's inbound traffic passes through Whittier and from there goes to Anchorage or south to destinations on the Kenai Peninsula. Whittier is closer to Anchorage than Seward by 107.8 km (67 miles). The railroad owns and operates the major docks in Seward and Whittier.

Figure 2-12



Source: Alaska Railroad, 1978.

In 1977, tonnage delivered by rail to Anchorage amounted to 191,754 metric tons (211,374 tons), which is 19% of inbound general cargo received by the Port of Anchorage. Less than 4% of this came through Seward. Traffic figures for the period 1972-1976 are shown in Table 2-3 by railcars and tonnage.

Whittier captures 85% of the railroad traffic to the Kenai Peninsula. Freight is shipped to Moose Pass and then transferred to trucks for delivery to Kenai, Homer, and other points on the Sterling Highway. Moose Pass is only 29 km (18 miles) further from Whittier than Seward, and shippers benefit from through rates given railcars entering Whittier.

The railroad serves as an extension of the marine mode, except for traffic generated and consumed in Alaska, such as gravel and coal. The railroad does not foresee any capacity constraints to be reached by the marine mode before being reached by the railroad (Coghill, 1978). The railroad will participate in any industrial growth that occurs on the Kenai Peninsula, the "railbelt" area from Anchorage to Fairbanks, or areas further north that can be reached by road.

2.4.3 CARRIERS

2.4.3.1 Common Motor Carriers.

Table 2-31 relates principal cities within the study area to the operating zones used by the Alaska Transportation Commission. Common motor

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Table 2-31

Motor Carrier Operating Zones

Operating Zone	Name	Representative Cities
3	Kens"i Peninsula	Seward, Whittier, Homer
5	South Central Alaska	
5A	Valdez Subzone	Valdez, Cordova
5B	Anchorage Subzone	Anchorage

Source: Alaska Transportation Commission, 1978. Scopebook Directory, Motor Carrier Operating Authority. Anchorage.

carriers authorized to carry general freight between Anchorage and the Kenai Peninsula include Sea-Land, Weaver Brothers, Lynden Transfer, Mammoth, Tachick Freight Lines, Arctic Motor Freight, and Bayless and Roberts. Mammoth currently has a contract with TOTE to move trailer loads to Kenai Peninsula destinations. Most of TOTE's incoming cargo is carload shipments. Weaver Brothers' operating rights were sold in February, 1979, when Alaska International Industries decided to divest its trucking business.

Since the trans-Alaska pipeline boom period, there has been excess capacity in the trucking industry. An estimated 1,000 trucks left Anchorage in 1978, and now supply is more in line with demand (Anchorage Times, 1979). The number and scope of operating authorities is expected to remain constant in the near future.

2.4.3.2 Buses

The two major interurban bus carriers within the State of Alaska are Transportation Services (TSI) and Alaska-Yukon Motorcoaches. The latter serves the route between Anchorage and the Alaskan-Canadian border via Tok on a seasonal basis. Within the impact area, Transportation Services has authority to operate routes serving Anchorage and the cities of Seward and Homer. Westours Motor Coaches offers sightseeing and tour services from Anchorage to Seward. The two carriers serve different clienteles.

TSI's Anchorage-Seward route is oriented towards Seward residents and also benefits from traffic to and from the job training center in the community. Three days a week in the winter (M-W-F) and five days a week in the summer (M through F), a bus leaves Seward at 8:30 a.m. and returns the same day at 7:30 p.m., providing approximately a four-hour layover in Anchorage. The one-way fare for the 204 km (127 mi.) journey is $10.80, which is less than one-half of the air fare.

2.4.4 PIPELINES

Pipelines should be considered as part of the overall and regional statewide transportation system to the extent that they substitute for other services. The petroleum products pipeline that Tesoro constructed between Nikiski and Anchorage reduced oil shipments into Anchorage from 1.5 million metric tons (1.7 million tons) in 1976 to 1.0 million metric tons (1.1 million tons) the following year, a reduction of 33%. The pipeline has a capacity of 36,000 barrels/day and is currently operating at about 22,000 barrels/day. Standard Oil, which also has a refinery at Nikiski, recently signed a contract with Tesoro and is now shipping its Anchorage-bound petroleum products by pipeline also.

2.5 Summary of Existing Conditions

Each of the three modes of travel -- marine, air, and land -- provides for the movement of goods and passengers within the study area. The adequacy of regional and local transportation systems varies by mode, location, and time of year. Of the communities selected for detailed analysis, all do not fall on Marine Highway System routes, some are not served by trunk airlines, and some are not accessible by road from the major highway system in Southcentral Alaska.

Marine facilities within the study area can be divided into those that predominately serve local needs, those that handle tonnage for transshipment, and those that serve both purposes. Roles can and oftentimes do vary for dry freight and liquid bulk tonnage at the same port. Anchorage and Whittier in that order are the major ports of entry because of their ability to efficiently handle inbound cargo. Anchorage has specialized container-handling facilities and roll-on, roll-off ramps while Whittier has railcar transfer facilities. Anchorage is the only community with facilities having strong local and transshipment roles. Approximately 80% of the dry freight received at the Port of Anchorage has a local destination, and the remaining 20% is transshipped by land to Fairbanks, Valdez, and Kenai Peninsula destinations. Port facilities in Cordova and Yakutat serve local needs for both dry freight and petroleum products. Whittier is a transshipment port for both dry freight and petroleum products. The inbound dry freight is principally for the Anchorage market and travels from Whittier by rail. The inbound petroleum products are for military uses and travel by a military-owned pipeline.

The port facilities in Seward and Valdez have large service areas because of good connecting land routes. However, except for oil tanker traffic at Valdez, these two ports have lesser importance than before the 1964 earthquake which caused severe damage to them.

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Dry freight tonnage at both ports is highly dependent upon the level of industrial activity within the State. For Seward, petroleum products are primarily for local use. Valdez, however, serves as a distribution point for Standard Oil petroleum products by marine and truck modes to nearby communities.

No port facilities within the study area have capacity problems based on existing tonnage figures. Dramatic shifts in demand or large industrial projects would be necessary before major improvements could be justified on the basis of capacity considerations alone.

The air mode within the study area is dominated by traffic to and from Anchorage to the same extent that the marine mode does. Anchorage International Airport is the only facility handling wide-body jet aircraft. All other communities being studied except Whittier have direct scheduled flights to Anchorage, but only Cordova and Yakutat are on airline routes serving Seattle. Seward and Valdez are served only by commuter airlines operating prop planes with nineteen seats or less. Cordova is the only community connected to Anchorage by both scheduled commuter and truck airlines. Air service, although important to all communities, is particularly important to Cordova and Yakutat, since they are inaccessible by land routes.

Major improvements in progress or programmed for the near future at Anchorage International Airport include a North-South runway which will reduce crosswind problems and a satellite terminal for international flights . At other facilities, runways and ground facilities are generally adequate for existing activities, although the need has been expressed for the capability to make instrument landings at Valdez and for passenger terminal improvements at Seward. Airline deregulation in the next few years is not expected to affect service to communities other than Anchorage that are potentially impacted by the OCS oil and gas lease sales in the Northern Gulf of Alaska because of the relatively small markets.

Transportation services in the land mode -- trucking and the Alaska Railroad -- serve a distribution function for goods arriving first by water at major ports of entry. Valdez and Seward are accessible by road from Anchorage. Whittier and Seward are connected to Anchorage by rail. Yakutat and Cordova are not currently accessible by land, although the Copper River Highway provided access to Cordova until damaged by the 1964 earthquake. The distribution function of the state highway system could diminish if major marine carriers provide regular service to the port approved for Valdez or ones proposed for either Kenai or Homer to serve the Kenai Peninsula. Highway traffic figures are highly seasonal in nature. Recreational traffic by Alaska residents and out-of-state tourists create major traffic flows during the summer months. The existing level of service provides free-flow conditions for vehicles except during some summer weekends.

3.0 BASE CASES

3.1 Introduction

The transportation base cases are an important element of the impact assessment process, since they provide the baseline conditions to which incremental OCS transportation demands are added. Figure 1-5 in Chapter 1 shows how the base cases are constructed.

The analysis will focus on the mean base case because, by definition, it has greater likelihood of occurrence. The low and high base cases will be examined in relationship to the mean base case and will serve to bracket impacts of conditions which do not include effects of the Northern Gulf of Alaska Lease Sale No. 55.

Four primary sources of data are involved in the development of the transportation demands and impacts. A description of each and its role in the formation of transportation demands and, ultimately, transportation impacts is provided below:

- Existing transportation demand and supply. Existing transportation demands for marine, air, and land services and facilities provide base conditions which are then converted into annual forecasts using the results of the local and regional socioeconomic studies. Threshold values are computed where possible for important elements of transportation services and facilities which make up the supply of transportation. Annual runway capacities have been estimated for both dry and liquid freight for each port (see Table A-7). For the air mode, thresholds for additional flights per week have been established, based on the estimated number of available seats. Assessments are also made for the present adequacy of runway capacity and passenger terminal space. Hourly capacities, based on stable traffic flow with speed restrictions becoming apparent (level of service B), have been computed for intercity road links on the Kenai Peninsula (Table 2-25).

- <u>Existing local population and 20-year forecasts.</u> Existing local population figures are used to establish a base demand per capita for each community. Transportation demands for a given year in the study period are the products of the population and the demand per capita, given the assumption of a straight-line relationship between demand and population.

A single base case exists for Seward, Cordova, and Yakutat. These data are presented in the mean base case. No discussion of transportation demands is provided for these communities in the low and high base cases, since the emphasis of the analysis for these two cases is on differences from the mean base case. For marine terminals, local population figures are used unless a significant amount of freight is distributed to other areas and then regional populations are used. For air passengers, the population of the smaller community on each link is used. Results for air links are presented in terms of passengers above base levels. Resulting transportation demands for all modes are compared against thresholds where applicable. Otherwise, qualitative impact assessments are made.

. Existing regional population and 20-year forecasts. Existing regional population figures and forecasts are used to compute demands when they are on a regional rather than a local level. The methodologies are identical to those for local population figures. Regional forecasts exist for each base case, as opposed to local community forecasts where only one set of base forecasts has been made. Data have been developed for three regions -- Anchorage, Southcentral (all of the Gulf of Alaska data collection area except for Anchorage), and Fairbanks.

. Previous oil and gas lease sales and specified developments. The first three categories are related to the development and impact assessment of induced, or indirect, transportation demands. This category represents direct demands created by specific developments and includes employee movements and freight required for construction and operations. Each of the developments is described in the following section. Differences in direct transportation demands between the three base cases are due only to differences in scenarios of previous OCS lease sales. The other development activities are maintained at the same level for all cases.

A detailed description of the methodologies used in developing the threshold values and transportation demands is contained in the Appendix.

3.2 Factors Causing Growth

Growth of transportation demand for the base cases during the study period has three components: (1) that caused directly by development activities with a single specified level of activity; (2) that caused directly by preceding OCS lease sales with a range of activity levels or scenarios; and (3) that caused indirectly by regional and local population growth occurring as a result of the first two components and other growth factors in the state's economy.

3.2.1 PREVIOUS BASE CASE DEVELOPMENTS

Tonnage figures for the Beaufort Sea OCS lease sale were taken from the Bureau of Land Management's Draft Environmental Impact Statement (BLM, 1979). In that document, worst cases were assumed for each mode, but for purposes of this study, it was necessary to establish route allocations which could be used for each of the three scenarios. The percentages adopted for the four main entry points are shown on Table 3-1. The Bering Sea all-water route is expected to receive the highest percentage of tonnage, but the reliability and year-round availability of truck

Table 3-1

Base Case Development Assumptions

1. Beaufort Sea OCS Tonnage[1]

   Seward - 30%
   Whittier - 20%
   McKenzie River - 15%
   Bering Sea - 35%

2. Lower Cook Inlet Tonnage[1]

   High Scenario = 75% Yakutat Shelf High (Sale No. 55)
   Mean Scenario = 26% Yakutat Shelf High (Sale No. 55)
   Law Scenario = Yakutat Shelf Low

   Note: Yakutat figures displaced three years for conversion to Lower Cook Inlet tonnages.

3. Northwest Gas Pipeline Tonnage[2]

   Dry Freight = 12,60 short tons/mile
   Fuel = 240 short tons/mile

   Prudhoe Bay - Delta Junction: 905 km (562 miles)

   Whittier - 75% dry freight
   100% fuel
   Seward - 25% dry freight

   Delta Junction - Burwash Landing, Canada: 526 km (327 miles)

   Whittier - 80% dry freight (40% inbound and outbound)
   Valdez - 100% dry freight (40% transshipped from Whittier)
   100% fuel

4. Pacific LNG Tonnage[3]

   200,000 tons in 1981 and 1982
   Whittier - 20%
   Seward - 15%

Sources: (1) Peter Eakland and Associates, 1979; (2) Pernela, 1976; (3) Frederick Harris, 1978.

carriers to the North Slope will encourage significant use of Seward for foreign-fabricated pipe and Whittier for miscellaneous breakbulk freight.

For the Lower Cook Inlet lease sale (Sale No. CI), no logistics requirements have been developed previously. The estimated high and low oil reserves for that sale were compared to those provided by Dames and Moore (1978) for the Yakutat Shelf High (5%) Scenario, and logistics requirements for that scenario were prorated accordingly. Since the mean scenario for the Yakutat Shelf had estimated oil reserves 35% of those in the high scenario, a similar percentage was used to establish a mean scenario for the Lower Cook Inlet. The resulting tonnages were backed up three years to reflect the date of the lease sale in Cook Inlet.

A review of tonnage per mile figures for the trans-Alaska and proposed Arctic Gas Pipelines (Pernela, 1976) resulted in per-mile estimates for both dry freight and fuel. Freight destined for the section of the line between Prudhoe Bay and Delta Junction was split between Whittier and Seward. Freight bound for the section of the line between Delta Junction and Burwash Landing, Canada, was split between Whittier and Valdez. For the latter segment dry freight was assumed to be transshipped on rail cars to Valdez through Whittier. A summary of the assumptions used is shown under item 3 of Table 3-1. An estimate was made of tonnage required for development of gas reserves for Pacific LNG and the tonnage allocated in 1981 and 1982 to Whittier and Seward.

For air transportation, except for links from local communities impacted by Sale No. 55 and 46 scenarios, the only link in the study area considered for impact by the development activities was Anchorage-Seattle. The number of non-Alaskan employees in each activity was estimated and converted to roundtrips per week. For the construction projects, 20% non-Alaskan employment was assumed. For OCS lease sale activities, Alaskan and non-Alaskan employment was estimated using ISER's SEAR factors (Table A-7). A roundtrip/month factor of 1.43 was used for the Beaufort Sea lease sale to reflect a manning policy of two weeks on, followed by one week off.

3.2.2 GROWTH FACTORS BY COMMUNITY

The potential impacts of the various growth components occurring during the study period vary by community. Terminals and links within the study area serve a mixture of local, regional, or state-wide (outside the study area) transportation demands based on their roles in the State of Alaska's overall transportation network.

The Port of Anchorage is assumed to receive negligible construction materials for development activities outside the local region. Its growth will be based on regional population increases. Anchorage's air facilities, on the other hand, will be impacted directly and indirectly by these development activities because of travel by employees living out of state and in Anchorage.

Whittier and Seward historically have served as the major ports of entry for construction equipment and materials, and will continue to do so. Because of tariff and handling advantages for traffic going through Whittier, Seward receives a smaller proportion of total traffic. However, materials originating outside the United States most likely will arrive in bulk cargo ships rather than on rail barges, and these ships will likely use Seward.

Seward and Yakutat have promise as regional centers for Alaska's emerging bottomfishing industry (Denconsult, 1978). The nature, extent and location of shoreside impacts caused by Alaska's involvement in the bottomfish industry is conjectural at this point. Differences between this fishery and those currently engaged in by Alaskan fishermen are substantial. Large, efficient harvesting and processing of low-priced bottomfish are required on a year-round basis in order to make a profit: whereas seasonal fisheries such as salmon or crab can be econom c with relatively small yields because of high prices per pound.

3.3 Mean Base Case

3.3.1 FACTORS CAUSING GROWTH

The reasons behind growth in induced and direct transportation demands for the mean base case will be examined separately. Increases in induced demands can be expected at both the local and regional levels because of forecast population growth. Base year population growth factors for Seward, Yakutat, and Cordova are shown in Table 3-2. Fishing is a major industry in all three communities. For Seward, summer recreational opportunities produce additional growth prospects. However, no major developments are expected to occur in any of the three communities during the study period. Seward will serve as an entry port for materials destined for inland development projects, but these transportation activities will have little effect on Seward's growth. All these communities are forecast to have slow, but steady growth. From 1978 to 2000, the average growth rate is slightly above 3% for Seward and Yakutat, slightly less for Cordova. The modest growth rates and the small lease population figures combine to keep population-based transportation demands at a low level. Anchorage's growth factors exceed those for the State for any given year, and its population is forecast to be 22% above the base year population of 190,188 at the end of the study period. Growth factors for the Fairbanks region first exceed those for Anchorage in 1981 and remain ahead for the rest of the study period. The Southcentral Region, where Seward, Cordova and Yakutat are located, participates less in population growth than the other two regions. This region's population is scattered over a wide area, and growth is isolated in several communities. In the year 2000, population in the region is forecast to be only 38% greater then the figure for 1977 in the mean base case.

Seward is a potential site for the location of major processing and ship repair facilities. Because of the uncertainties involved, this industry has not been considered explicitly in the forecasting of transportation demands.

3.3.2 WATER MODE

3.3.2.1 Description of Activities

The water mode is limited to movements of freight and fuel with the exception of the ferry systems operated by the State of Alaska. Table 3-4 shows the marine freight forecasts for terminals in Anchorage, Seward, Whittier, Cordova, and Valdez. Dry bulk and petroleum have been shown separately. The forecasts are presented as percentages of base year (1977) tonnages and can be compared to threshold values provided at the bottom of the table. Base case development tonnage has been included with normal growth where existing facilities would be used.

3.3.2.2 Terminals

Only the Port of Anchorage can expect impacts during the mean base case, on the basis of computed threshold values. Anchorage will experience the beginnings of congestion for dry bulk freight in the late 1990's when the low threshold value is exceeded, but existing berths will still be adequate. Petroleum throughout for the Port of Anchorage will closely approach the low threshold value by 2000. Without diversion of some inbound fuel to the Nikiski pipeline, the value would have been reached much sooner. Since Port of Anchorage tonnage is based on population growth rather than development activities a relatively constant flow throughout the year exists across the principal docks, despite ice problems during the winter. Both TOTE and Sea-Land have the same number of sailings during the winter as the summer.

None of the other ports is expected to experience any congestion, as the freight and petroleum growth factors fall short of even low threshold values for the entire study period (Table 3-4). For Whittier, growth factors are above 2.0 during the first two years of the study period due to development activities but do not again reach this value until the last three years of the study period. The largest growth factor is 2.19, which is 80% of the low threshold value.

Seward, like Whittier, is expected to receive development-related freight early in the study period. Unlike Whittier, the 1982 value of 2.51, which is 64% of the low threshold value, is not reached again during the study period. At Cordova and Yakutat, no development-related freight is expected during the base cases, and the population-related tonnage is forecast to show a steady growth. By the end of the study period, the growth at Cordova will have reached 49% and 73%, respectively, of the estimated low thresholds for dry freight and petroleum. Yakutat's growth rate factors never exceed 20% of the low freight and petroleum capacity figures. Despite these figures, Yakutat's ability to efficiently handle cargo will depend upon major repairs to at least one of two existing facilities. In the absence of new oil and gas activities in the eastern Gulf of Alaska, ARCO probably would abandon the support base facility that it built in Monti Bay, and it would then belong to the City of Yakutat.

At Valdez, construction activities for the Northwest gas pipeline are expected to produce significant tonnage for Valdez early in the study period. Chances are unlikely that the 1982 growth factor value of 8.39 will be even closely approached for the rest of the study period. This value, however, is only 42% of the low capacity threshold value and 20% of the high value.

Refined petroleum products is not expected to have the same degree of fluctuations in demand, the growth factor at the end of the study period will reach 34% of the low threshold value. Annual oil production reaching Valdez from the North Slope will reach its peak in 1986, as shown in Table 3-5. The value of 641.5 million barrels will require 691 tanker sailings. Only in this year is the computed threshold for four berths (682 sailings per year) exceeded. From 1979 through 1993, at least four berths are required in the moderate base case. Production from the Beaufort Sea OCS lease sale is not expected to begin until 1989. Beaufort Sea production in the moderate base case peaks in the early 1980's at 55 million barrels per year. Production from this area never exceeds 23% of Prudhoe Bay production during the study period. The effect on oil tanker traffic by Beaufort Sea activity is modest. Peak production requires only an additional 60 sailings per year, or slightly more than one a week. Construction of the Alpetco petrochemical complex in Valdez will not affect the level of petroleum tonnage, since most of its oil will come from the Trans-Alaska Pipeline.

3.3.2.3 Carriers

Existing carriers are forecast to incrementally increase their services as population within the study area increases both in terms of equipment and frequency. Sea-Land will increase the size of ships serving Anchorage and Kodiak. Tug and barge carriers also will expand services but most likely through more frequent service rather than larger equipment. The Seattle-to-Alaska marine shipping market is highly competitive at present and should remain so although tariffs will steadily increase as fuel prices climb. No shift of services from existing routes is contemplated. Prudhoe Bay sealifts in 1970 and 1975 required 36 and 48 barges, respectively (Pernela, 1977). These massive barge requirements during the short Arctic Ocean shipping season kept Hydro-Train traffic to Whittier from reaching levels which otherwise might have been reached. However, even with development of Beaufort Sea oil and gas reserves, the major infrastructure for that area is in place and shipping requirements will be considerably more modest even if all materials go by sea. In addition, fuel requirements can be met by Prudhoe Bay's refining capacity. The peak year of development for Beaufort Sea would require only five to eight barges (BLM, 1979). Services of small tug and barge operators would not likely be diverted to transport oil and gas-related materials. As they have in the past, oil companies would contract with large companies such as Crowley Maritime or Dillingham Maritime which would be capable of providing all services, except those which require equipment unique to offshore oil and gas operations.

Given a flourishing bottomfish industry in either Seward of Yakutat, TOTE's cargo ships would certainly consider stopping at ports along its return route to Tacoma in order to build up back-haul traffic. Likely back-haul ports are Homer and Ketchikan, if adequate berthing facilities can be provided. Even though stopping at these ports would require only minor deviations from TOTE's present route, any stops besides Anchorage would prevent TOTE from providing twice-weekly service.

Expansion of the State of Alaska's Marine Highway System might occur, either by increasing service on existing routes or increasing the number of communities served, but such a decision likely would be based more on politics than on traffic demand and economics. Except for the Whittier-Valdez run in the summer by the M. V. Bartlett, existing load factors allow for substantial growth on the system although occasional bottlenecks for vehicle traffic occur during peak summer seasons. Even if high load factors should consistently develop in the future, low winter load factors act as a considerable financial constraint to increases in existing service.

3.3.2.4 Issues

There are numerous issues regarding marine commerce in the study area which potentially could affect impacts discussed in the previous sections, but they vary from community to community.

Several major communities in Southcentral Alaska see port development as an opportunity for creating a stable economy and reducing freight costs. Overall regional population growth and potential developments in offshore oil and gas and bottomfishing are seen as springboards to realize these objectives.

Studies have been initiated, completed, or seriously contemplated by the Matanuska-Susitna Borough, the Kenai Peninsula Borough, Seward and Valdez, as well as Homer and Kodiak, which are adjacent to the primary study area. Valdez has taken the lead by presenting a $48 million bond issue to the voters in April, 1979, which was overwhelmingly approved. Adequate port capacity presently exists at all facilities based on a comparison of growth factors and threshold values (Table 3-4). Additional port development would provide back-up facilities during periods of high development and would provide capacities that would be adequate well into the next century. Port development projects likely will not create any new traffic, but could create some slight diversions of traffic from other ports if carriers respond by providing fast and frequent service.

Hydroelectric power has the potential for serving Seward and Anchorage. Should prospective sites be developed fuel shipments particularly to Seward would diminish because it now depands upon diesel generators for electrical generation.

While potential entry ports are planning how to capture additional traffic, Yakutat is most considered with insuring the availability of basic port facilities.

Marine safety in Price William Sound remains a concern because of the heavy tanker traffic that would occur throughout the study period, despite the success to-date of the U. S. Coast Guard's traffic control system.

An emerging issue is the respective roles of agencies and private companies in financing construction and in operating new facilities. The state, to date, has focused on small boat harbors and has not funded major port facilities. The Corps of Engineers is restricted to the funding of breakwaters and entrance channels. Few, if any communities, have the financial strength of Valdez to launch port development on their own. In some cases, such as the Sea-Land facility at Dutch Harbor, the economic gains may be such that a major shipper will undertake financing and construction on its own. Proposals have been advanced for port authorities at the borough or State levels, but none within the study are *in* the process of being implemented.

In Anchorage, where waterfront space available for major port facilities has already been developed, the principal issue is whether any changes in use should occur as demand increases. Construction of additional pipeline capacity from Nikiski or other locations could free up the Port's petroleum pier for additional dry freight handling.

3.3.2.5 Summary of Impacts

During the study period, population-related marine freight will cause the low capacity service level to be reached in Anchorage for both fuel and dry freight. Freight increases at Seward, Whittier, and Valdez will be pronounced during the early 1980's because of non-Gulf of Alaska development but can easily be accommodated. Carriers and routes are anticipated to be easily capable of handling increased tonnage during the study period.

3.3.3 AIR MODE

3.3.3.1 Description of Activities

Growth in demands for aviation depends upon the same factors as for the marine mode -- population growth and major development activities. One difference is that for the air mode potential impacts are almost always additive since both types of demand will use the same facilities and the same carriers. No new major airports are contemplated. Air freight forecasts have not been developed because virtually all materials for development activities will be shipped via the marine mode. Although a basic requirement for service base sites is that they have access to a 1,524 m (5,000 foot) runway suitable for operations by large cargo planes (jets or Hercules), Seward's land access to Anchorage minimizes the need for extensive air freight to the community. Air freight increases are expected to follow the population-related growth of passenger travel since most flights carry both freight and passengers. Wien, Northwest and Flying Tiger offer separate freight-only service from the Lower 48 to Anchorage.

Demand for air passenger service was examined on a link-by-link basis for August, the peak summer month. Table 3-6 shows forecast traffic above base year figures for the mean base case on all links except Anchorage-Seattle. Traffic on this link is shown on Table 3-7. For Anchorage-Seattle flights, service measured in seating capacity will have to double by 1997. Population growth in the Anchorage region will account for most of the growth. Travel related to out-of-state employees working on development projects in Alaska during the early 1980's causes population growth to fall to 72% of total growth, its lowest level during the study period. By 2000, additional peak weekly traffic of 16,160 is expected. This figure will account in large part for the increased demand for terminal space at Anchorage International Airport, since approximately one-half of the enplanements are non-stop passengers from Anchorage to Seattle. Only the

Anchorage-Seattle link includes travel by development activity employees. The largest increase in the number of peak month passengers is expected on the Cordova-Anchorage link, followed by Yakutat-Southeast (Juneau), Cordova-Yakutat, Seward-Anchorage, and Yakutat-Cordova. The Southeast-Seattle link only examines trips originating from Yakutat and Cordova.

General aviation operations can be expected to increase, commensurate with population increases. At the major facilities in Anchorage, Merrill Field and Anchorage International Airport, general aviation operations exceed those for air carriers (FAA, 1977). Training operations exceed both categories, reaching approximately one-third of total operations at Anchorage International Airport. The percentage of general aviation and air carrier operations is likely to increase at major facilities and that of training decline, as secondary and satellite airfields assume the training role to a greater degree, particularly in Anchorage where severe congestion would otherwise result.

3.3.3.2 Terminals

At Anchorage International Airport, a total of 23 gate positions are available, 11 for domestic flights, five for international flights, and seven for domestic flights. The existing passenger terminal has 28,520 m2 (307,000 sq. ft.), approximately 72% is for domestic and 28% for international functions. By 1989, 39 gate positions will be required. According to the draft Anchorage International Airport Master Plan, by 1986 the existing space will be used exclusively for domestic functions, and a separate 14,400 m^2 (155,000 sq. ft.) structure will be constructed for domestic functions (DOTPF, 1979). Additional taxiways will be construtted and the North-South runway will be completed. The State has assumed responsibility for passenger terminal construction at airports in Anchorage and Fairbanks. Otherwise, other entities, public or private, must arrange for the financing, construction and operation of such facilities.

A proposed elimination of training operations at Anchorage International Airport will provide adequate runway capacity for both air carriers and general aviation during the study period.

Except for Anchorage facilities, operations will not conceivably reach the level where capacity will become a constraint. Operations at Seward, Valdez and Cordova fall below 10,000 per year compared to capabilities of at least 100,000. Currently, no commercial carriers operate jets into either Valdez or Seward.

No major improvements are scheduled for the Seward airport. Growth in traffic increases the need for a passenger terminal, but financing would have to come from the community or the carrier, AAI. Another incremental improvement would be upgrading of the runway surface to a 7.6 cm (3 in.) layer of bituminous asphalt which is not currently scheduled for Seward. Likewise, projects at Cordova and Yakutat will emphasize maintenance of existing facilities, particularly runways.

3.3.3.3 Carriers

Major carriers on interstate routes from Anchorage to Seattle and further south will gradually shift the mix of planes toward wide-body jets. At present, only approximately one-third daily summer jet flights utilize wide-body planes. The entry of new carriers in interstate markets is likely by the mid-1980's when complete deregulation is scheduled to occur.

Forecast increases in passenger traffic will create the demand for an additional 126 flights per week on the Anchorage-Seattle link, or approximately seven per day. The increased demand on the Seward-Anchorage link should lead to an increase of three to four flights per day by the mid-1990's. The Cordova-Anchorage link becomes the critical link on jet service between Anchorage and Seattle with stops at Cordova, Yakutat, and Southeast cities. The estimated number of available seats on the link, which is 144 (see Tables A-12 and A-13) is first exceeded in 1993 (Table 3-6). An additional daily flight at this time would be adequate for the remainder of the study period. The next most critical link is Yakutat-Juneau, but demand would not require an additional flight.

3.3.3.4 Issues

Federal and State regulations of air carriers -- particularly the extent and impact of deregulation -- will be a major issue during the study period. Deregulation of interstate transportation of air freight has already been implemented by the Civil Aeronautics Board, and in early 1979 de-regulation provided for increased competition on major passenger routes into Alaska from the Pacific Northwest. It is l·kely that the Alaska

Transportation Commission, which has authority over intrastate air carriers, will lag behind the CAB in deregulation. Of the links analyzed in this study, only those operated by commuter airlines are regulated solely by the Alaska Transportation Commission. Large seasonal differences in demand exist for air carrier services in Alaska. Complete intrastate deregulation could lead to an influx of non-Alaskan services during the peak summer season. Cutbacks in existing service would likely occur during slack periods, due to the weakened financial condition of Alaskan carriers. The manner in which the Alaska Transportation Commission and the legislature balance the competing goals of adequate service to consumers and of strong financial conditions of carriers will strongly influence the nature and extent of impacts in areas served by regional carriers such as AAI and Kodiak-Western Alaska.

Deregulation has the in-built potential for increasing services in large markets but on the negative side has the potential for decreasing service in small markets. Recognizing this, the CAB is establishing guidelines for the possible use of subsidies to insure adequate service to communities served by none or only one CAB-certified carrier.

3.3.3.5 Summary of Impacts

Landing capacities of runways within the study area are not expected to be a constraint, if recommendations for virtual elimination of training operations at Anchorage International Airport are adopted. Passenger terminal facilities will require upgrading in Anchorage. Plans have already been developed for the necessary expansion at Anchorage. Growth in services by air carriers will be steady, and favorable financial forecasts for airlines will enable the additional demand to be easily accommodated. Significant service increases can be expected in the Anchorage-Seattle market, and an additional daily flight expected for commuter service to Seward and jet service to Cordova. Federal deregulation will guarantee adequate competition on interstate routes, and the combination of potential Federal subsidies and State of Alaska regulation will insure adequate and reasonab' y-priced service to small communities.

3.3.4 LAND MODES

3.3.4.1 Roads

Traffic on the Seward Highway will steadily increase as population growth occurs in Anchorage and on the Kenai Peninsula. Assuming traffic increases based on Anchorage" population growth, level of service B, will be exceeded in 1987 when the Anchorage growth factor first brings volumes in excess of the service capacity. Level of service B is the design standard for rural highways; it represents stable flow where restrictions in speed become apparent.

Three major projects, each costing $8-70 million, are scheduled for construction from 1983 - 1986 in the Granite Creek-Turnagain Pass section of this segment (DOT PF, 1978). Improved alignments and cross-sections will provide incremental increases but far less than could be achieved by provialing for additional lanes. The limited amount of Federal-aid funds that the State annually receives (approximately $100 million) will not enable it to meet all forecast roads needs on the Kenai Pen' nsula during the study period. Capacity problems are only one consideration in the prioritization of projects. Others are road condition and the political need to distribute projects throughout the state.

3.3.4.2 Railroad

No changes are anticipated in railroad operations during the study period, and no capacity problems are anticipated. The single mainline track from Seward to Whittier to Anchorage has never had a congestion problem, even during the construction of the trans-Alaska pipeline. Existing passenger routes are anticipated to remain intact, although the service between Anchorage and Whittier requires a subsidy from the State of Alaska. Passenger service between Anchorage and Seward was abandoned in 1954 (Pernela, 1977) and is not expected to be revived, even if congestion develops on the Seward highway. Buses could handle the traffic at lower cost.

3.3.4.3 Issues

For roads within the study area, the major issue is whether the State will have sufficient funds not only to keep existing roads in adequate condition but also to expand capacity on route segments in a timely manner. The-State has tried to have primary routes declared part of the Interstate system by the Federal Highway Administration, but to date has been unsuccessful. The financial condition of the Federally-owned Alaska Railroad could become an issue, although an increase in development activities should provide a series of money-making years for the operation.

Table 3-2

Regional Population Projections: Moderate Base Case (BM)

Year	Statewide	Anchorage	Southcentral	Fairbanks
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Factors to Produce Forecasts		
1978	0.990	1.038	0.913	0.925
1979	1.019	1.058	0.946	0.983
1980	1.057	1.090	1.002	1.044
1981	1.109	1.148	1.044	1.140
1982	1.184	1.236	1.061	1.330
1983	1.224	1.287	1.050	1.410
1984	1.221	1.282	1.074	1.334
1985	1.240	1.305	1.084	1.369
1986	1.274	1.347	1.100	1.427
1987	1.312	1.395	1.114	1.492
1988	1.356	1.449	1.137	1.561
1989	1.401	1.505	1.160	1.630
1990	1.440	1.554	1.186	1.691
1991	1.478	1.607	1.180	1.758
1992	1.516	1.659	1* 199	1.822
1993	1.559	1.718	1.218	1.892
1994	1.603	1.778	1.239	1.963
1995	1.650	1.843	1.262	2.038
1996	1.701	1.912	1.286	2.118
1997	1.751	1.983	1.308	2.201
1998	1.803	2.057	1.328	2.286
1999	1.862	2.141	1.353	2.382
2000	1.922	2.222	1.380	2.482

Source: ISER, 1979,

Table 3-3

Community Areawide Population Forecasts for Base Case

Year	Seward	Yakutat	Cordova
	Base Populations		
1978	2,600	567	2,762
	Factors to Produce Base Case Forecasts		
1979	1.005	1.016	1.030
1980	1.022	1.065	1.040
1981	1.037	1.065	1.087
1982	1.051	1.097	1.106
1983	1.072	1.118	1.124
1984	1.114	1.118	1.143
1985	1.170	1.127	1.161
1986	1.174	1.148	1.182
1987	1.178	1.194	1.203
1988	1.183	1.222	1.224
1989	1.247	1.226	1.245
1990	1.302	1.316	1.266
1991	1.314	1.349	1.292
1992	1.327	1.388	1.319
1993	1.367	1.460	1.345
1994	1.408	1.494	1.374
1995	1.450	1.547	1.402
1996	1.495	1.577	1.432
1997	1.542	1.591	1.464
1998	1.588	1.635	1.495
1999	1.638	1.635	1.528
2000	1.690	1.647	1.565

Source: Alaska Consultants, 1979,

Table 3-4

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage
Mean Base Case (BM)

Calendar Year	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petroleum	Dry Bulk	Mean Base Development (1)	Total	Petroleum	Whittier Dry Bulk	Mean Base Development (1)	Total	Petroleum	'can 'ase Development (1)	Total
1981	1	1.15	1.15	1.14	1.27	2.41	1.04	1.14	.89	2.03	1.00	,90	1.90
1982	2	1.25	1.24	1.24	1.27	2.51	1.05	1.24	.89	2.13	1.00	.90	1.90
1983	3	1.31	1.29	1.29	.56	1.85	1.07	1.29	.52	1.81	1.00	.60	1.60
1984	4	1.29	1.28	1.27	.57	1.84	1.11	1.27	.52	1.79	1.00	.60	1.60
1985	5	1.32	1.31	1.30	.02	1.32	1.17	1.30		1.30	1.00		1.00
1986	6	1.36	1.35	1.34	.03	1.37	1.17	1.34	.01	1.35	1.00		1.00
1987	7	1.41	1.40	1.39	.08	1.47	1.18	1.39	.01	1.40	1.00		1.00
1988	8	1.47	1.45	1.44	.16	1.60	1.18	1.44	.03	1.47	1.00		1.00
1989	9	1.53	1.51	1.50	.14	1.64	1.25	1.50	.02	1.52	1.00		1.00
1990	10	1.58	1.55	1.54	.14	1.68	1.30	1.54	.02	1.56	1.00		1.00
1991	11	1.64	1.61	1.59	.06	1.65	1.31	1.59	.01	1.60	1.00		1.00
1992	12	1.69	1.66	1.65	.05	1.70	1.33	1.65	.01	1.66	1.00		1.00
1993	13	1.75	1.72	1.70	.02	1.72	1.37	1.70		1.70	1.00		1.00
1994	14	1.82	1.78	1.76	.02	1.78	1.41	1.76		1.76	1.00		1.00
1995	15	1.88	1.84	1.82	.02	1.84	1.45	1.92		1.82	1.00		1.00
1996	16	1.95*	1.91	1.89	.02	1.91	1.50	1.89		1.89	1.00		1.00
1997	17	2.03*	1.98	1.96	.01	1.97	1.54	1.96		1.96	1.00		1.00
1998	18	2. 10*	2.06	2.03		2.03	1.59	2.03		2.03	1.00		1.00
1999	19	2. 19*	2.14	2.11		2.11	1.64	2.11		2.11	1.00		1.00
2000	20	2.27*	2.22	2.19		2.19	1.69	2.19		2.19	1.00		1.00
Threshold Value for Low Capacity		1.92	2.24	6.25		3.78	3.26	2.74		2.74			
Threshold Value for Nigh Capacity		2.70	3.54	9.09		5.42	4.64	3.90		3.90	No		
Low Value (year)		1.15 (1981)	1.15 (1981)	1.14 (1981)		1.32 (1985)	1.04 (1981)	1.14 (1981)		1.30 (1985)	increase		
High Value (year)		2.27 (2000)	2.22 (2000)	2.17 (2000)		2.51 (1982)	1.69 (2000)	2.19 (2000)		2.19 (2000)	expected		
Value Exceeding Low Capacity		*											
High Capacity		**											

Note: (1) Mean development includes Beaufort Sea OCS mean scenario, Lower Cook Inlet mean scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and Associates, 1979.

Table 3-4 (cont.)

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage - Mean Base Case (BM) (Cent.)

Calendar Year	Years After Lease Sale	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry Bulk	Yakutat Petroleum	Valdez Dry Bulk	Valdez Base Development	Valdez (1) Total	Valdez Petroleum	Valdez Base Development	Valdez (1) Total
1981	1	1.09	1.09	1.07	1.07	1.09	7.19	8.28	1.04	.06	1.10
1982	2	1.11	1.11	1.10	1.10	1.20	7.19	8.39	1.06	.06	1.12
1983	3	1.12	1.12	1.12	1.12	1.23	4.79	6.02	1.05	.04	1.09
1984	4	1.14	1.14	1.12	1.12	1.20	4.79	5.99	1.07	.04	1.11
1985	5	1.16	1.16	1.13	1.13	1.23		1.23	1.08		1.08
1986	6	1.18	1.18	1.15	1.15	1.26		1.26	1.10		1.10
1987	7	1.20	1.20	1.19	1.19	1.30		1.30	1.11		1.11
1988	8	1.22	1.22	1.22	1.22	1.35		1.35	1.14		1.14
1989	9	1.25	1.25	1.23	1.23	1.40		1.40	1.16		1.16
1990	10	1.27	1.27	1.32	1.32	1.44		1.44	1.19		1.19
1991	11	1.29	1.29	1.35	1.35	1.47		1.47	1.18		1.18
1992	12	1.32	1.32	1.39	1.39	1.51		1.51	1.20		1.20
1993	13	1.35	1.35	1.46	1.46	1.56		1.56	1.22		1.22
1994	14	1.37	1.37	1.49	1.49	1.60		1.60	1.24		1.24
1995	15	1.40	1.40	1.55	1.55	1.65		1.65	1.26		1.26
1996	16	1.43	1.43	1.58	1.58	1.70		1.70	1.29		1.29
1997	17	1.46	1.46	1.59	1.59	1.75		1.75	1.31		1.31
1998	18	1.50	1.50	1.64	1.64	1.81		1.81	1.33		1.33
1999	19	1.53	1.53	1.64	1.64	1.87		1.87	1.35		1.35
2000	20	1.57	1.57	1.65	1.65	1.93		1.93	1.38		1.38
Threshold Value for Low Capacity		3.23	2.15	9.09	11.20	19.90		19.90	3.09		3.09
Threshold Value for High Capacity		3.45	4.55	20.00	23.44	41.40		41.40	6.25		6.25
Low Value (year)		1.09 (1981)	1.09 (1981)	1.07 (1981)	1.07 (1981)	1.09 (1981)		1.23 (1985)	1.04 (1981)		1.08 (1981)
High Value (year)		1.57 (2000)	1.57 (2000)	1.65 (2000)	1.65 (2000)	1.93 (2000)		8.28 (1981)	1.38 (2000)		1.38 (2000)
Value Exceeding Low Capacity		*									
High Capacity		**									

Note: (1) Mean development includes Beaufort Sea OCS mean scenario, Lower Cook Inlet mean scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and Associates, 1979.

Table 3-5

Base Case Crude Oil Traffic From Valdez

	Annual Production (Millions of Bbl)[1]				Total Production/Year (Millions of Bbl)[2]			Tanker Sailings/Year[3]		
Year	Prudhoe Bay	Beaufort High	Beaufort Moderate	Beaufort Low	High Base	Moderate Base	Low Base	High Base	Moderate Base	Low Base
1978	237.3				237.3			255		
1979	474.5				474.5			510		
1980	584.0				584.0			629		
1981	595.7				595.7			641		
1982	607.5				607.5	Same as		654	Same as	
1983	619.6				619.6	for High Case		667	for High Case	
1984	631.5				631.5			680		
1985	641.5				641.5			691		
1986	613.2				613.2			660		
1987	545.7				545.7			588		
1988	511.9				511.9			551		
1989	475.4	45	15	11	520.4	490.4	486.4	560	528	524
1990	409.7	75	40	27	484.7	449.7	436.7	522	484	470
1991	367.7	90	54	35	457.7	421.7	402.7	493	454	434
1992	347.7	91	55	43	438.7	402.7	390.7	472	434	421
1993	329.4	91	55	43	420.4	384.4	372.4	453	453	401
1994	299.3	91	55	43	390.3	354.3	342.3	420	381	369
1995	268.3	91	54	43	359.3	322.3	311.3	387	347	335
1996	246.4	91	53	41	337.4	299.4	287.4	363	363	309
1997	228.1	89	52	39	317.1	280.1	267.1	341	341	288
1998	211.7	82	48	36	293.7	259.7	247.7	316	280	267
1999	197.5	70	43	32	267.5	240.5	229.5	288	259	247
2000	183.8	60	38	28	243.8	221.8	211.8	262	239	228

Notes: (1) Table assumes that all Beaufort Sea production will be transported by the trans-Alaska pipeline to Valdez and then shipped by tanker to West Coast ports.
(2) Total Production = (Prudhoe Bay + Beaufort Scenario).
(3) Tanker Trips/Day = (Total Production/Year)/(7.74)(120,000) . . Assumes average tanker fleet size of 120,000 DWT. 7.74 bbls = 1 long ton.

Source: Bureau of Land Management, 1979; Peter Eakland and Associates.

Table 3-6

Induced Air Travel from Yakutat, Cordova, and Seward Growth - Base Case[1]

Calendar Year	Cordova-Yakutat Induced YAK	Cordova-Yakutat Induced CDV	Cordova-Yakutat Total Weekly Trips	Yakutat-S.E. Induced YAK	Yakutat-S.E. Induced CDV	Yakutat-S.E. Total Weekly Trips	Seattle-S.E. Induced YAK	Seattle-S.E. Induced CDV	Seattle-S.E. Total Weekly Trips	Cordova-Anchorage Induced YAK	Cordova-Anchorage Induced CDV	Cordova-Anchorage Total Weekly Trips	Yakutat-Cordova Induced YAK	Yakutat-Cordova Induced CDV	Yakutat-Cordova Total Weekly Trips	Seward-Anchorage Weekly Trips
1981	8	15	23	11	15	26	7	11	18	7	26	33	7	8	15	9
1982	11	19	30	16	18	34	10	13	23	11	31	44	11	10	21	12
1983	13	22	35	20	21	41	13	15	28	13	36	49	13	12	25	17
1984	13	25	38	20	24	44	13	17	30	13	42	55	13	13	26	27
1985	14	28	42	21	27	48	14	19	33	14	47	61	14	15	29	40
1986	16	32	48	25	31	56	16	22	38	16	53	69	16	17	33	41
1987	21	35	56	32	34	66	20	24	44	21	59	80	21	19	40	42
1988	24	39	63	37	38	75	23	26	49	24	65	89	24	21	65	43
1989	25	42	67	38	41	79	24	29	53	24	72	96	24	23	47	58
1990	35	46	81	52	45	97	33	31	64	34	78	112	33	24	57	71
1991	38	50	88	58	49	107	36	34	70	37	85	122	37	27	64	74
1992	42	55	97	64	54	118	40	38	78	42	93	135	41	29	70	77
1993	50	59	109	76	58	136	48	41	89	49	101	150	48	32	80	86
1994	54	64	118	82	63	145	51	44	95	53	109	162	52	34	86	96
1995	60	69	129	90	68	158	57	47	104	58	117	175	57	37	94	106
1996	63	74	137	95	73	168	60	51	111	62	126	188	61	39	100	116
1997	64	80	144	97	78	175	61	54	115	63	135	198	62	42	104	127
1998	69	85	154	105	83	188	66	58	124	68	144	212	67	45	112	138
1999	69	91	160	105	89	194	66	62	128	68	154	222	67	48	115	150
2000	70	97	167	107	95	202	67	66	133	69	164	233	68	51	119	162

Note: (1) Induced travel is equal to summer weekly patronage on link multiplied by the growth factor. For these communities, only one base case has been forecast.

Source: Peter Eakland and Associates, 1979.

Table 3-7

Induced and Development Air Travel from Anchorage to Seattle - Base Cases

Calendar Year	Years After Lease Sale	Low Base Case: Low Growth	Non-Alaskan Round Trips: Beaufort Low	LCI Low	NW Gas Pipeline	Pac. LNG Plant	Total	Mean Base Case: Mean Growth	Non-Alaskan Round Trips: Beaufort Mean	LCI Mean	NW Gas Pipeline	Pac. LNG Plant	Total	High Base Case: High Growth	Non-Alaskan Round Trips: Beaufort High	LC1 High	NW Gas Pipeline	Pac. LNG Plant	Total
1981	1	1,815	98	147	184	19	2,263	1,905	98	614	184	19	2,801	1,853	98	409	184	19	2,563
1982	2	2,908	301	88	184	109	3,590	3,037	399	413	104	109	4,142	2,947	301	612	184	109	4,153
1983	3	3,564	316	59	615	171	4,725	3, 693	316	338	615	171	5,133	3,783	316	1,004	615	171	5,889
1984	4	3,500	358	30	602	54	4,544	3,629	358	402	602	54	5,045	3,925	35B	1,303	602	54	6,242
1985	5	3,796	109	30	34		3,969	3,925	109	390	34		4,458	4,246	109	1,101	34		5,490
1986	6	4,323	161				4,484	4,465	221	352			5,038	4,735	201	869			5,8o5
1987	7	4,915	243				5,158	5,083	441				5,524	5,353	366				5,719
1988	8	5,584	388				5,972	5,777	728				6,505	6,073	602				6,675
1989	9	6,'279	528				6,807	6,498	885				7,383	6,819	899				7,718
1990	10	6,935	501				7,436	7,128	760				7,888	7,450	903				8,353
1991	11	7,630	558				8,188	7,B10	673				8,483	t3, 158	969				9,127
1992	12	8,299	485				8,784	8,479	624				9,103	8,839	922				9,761
1993	13	9,058	464				9,522	9,238	561				9,799	9,624	879				10,503
1994	14	9,830	39				9,419	10,010	46				10,056	10,422	75				10,497
1995	15	10,641	18				10,659	10,847	23				10, L370	11,258	37				11,295
1996	16	11,477	5				11,482	11,734	7				11,741	12,107	11				12,118
1997	17	12,390					12,390	12,648					12,648	13,034					13,034
1998	18	13,355					13,355	13,600					13,600	14,012					14,012
1999	19	14,423					14,423	14,681					14,681	15,092					15,092
2000	20	15,465					15,465	15,723					15,723	16,160					16,160

source: Peter Eakland and Associates, 1979.

3.3.4.4 Summary of Impacts

The most evident impact will be capacity problems on the Seward Highway north of the Sterling Highway Junction.

3.3.5 SUMMARY OF MEAN BASE CASE

Terminal impacts for the marine mode will occur only at Anchorage, if at all. For the air mode, the extent of impacts on landing facilities depends upon the ability to divert training operations to feeder airports in the Anchorage area. Passenger terminal expansion will occur in Anchorage. Air carriers will be impacted by Federal deregulation which attempts to provide greater competition. Traffic will steadily increase on the main road leading to the Seward Highway. Congestion will occur more frequently, and in 1987, the 30th highest hour can be expected to be at level of service C. Although flow will still be stable, substantial reductions in operating speeds are possible.

3.4 Low Base Case: Comparison with Mean Base Case

3.4.1 FACTORS CAUSING GROWTH

The activities affecting growth in the low base case are the same as in the mean base case, except that the extent of OCS activities is reduced. Exploration only is assumed for the preceding lease sale in the Lower Cook Inlet (Sale CI) and a low level of development in the Beaufort Sea. Exploration in the Lower Cook Inlet sale will have been virtually completed in

198? . The lack of OCS development produces lower population levels in Anchorage. Population levels in the smaller communities -- Seward, Cordova, and Yakutat -- are unchanged from the mean base case. Thus, population-related transportation demands are not discussed in this section.

Table 3-6 shows the base year growth factors for regions which are a ratio of forecast to base year regional populations. In 1986, the factors are approximately 0.03 less for the Southcentral Region and 0.01 for Anchorage. By 2000, the difference for the Southcentral Region has fallen slightly to 0.025 and that for Anchorage increases to 0.02.

3.4.2 WATER MODE

3.4.2.1 Description of Activities

The differences in waterborne commerce are due to the slightly smaller regional population figures and the lack of major development and production phases for the OCS lease sales in the Beaufort Sea and Lower Cook Inlet (Sales No. CI). Decreases for base year growth factors are uniformly small and in most cases almost negligible. They never exceed 10% of the base year tonnage in any one year and approach that figure only at Seward in the late 1980's when development is scheduled in the low scenario of the Beaufort Sea lease sale.'"

3.4.2.2 Terminals

The impact on terminals within the study area of population growth and statewide development projects remains essentially the same in low base case as was discussed for the mean base case. As shown in Table 3-9, the low capacity threshold value will be exceeded in the same year, 1986; all other figures remain at acceptable levels.

The berth requirements at Valdez remain the same since the peak year of production occurs before the start of Beaufort Sea production. The time period in which at least four berths is required becomes shorter by three years, as seen in Table 3-5. The last year is 1990 rather than 1993 as in the mean base case.

3.4.2.3 Carriers

No changes from the mean base case are forecast for scheduled carriers. For contract carriers, the statewide demand for barges will be substantially reduced due to a significant reduction in OCS development activities, particularly in the Beaufort Sea.

3.4.2.4 Issues

Reduced demand will be noticed only at Seward and even there the reduction is less than 10% of the base year tonnage and occurs for only several years in the late 1980's. Essentially, issues discussed in the mean base case remain unchanged for the low base case.

3.4.2.5 Summary of Impacts

Impacts are virtually the same as in the mean base case. The demand for tanker berthes abates a bit sooner in the low base case but otherwise no discernible differences exist.

3.4.3 AIR MODE

3.4.3.1 Description of Activities

Passenger travel remains the same for all links except Anchorage-Seattle since forecasting for trips beginning in Yakutat, Seward, or Cordova are based on local population figures. No travel by development employees is assumed to travel on these links. Anchorage-Seattle passenger traffic above existing traffic for both the mean and low base cases is shown on Table 3-7. The largest differences occur early in the study period when employee movements of development projects are most pronounced. Low base case conditions cause a 19% drop in passenger traffic in 1981 on the Anchorage-Seattle link compared to the mean base case. By 1990, the difference has dropped to 6% and by 2000 has further dropped to 2%.

3.4.3.2 Terminals

The reduction from the mean (BM) to the low (BL) base case in passengers handled by Anchorage International Airport does not substantially reduce the urgency for passenger terminal improvements since the reduction never reaches 20% of the forecast growth in any one year. The timing of increases is shifted several years, but basic needs remain unchanged.

3.4.3.3 Carriers

Demand for scheduled carriers will remain approximately the same. Statewide business for contract cargo carriers and helicopter operators will be less.

3.4.3.4 Issues

Issues remain unchanged although in some cases the urgency of the issues is slightly diminished.

3.4.3.5 Summary of Impacts

Growth will be lower in the low base case for the Anchorage-Seattle market, especially at the beginning of the study. Basically, the timing and extent of air facility and services remains unchanged compared to the mean base case.

3.4.4 LAND MODES

3.4.4.1 Roads

As with other facilities whose traffic is related to Anchorage-area population growth, the Seward Highway between Girdwood and the Sterling Highway Junction will see a slight shift in congestion levels but not enough to affect the need to upgrade capacity by 1987. A statewide reduction in demand for the motor carrier industry can be expected since only a low level of OCS development activities will occur to take the place of the gas pipeline project, scheduled for completion in 1984.

3.4.4.2 Railroads

Decreases in tonnage on the railroad will be related primarily to reduced development in the Beaufort Sea.

3.4.4.3 Issues

For road construction, the funding problem remains paramount. The railroad and the trucking industry respond to state-wide as well as local and regional shifts in transportation demands, and a fall-off in demand within the study area will not be critical if other projects in the interior of the state materialize.

3.4.5 SUMMARY OF LOW BASE CASE

Steady population growth in Anchorage, even if development and production do not occur in preceding OCS lease sales, will for the most part justify the need for improvements in marine, air, and land facilities identified in the discussion of the mean base case. A demand shift of one to two years at most will occur. No peak levels of demand since they occur late in the study period or are unaffected by the differences between base cases. Noticeable decreases in demand, principally on the Anchorage-Seattle link for passengers and for dry freight at the Port of Seattle, occur relatively early in the study period.

Table 3-8

Regional Population Projections: Low Base Case (BL)

Year	Statewide	Anchorage	Southcentral	Fairbanks
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Factors to Produce Forecasts		
1978	0.990	1.038	0.914	0.925
1979	1.017	1.056	0.934	0.983
1980	1.051	1.085	0.972	1.042
1981	1.100	1.141	1.005	1.137
1982	1.175	1.226	1.034	1.325
1983	1.215	1.277	1.026	1.405
1984	1.211	1.272	1.041	1.330
1985	1.229	1.295	1.052	1.364
1986	1.262	1.336	1.069	1.422
1987	1.301	1.382	1.090	1.485
1988	1.343	1.434	1.113	1.552
1989	1.386	1.488	1.136	1.620
1990	1.427	1.539	1.163	1.682
1991	1.465	1.593	1.156	1.750
1992	1.503	1.645	1.175	1.813
1993	1.547	1.704	1.194	1.883
1994	1.590	1.764	1.216	1.954
1995	1.636	1.827	1.237	2.028
1996	1.683	1.892	1.259	2.103
1997	1.734	1.963	1.281	2.186
1998	1.787	2.038	1.302	2.272
1999	1.845	2.121	1.328	2.368
2000	1.905	2.202	1.355	2.468

Source: ISER, 1979,

Table 3-9

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage - Low Base Case (BL)

		Anchorage		Seward				Whittier					
Calendar Year	Years After Lease Sale	Dry Bulk	Petroleum	Dry Bulk	Low Development (1)	Total	Petroleum	Dry Bulk	Low Development (1)	Total	Petroleum	Low Development (1)	Total
1981	1	1.14	1.14	1.13	1.26	2.39	1.04	1.13	.89	2.02	1.00	.90	1.90
1982	2	1.25	1.23	1.23	1.26	2.49	1.05	1.23	. 89	2.02	1.00	.90	1.90
1983	3	1.30	1.28	1.28	.55	1.83	1.07	1.28	.51	1.79	1.00	.60	1.60
1984	4	1.28	1.28	1.26	.56	1.82	1.11	1.26	.51	1.77	1.00	.60	1.60
1985	5	1.31	1.30	1.28	.01	1.29	1.17′	1.28		1.28	1.00		1.00
1986	6	1.35	1.34	1.33	.02	1.35	1.17	1.33		1.33	1.00		1.00
1987	7	1.40	1.38	1.37	.05	1.42	1.18	1.37	.01	1.38	1.00		1,00
1988	8	1.46	1.43	1.43	.09	1.52	1.18	1.43	.01	1.44	1.00		1.00
1989	9	1.51	1.49	1.48	.08	1.56	1.25	1.48	.01	1.49	1.00		1.00
1990	10	1.57	1.54	1.53	.07	1.60	1.30	1.53	.01	1.54	1.00		1.00
1991	11	1.62	1.59	1.58	.06	1.64	1.31	1.58	.01	1.59	1.00		1.00
1992	12	1.68	1.65	1.63	.02	1.65	1.33	1.63		1.63	1.00		1.00
1993	13	1.74	1.70	1.69	.01	1.70	1.37	1.69		1.69	1.00		1.00
1994	14	1.80	1.76	1.75		1.75	1.41	1.75		1.75	1.00		1.00
1995	15	1.87	1.83	1.81		1.81	1.45	1.81		1.81	1.00		1.00
1996	16	1.93*	1.89	1.87		1.87	1.50	1.87		1.87	1.00		1.00
1997	17	2.01*	1.96	1.94		1.94	1.54	1.94		1.94	1.00		1.00
1998	18	2. 08*	2.04	2.01		2.01	1.59	2.01		2.01	1.00		1.00
1999	19	2.17*	2.12	2.09		2.09	1.64	2.09		2.09	1.00		1.00
2000	20	2.26*	2.20	2.17		2.17	1.69	2.17		2.17	1.00		1.00
Threshold Value for Low Capacity		1.92	3.54	6.25		3.76	3.26	2.74		2.74	No		
Threshold Value for High Capacity		2.70	3.24	9.09		5.42	4.64	3.90		3.90	increase		
Low Value (year)		1.14 (1981)	1.14 (1981)	1.13 (1981)		1.29 (1985)	1.04 (1981)	1.13 (1981)		1. 28 (1985)	expected		
Nigh Value (year)		2.26 (2000)	2.20 (21200)	2.17 (2000)		2.49 (1982)	1.69 (2000)	2.17 (2000)		2.17 (2000)			
Value Exceeding Low Capacity		*											
Nigh Capacity		**											

Note: (1) Low development includes Beaufort Sea OCS low scenario, Lower Cook Inlet low scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and AssOcia Les, 1979.

Table 3-9 (Cont.)

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage -
Law Base Case (BL) (Cont.)

Calendar Year	Years After Lease Sale	Cordova		Yakutat							
		Dry Bulk	Petroleum	Dry Bulk	Petroleum	Dry Bulk	Low Development (1)	Total	Petroleum	Low Development (1)	Total
1981	1	1.09	1.09	1.07	1.07	1.31	7.19	8.50	1.01	.06	1.07
19S2	2	1.11	1.11	1.10	1.10	1.18	7.19	8.37	1.03	.06	1.09
1983	3	1.12	1.12	1.12	1.12	1.22	4.79	6.01	1.03	.04	1.07
1984	4	1.14	1.14	1.12	1.12	1.19	4.79	5.98	1.04	.04	1.08
19s5	5	1.16	1.16	1.13	1.13	1.21		1.21	1.05		1.05
1986	6	1.18	1.18	1.15	1.15	1.25		1.25	1.07		1.07
19s7	7	1.20	1.20	1.19	1.19	1.29		1.29	1.09		1.09
1988	8	1.22	1.22	1.22	1.22	1.33		1.33	1.11		1.11
19s9	9	1.25	1.25	1.23	1.23	1.38		1.38	1.13		1.13
1990	10	1.27	1.27	1.32	1.32	1.42		1.42	1.16		1.16
1991	11	1.29	1.29	1.35	1.35	1.45		1.45	1.16		1.16
1992	12	1.32	1.32	1.39	1.39	1.49		1.49	1.18		3.18
1993	13	1.35	1.35	1.46	1.46	1.54		1.54	1.19		1.19
1994	14	1.37	1.37	1.49	1.49	1.59		1.59	1.22		1.22
1995	15	1.40	1.40	1.55	1.55	1.63		1.63	1.24		1.24
1996	16	1.43	1.43	1.58	1.58	1.68		1.68	1.26		1.26
1997	17	1.46	1.46	1.59	1.59	1.73		1.73	1.28		1.28
1998	18	1.50	1.50	1.64	1.64	1.79		1.79	1.30		1.30
1999	19	1.53	1.53	1.64	1.64	1.85		1.85	1.33		1.33
2000	20	1.57	1.57	1.64	1.64	1.91		1.91	1.36		1.36
Threshold Value for Low Capacity		3.23	2.15	9.09	11.20	19.90		19.90	3.09		3.09
Threshold Value for Nigh Capacity		3.45	4.55	20.00	23.44	41.40		41.40	6.25		6.25
Low Value (year)		1.09 (1981)	1.09 (1981)	1.07 (1981)	1.18 (1982)	1.18 (1982)		1.21 (1985)	1.01 (1981)		1.05 (1985)
High Value (year)		1.57 (2000)	1.57 (2000)	1.64 (2000)	1.64 (2000)	1.91 (2000)		8.50 (1981)	1.36 (2000)		1.36 (2000)
Value Exceeding Low Capacity		*									
Nigh Capacity		* *									

Note : (1) Low development includes Beaufort Sea OCS low seen.rio, Lower Cook Inlet low scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and Associates, 1979.

3.5 High Base Case: Comparison with Mean Base Case

3.5.1 FACTORS CAUSING GROWTH

The only difference between the mean and the high base cases is that a higher level of development and production results from the Lower Cook Inlet (Sale CI) and Beaufort Sea OCS lease sales. Discoveries at the high (5% probability) level in these areas will result in larger direct OCS transportation demands for employees and freight but also larger indirect demands resulting from population increases at the local and regional 1 evels. Regional popu' ation factors for the high base case are shown in Table 3-10. Discuss" on for the high base case, as was true for the low base case, will be limited to changes in direct OCS demands and demands affected by regional-level causes. Only a single base case was constructed for the local communities. The transportation of goods through the ports of Anchorage, Seward, and Whittier will increase in the high base case as will passengers through the Anchorage air terminal.

3.5.2 WATER MODE

3.5.2.1 Description of Activities

For the Ports of Anchorage, Seward, and Whittier, incremental increases in regional population, compared to the mean base case, produce corresponding incremental increases in population-related tonnage (Table 3-11). By the year 2000, the increase in the base year growth factors is only 0.04 for petroleum and dry bulk in Anchorage and 0.03 for dry bulk in Seward and

Whittier. High base development activities introduce increases in tonnage for Whittier and Seward in the late 1980's. The high base year growth factor for the period in Seward continues to be in 1982 but increases from 0.20 to 0.26 occur from 1987 to 1989. At Whittier, the increases are more modest, reaching a high of 0.06 in 1989.

3.5.2.2 Terminals

At Anchorage, the low capacity threshold for dry freight is first exceeded in 1996, the same year as in the mean base case. The low capacity threshold for petroleum products is first exceeded in 2000 for the high base case but not at all in the mean base case.

Forecast tonnage in the high base case is identical for the mean base case at the ports of Valdez, Cordova and Yakutat. Increases in tonnage at Whittier and Seward occur, especially in the late 1980's, but the high values are only marginally affected. Since they still fall significantly short of even the low capacity threshold values, no change in imports is foreseen for the high base case.

3.5.2.3 Carriers

No changes from the base case are forecast for scheduled carriers because of the small changes in forecast tonnage of the high base case in comparison to the mean base case.

3.5.2.4. Issues

No new issues arise in the high base case.

3.5.2.5 Summary of Impacts

Low thresholds are reached at the Port of Anchorage in the high base case for both dry freight and petroleum late in the study period. Small changes in tonnage at Seward and Whittier do not affect impacts at those facilities.

3.5.3 AIR MODE

3.5.3.1 Description of Activities

Direct air passenger demands on the Anchorage-Seattle link related to development and production activities will be of a higher magnitude and of longer duration than were experienced during the mean base case. In addition, increases will occur because of increased population in Anchorage.

The additional passenger demands forecast on this link for the mean and high base cases are shown on Table 3-7. Increases for the high base case are derived principally from increased oil and gas activity in the Beaufort Sea and Lower Cook Inlet. The largest increase percentage-wise and in number of passengers occurs in 1984. The passenger increase is 1,032 trips/week the percentage increase is 23%. This increase converts to an additional 13 flights per week, or almost two flights per day. An increase of 700 passengers per week occurs at late as 1993, but by 1997 interstate travel related to development activities ceases. The increase is only 437 passengers by the year 2000.

3.5.3.2 Terminals

The additional passenger travel to and from Anchorage International Airport can be accommodated by the Master Plan which has recently been approved. Passenger terminal improvements most likely will be in place by the mid-1980's when needs will become critical. The increase in base development passengers of over 1,000 passengers per week in 1984 on the Anchorage-Seattle link will have twice the impact of population-related growth in the Anchorage region since these trips have begun in other cities. The total additional passenger demand in 1984 of 6,242 will produce 17,118 boardings and deplaning compared to 12,922 fur the passenger demand of 5,045 in the mean base case.

3.5.3.3 Carriers

The increase in traffic is expected to cause a continued shift towards larger aircraft on the Anchorage-Seattle link. Carriers should be able to meet increased demands on existing routes. However, the large demand due to petroleum industry activities could lead to direct flights to Anchorage by a carrier such an Braniff with extensive routes in the south and southwest of the country, especially once deregulation of the air carrier industry becomes complete.

3.5.3.4 Issues

Key issues remain the manner in which deregulation is carried out by the Federal and state governments and how the State carries out its capital improvement plan for Anchorage International Airport.

3.5.4 LAND MODES

3.5.4.1 Roads

An incremental population increase in the Anchorage region over the mean base case will cause a given level of traffic to occur one year earlier on the Seward Highway.

3.5.4.2 Railroad

Additional traffic will occur on the Alaska Railroad, particularly due to increased OCS development in the Beaufort Sea, but the tonnage can easily be accommodated,.

3.5.4.3 Issues

No change in issues. The funding for road construction, which was inadequate in the mean base case, becomes more critical as the need for capacity improvements for the road leading to the Kenai Peninsula occurs at an earlier date.

3.5.4.4 Summary of Impacts

Land impacts are confined to congestion problems occurring earlier on the Seward Highway leading from Anchorage to the Kenai Peninsula.

3.5.5 SUMMARY OF HIGH BASE CASE

Compared to the mean base case, the high base case will increase the need for port improvements in Anchorage and passenger facilities at Anchorage International Airport. The latter is more critical because of the high demand early in the study period. No impacts on scheduled carriers will occur in any of the modes. Existing carriers providing incremental increases in service over the study period should be able to handle projected traffic demands.

Table 3-10

Regional Population Projections: High Base Case (BH)

Year	Statewide	Anchorage	Southcentral	Fairbanks
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Factors to Produce Forecasts		
1978	0.990	1.038	0.914	0.925
1979	1.017	1.056	0.934	0.983
1980	1.051	1.085	0.972	1.042
1981	1.104	1.144	1.028	1.138
1982	1.180	1.229	1.075	1.321
1983	1.235	1.294	1.113	1.410
1984	1.247	1.305	1.159	1.353
1985	1.265	1.330	1.152	1.387
1986	1.293	1.368	1.149	1.438
1987	1.331	1.416	1.156	1.503
1988	1.375	1.472	1.178	1.572
1989	1.421	1.530	1.203	1.643
1990	1.462	1.579	1.232	1.704
1991	1.501	1.634	1.223	1.769
1992	1.541	1.687	1.246	1.838
1993	1.586	1.748	1.265	1.912
1994	1.631	1.810	1.287	1.985
1995	1.679	1.875	1.310	2.061
1996	1.726	1.941	1.333	2.136
1997	1.777	2.013	1.355	2.220
1998	1.830	2.089	1.376	2.306
1999	1.890	2.173	1.401	2.404
2000	1.951	2.256	1.428	2.505

Source: ISER, 1979,

Table 3-11

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage - High Base Case (BH)

Calendar Year	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petroleum	Seward Dry Bulk	Seward Low Development	Seward (1) Total	Seward Petroleum	Whittier Dry Bulk	Whittier Low Development	Whittier (1) Total	Whittier Petroleum	Whittier Low Development	Whittier (1) Total
1981	1	1.14	1.14	1.13	1.30	2.43	1.04	1.13	.90	2.03	1.00	.90	1.90
1982	2	1.25	1.23	1.23	1.30	2.53	1.05	1.23	.90	2.13	1.00	.90	1.90
1983	3	1.32	1.29	1.30	.59	1.89	1.07	1.30	.52	1.82	1.00	.60	1.60
1984	4	1.31	1.31	1.30	.06	1.36	1.11	1.30	.52	1.82	1.00	.60	1.60
1985	5	1.34	1.33	1.32	.10	1.42	1.17	1.32	.01	1.33	1.00		1.00
1986	6	1.38	1.37	1.36	.19	1.55	1.17	1.36	.03	1.39	1.00		1.00
1987	7	1.43	1.42	1.41	.32	1.73	1.1s	1.41	.04	1.45	1.00		1.00
1988	8	1.49	1.47	1.46	.37	1.83	1.18	1.46	.04	1.50	1.00		1.00
1989	9	1.55	1.53	1.52	.32	1.84	1.25	1.52	.08	1.60	1.00		1.00
1990	10	1.60	1.58	1.57	.20	1.77	1.30	1.57	.07	1.64	1.00		1.00
1991	11	1.66	1.63	1.62	.10	1.72	1.31	1.62	.04	1.66	1.00		1.00
1992	12	1.72	1.69	1.67	.06	1.73	1.33	1.67	.01	1.68	1.00		1.00
1993	13	1.70	1.75	1.73	.04	1.77	1.37	1.73	.01	1.74	1.00		1.00
1994	14	1.85	1.81	1.79	.03	1.82	1.41	1.79	.01	1.80	1.00		1.00
1995	15	1.91	1.88	1.86	.01	1.87	1.45	1.86		1.86	1.00		1.00
1996	16	1.98*	1.94	1.92		1.92	1.50	1.92		1.92	1.00		1.00
1997	17	2.05*	2.01	1.99		1.99	1.54	1.99		1.99	1.00		1.00
1998	18	2.13*	2.09	2.06		2.06	1.59	2.06		2.06	1.00		1.00
1999	19	2.22*	2.17	2.14		2.14	1.64	2.14		2.14	1.00		1.00
2000	20	2.31*	2.26*	2.22		2.22	1.69	2.22		2.22	1.00		1.00
Threshold Value for Low Capacity		1.92	2.24	6.25		3.78	3.26	2.74		2.74	No		
Threshold Value for High Capacity		2.70	3.54	9.09		5.42	4.64	3.90		3.90	increase		
Low Value (year)		1.14 (1981)	1.14 (1981)	1.13 (1981)		1.36 (1984)	1.04 (1981)	1.13 (1981)		1.33 (1985)	expected		
High Value (year)		2.31 (2000)	2.26 (2000)	2.22 (2000)		2.22 (2000)	1.69 (2000)	2.22 (2000)		2.22 (2000)			
Value Exceeding Low capacity		*											
High Capacity		**											

Note: (1) High base development includes Beaufort Sea OCS high scenario, Lower Cook Inlet high scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and Associates, 1979.

Table 3-11 (cont.)

Base Year Growth Factors by Port for Dry Bulk and Petroleum Tonnage - High Base Case (BH) (Cont.)

Calendar Year	Years After Lease Sale	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry Bulk	Yakutat Petroleum	Valdez Dry Bulk	Valdez Low Development (1)	Valdez Total	Valdez Petroleum	Valdez Low Development (1)	Valdez Total
1981	1	1.09	1.09	1.07	1.07	1.08	7.19	8.27	1.03	.06	1.09
1982	2	1.11	1.11	1.10	1.10	1.20	7.19	8.39	1.08	.06	1.14
1983	3	1.12	1.12	1.12	1.12	1.26	4.79	6.05	1.11	. D4	1.15
1984	Q	1.14	1.14	1.12	1.12	1.26	4.79	6.05	1.16	.04	1.20
1985	5	1.16	1.16	1.13	1.13	1.27		1.27	1.15		1.15
1986	6	1.18	1.18	1.15	1.15	1.29		1.29	1.15		1.15
1987	7	1.20	1.20	1.19	1.19	1.33		1.33	1.16		1.16
1988	8	1.22	1.22	1.22	1.22	1.38		1.38	1.18		1.18
1989	9	1.25	1.25	1.23	1.23	1.42		1.42	1.20		1.20
1990	10	1.27	1.27	1.32	1.32	1.47		1.47	1.23		1.23
1991	11	1.29	1.29	1.35	1.35	1.50	.	1.50	1.22		1.22
1992	12	1.32	1.32	1.39	1.39	1.54		1.54	1.25		1.25
1993	13	1.35	1.35	1,46	1.46	1.59		1.59	1.27		1.27
1994	14	1.37	1.37	1,49	1.49	1.64		1.64	1.29		1.29
1995	15	1.40	1.40	1.55	1.55	1.69		1.69	1.31		1.31
1996	16	1.43	1.43	1.58	1.58	1.73		1.73	1.33		1.33
1997	17	1.46	1.46	1.59	1.59	1.79		1.79	1.36		1.36
1998	18	1.50	1.50	1.64	1.64	1.84		1.84	1.38		1.38
1999	19	1.53	1.53	1.64	1.64	1.90		1.90	1.40		1.40
2000	20	1.57	1.57	1.65	1.65	1.97		1.97	1.43		1.43
Threshold Value for Low Capacity		3.23	2.15	9.09	11.20	19.90		19.90	3.09		3.09
Threshold Value for High Capacity		3.45	4.55	20.00	23.44	41.40		41.40	6.25		6.25
Low Value (year)		1.09 (1981)	1.09 (1981)	1.07 (1981)	1.07 (1981)	1.08 (1981)		1.27 (1985)	1.03 (1981)		1.09 (1981)
High Value (year)		1.57 (2000)	1.57 (2000)	1.65 (2000)	1.65 [2000]	1.97 (2000)		8.27 (1981)	1.43 (2000)		1.43 (2000)
Value Exceeding Low Capacity		*									
High Capacity		* *									

Note: (1) High base development includes BeauFort Sea OCS high scenario, Lower Cook Inlet high scenario, Northwest gas pipeline, and Pacific LNG.

Source: Peter Eakland and Associates, 1979.

4.0 NORTHERN GULF OF ALASKA OCS CASES

4.1 Introduction

The purpose of this chapter is to present for the OCS cases indirect and direct transportation demands and their associated impacts within the study area by mode. Impacts are analyzed at both the regional and local levels. The analysis of local impacts focuses on the communities of Seward, Cordova, Yakutat, and Anchorage. The analysis of regional impacts focuses on routes, especially for the marine mode and intercity roads on the Kenai Peninsula. Port facilities in Valdez and Whittier are included as part of the regional marine transportation network.

Figure 1-2 shows the location of areas selected for development in the Yakutat, Yakataga, and Middleton Shelves (Dames and Moore, 1978). Figures 2-6 and A-19, respectively, show the location of scheduled marine transportation routes and supply boat routes. The estimated location of oil and gas discoveries falls east of shipping lanes to Anchorage but in proximity to tanker routes between Valdez and the West Coast. Three types of potential vessel conflicts exist, as follows: (1) conflicts between fishing and supply boats in the areas being developed and in the approach to Cordova, Seward, and Yakutat's port facilities; (2) conflicts between commercial carriers and supply boats in the approach to port facilities and where routes from Seward cross commercial routes, and (3) conflicts between tankers serving Valdez and traffic related to Northern Gulf of

Alaska OCS activities. For air and land modes, direct and indirect transportation traffic tend to travel on the same routes and use the same facilities and services. In such cases, the emphasis is less on conflicts between users but more on the impacts of cumulative transportation demands.

Each OCS case has associated with it one of the three base cases and one of the three Northern Gulf of Alaska scenarios. Of the nine possible combinations of base cases and OCS scenarios, five have been selected by the Bureau of Land Management for analysis, as shown in Figure 1-5. Three of the OCS cases provide the range of impacts for the mean base case assumptions. They are the low-OCS-mean base case (LBM), the mean-OCS-mean base case (MBM), and the high-OCS-mean base case (HBM). The remaining two cases represent the high and low extremes of cumulative transportation demands. They are the 1ow-OCS-1OW base (LBL) and the high-OCS-high base case (HBH). Three types of impacts are assessed. First is an assessment of the cumulative transportation demands for an individual OCS case. Second, the cumulative impacts are compared to the impacts of the associated base case to produce an incremental impact assessment. Finally, for the LBM and HBM cases, the emphasis is on assessing differences between the cumulative impacts of these cases and those for the MBM case. The emphasis is on the mean OCS-mean base case (MBM), since by definition it represents the case most likely to occur.

Figure 1-5 graphically shows how the transportation demands for the OCS cases are generated. Three data sets are involved, as follows: (1) data carried forward from the base cases; (2) induced, or population-related demands; and (3) direct transportation demands for each Northern Gulf of Alaska scenario.

- Base case data. The only transportation demands carried forward intact from the base cases are direct transportation demands of special developments and previous oil and gas lease sales.

- Induced demands. These demands correspond to two of the data sets used in the base cases - existing local population and 20-year forecasts, and existing regional population and 20-year forecasts. For local communities--Seward, Yakutat, and Cordova--total population forecasts are made for each scenario, since only a single base forecast is made. At the regional level, including Anchorage, separate population forecasts are made for each of the five OCS cases. Converting population figures into demands is accomplished using the same methodology as for the base cases.

- Western Gulf of Alaska scenario demands. Direct transportation demands are developed for each scenario and are incremental in nature. Where appropriate, they are combined with direct demands of base case development activities to produce cumulative demands.

4.2 Review of Mean Base Case

Transportation impacts of growth and development activities forecast for the mean base case vary from community to community. At the Port of Anchorage, the low capacity threshold value will be reached for dry bulk in 1996 but only approached for petroleum by 2000. Increases in air passenger traffic to and from Anchorage, particularly on the Anchorage-Seattle route, will create demands for a larger terminal. Runway capacity at Anchorage International Airport will be adequate during the study period if training operations can be eliminated. Priorities at Anchorage are first for air facilities and ater for marine facilities.

The remaining facilities examined for the marine mode are forecast to be adequate for the entire study period. They include ports in Seward, Yakutat, Cordova, Valdez, and Whittier. Runways in Cordova, Seward, and Yakutat will receive additional flight operations, but total operations in each case will not approach the capacity.

Non-stop air service between Anchorage and Seattle will more than double, and an additional flight will be required on the commuter route serving Seward and the jet route serving Cordova and Yakutat. The Anchorage-Cordova link is the critical link on the latter route.

4.3 Mean-OCS-Mean Base Case (MBM)

4.3.1 FACTORS CAUSING GROWTH

Table 4-1 shows the incremental base year growth factors for Fairbanks and the two regions in the primary study area--Anchorage and Southcentral

Alaska (excluding Anchorage). The factors are the population difference between the mean OCS-mean base case (MBM) and the mean base case (BM) expressed as a percentage of the base year population. For Anchorage, the incremental factors do not reach 1% until 1986, peak at 5.4% in 1990, and remain at approximately 4% for the second half of the study period. For the Southcentral region, the percentage increases are approximately double those for Anchorage. The peak is 11.5% in 1990 and lessens to approximately 8% for most of the second half of the study period.

Table 4-2 shows the population forecasts at the local level for the three OCS scenarios, and Table 4-3 shows these data converted into incremental base year growth factors. In the mean OCS case, the largest increase in growth factors occurs for Yakutat, followed by Cordova and finally Seward.

In Yakutat, steady population growth during the exploration phase results in incremental growth factors of 31%, but development brings even greater increases. In 1986, the forecast MBM population first exceeds the largest population figure in the mean lease case. By 1991, the total population is 3,606 which results in an incremental growth factor of 5.0. A slight decrease in population then occurs, and the growth factor in 2000 is 4.825.

For Cordova, a dramatic jump in population occurs from 1987 to 1988. Until 1987, the incremental growth rate factors are less than 2.5%, but thereafter are 20-25%. At Seward, OCS is limited to the exploration and development phases. Incremental growth factors reach a high of 14.8% in 1989 but fall to only 1.4% by 1994.

Activities in the mean OCS case are forecast only for the Yakutat and Middleton Shelves. Tables 4-4 and 4-5 show the extent and timing of activities that produce direct transportation demands for each of these shelves. Economic discoveries of both oil and gas are made in both the Yakutat and Middleton Shelves. Supply bases are constructed at Seward and Yakutat. LNG plants and oil terminals are constructed at Yakutat and on Hinchinbrook Island. Logistics for exploration are shared between Seward and Yakutat. Cordova shares logistics support for the production phase in the Middleton Shelf with Seward. Helicopters move offshore employees to either Yakutat or Cordova, depending upon the location of the activities. From these communities, scheduled airlines are assumed to carry nonlocal employees to their cities of residence.

Total reserves discovered and developed in the mean reseource level scenario are as follows: oil --- 1,400 mmbbl, associated gas --- 1,000 Bcf, and non-associated gas --- 4,000 Bcf. For all three types of reserves, one-quarter was assumed to be located in the Middleton Shelf and three-quarters in the Yakuta Shelf. No economic reserves were assumed to be found in the Yakataga Shelf (Dames and Moore, 1978).

4.3.2 WATER MODE

4.3.2.1 Description of Activities

Industrial Freight. Commodities used for drilling and construction and consumables for nonlocal and offshore employees constitute industrial freight. Drilling supplies can be broken down into drill pipe, dry bulk, fuel, and drill water while categories of construction tonnage include equipment, materials and camp modules. Logistics for drilling occurs throughout the year, but movement of construction-related tonnage will take place principally during the summer. Tables 4-6 and 4-7 show the tonnages required for drilling operations supplied by Yakutat and Seward, respectively. Seward is assumed to provide all support during exploration and development for the Middleton Shelf, and Yakutat the same level of support for the Yakutat Shelf.

Barges and small tankers will carry the inbound cargo, which will then be delivered by supply boats to drill rigs and platforms on an as-needed basis. Maximum tonnage occurs in 1988 and 1989 when three inbound barges and four tankers are forecast. The minimum number of supply boat trips needed for this peak load is 73, based on the material presented in Table A-4 in the Appendix. The actual number of annual supply boat trips will be considerably larger because not all trips will have capacity loads and they are used for purposes other than supporting drilling. The peak inbound loads represent 20% of the base year tonnage. Throughput factors are twice this figure, or 40%. Construction activities at Seward during the mean OCS scenario include construction of a support base in 1985, as shown in Table 4-9. This table summarizes the tonnage requ· red for all construction activities.

For Yakutat, tonnage for both drilling and construction activities is greater than those for Seward. The only activity missing in Yakutat is concrete coating of pipe for offshore pipelines. A moderate level of activity occurs as shown in Table 4-6 from 1981 to 1988 but the level of drilling sharply increases for the next four years. The peak occurs in 1991 when an estimated 13 dry goods barges and 18 fuel tankers would be required. This inbound cargo is almost 53 times Yakutat's base level for dry goods and 10 times that for fuel. For this peak activity, a minimum of 387 annual supply boat trips, or more than one a day, would be required. However, as noted, actual supply boat movements will be dramatically higher. Construction of the LNG plant and oil terminal in Yakutat will take place from 1986 to 1989, and at least 20 barges are forecast for the first threes of activity, as shown on Table 4-9. Conversions of the industrial tonnage categories into lease year factors are shown in Table 4-13.

Cordova is not anticipated to handle any heavy industrial freight. Trips there by supply boats will be limited to receiving miscellaneous supplies during the production phase.

Table 4-12 shows the extent of inbound tonnage for consumable supplies, which are for supporting offshore and non-local construction workers. The quantities are modest particularly from the point of view of marine carriers. The peak for Yakutat is 15 containers per month in 1988, seven containers per month for Cordova in 1990, and one container for Seward. These supplies are expected to travel primarily via marine and air carriers for Cordova and Yakutat and marine and land carriers for Seward.

Supply Boat Movements and Berths. Table 4-1 shows the estimated number of monthly boat round-trips during the summer months based on assumptions contained in Table A-10. For Seward, the largest number of monthly trips is 131 and occurs in 1986. A total o' four berths is required in that year and at least two berths for the next three years. Otherwise, a single berth is adequate to handle log' sties requirements. A single berth is adequate throughout the study per od for Cordova once supply boat activities begin in 1988. For Yakutat, peak supply boat activity occurs in 1991 and at 264 trips per month is approximately twice the peak forecast for Seward. Two berths are required as soon as exploration begins in 1981, and berth requirements for the peak period are five berths. More than two berths are required from 1988 to 1992.

Table 4-14 shows the estimated daily frequency of different types of vessels. At Seward and Cordova, movements of fishing vessels will be significantly greater than those of supply boats, whereas in Yakutat for the mean base case the maximum number of daily supply boat movements will be approximately the same as fishing boat movements.

Induced Growth. Table 4-12 contains the base-year growth factors for the six primary port facilities that have been analyzed. Regional increases produce only incremental growth in tonnage at the ports of Anchorage, Seward, Whittier, and Valdez. Increases compared to the mean base case generally fall in the range of 0.05 which is less than the annual increase of factors in the mean base case. Anchorage's low capacity threshold is reached in 1995, a year earlier than in MBM. Increases in the growth factors for tonnage at Cordova and Yakutat are greater than for communities with regional markets, but the largest figures still fall considerably short of even the computed values for low capacity thresholds.

Transportation of Oil and Gas. Table 4-15 shows the estimated production of oil and gas from the Yakutat and Middleton Shelf fields. Offshore and onshore loading of oil production are listed separately because of their different impacts. Production in the Yakutat Shelf peaks at 151.6 million barrels (mmbbls), of which 54% reaches an onshore oil terminal and the rest is loaded offshore. LNG production peaks a year earlier at 341.6 billion cubic feet (BCF). The Hinchinbrook oil terminal handles all of the oil produced in the Middleton Shelf. Peak annual production is 35.0 mmbbl and occurs from 1990 to 1992. Peak LNG production from the Middleton Shelf is 95.1 BCF and occurs from 1993 to 1995. The assumed vessel capacities are 120,000 long tons for oil tankers and 2.8 BCF for LNG. Using these figures, the peak number of annual oil tankers and LNG vessels, respectively, arriving in the Yakutat area are 163 and 122. For the Hinchinbrook facilities, the corresponding numbers are 38 tankers and 34 LNG vessels.

4.3.2.2 Summary of Impacts

Terminals. No significant impacts are likely to occur at port facilities where the increases in tonnage compared to the mean base case are related solely to increases in population. The effect of increases is felt more in Anchorage than other ports because computed low capacity thresholds are exceeded for both dry bulk and fuel late in the study period. Slight increases in waiting time for vessels to use berths in Anchorage probably will occur, particularly for those berths where users do not operate on strict schedules.

The potential for major impacts occurring at marine terminals exists primarily at Seward and Yakutat, the communities receiving most of the direct OCS-related transportation demands. Elsewhere, existing facilities will be adequate for the entire study period. For Seward and Yakutat, the extent of impacts will depend upon t'he timing of construction for new facilities, the facilities to be used by each category of freight, and to a lesser degree seasonal differences in demand.

At Yakutat, existing facilities include a two-berth supply base (owned by ARCO) and separate facilities for dry bulk (city-owned) and fuel deliveries. The mean OCS scenario will produce four new or expanded facilities between 1986 and 1989, as follows: an expanded support base, a dock to receive inbound construction materials for the oil terminal and LNG plant, an oil tanker pier, and an LNG tanker pier. The existing support base will be adequate until three berths are required, which does not occur until two years after the scheduled construction of an expanded facility in 1986. A minimum of five berths are required in the expanded facility. Other direct OCS demands will not require use of existing facilities, since specialized facilities will be constructed before their need arises. Two berths will be required at both the LNG and oil piers, based on the information in Table A-9, and the construction dock must be able to handle large barges. It is assumed that inbound barges will avoid as much as possible the peak period for supply boat movements in order to minimize berth requirements. Large seasonal differences have the effect of increasing the base year growth factors which are provided in Table 4-13 for all categories of freight.

Even with severe seasonality of marine traffic, chances of impacts to existing facilities are remote, except perhaps for the fuel terminal if it handles all inbound supplies for population and drilling needs.

At Seward, although circumstances differ from Yakutat, the conclusions are basically the same. The existing railroad dock will serve multiple uses until the support base is built. It will handle induced-freight, base case development freight, inbound and outbound drilling materials, and induced-fuel. The facility should be adequate since only a single berth is required until 1986, a year after construction of the support base is scheduled. The base must have a minimum of four berths. Only extreme seasonality of demands could create impacts at the railroad facility in the early 1980's, since the totals for both dry bulk and fuel are less than 70% of the low capacity thresholds.

<u>Carriers and Routes.</u> The small increase in induced transportation

demands for the mean OCS case will not cause any measurable impacts by carriers. Direct OCS tonnage will be carried primarily by contract carriers, who specialize in providing logistics to oil companies and can draw upon a world-wide fleet of barges and tugboats. Route impacts will be minimal given adequate coordination between fishermen, the United States Coast Guard, and operators of OCS-related marine traffic. The goal of such coordination would be shipping lanes that would be recognized and adhered to by the appropriate parties. Table 4-16 shows the forecast number of oil tankers that will carry oil southbound in each of four route segments. The first column shows the number of vessels per week from Valdez. The three remaining columns show the cumulative additional trips generated by Northern Gulf of Alaska OCS activities. For the mean base case, additional trips per week from Middleton Shelf to Yakataga Shelf reach a maximum of 0.7 for both oil tankers and LNG ships. The same figures hold true for the next segment since no production of oil or gas takes place in the Yakataga. Shelf.. The peak south of Yakutat Shelf is 3.8 oil tankers per week and 3.0 LNG ships per week from Northern Gulf OCS activities. For that year, there are 8.7 oil tanker trips per week from Valdez. The total of 12.5 vessels per week falls short of the peak traffic from Valdez, which is 13.3 in 1985. Possible route impacts, thus, will not be due to the level of traffic but to additional routes for large tankers which will require possible modifications to existing shipping lanes and establishment of new ones. Experience gained in the development of shipping lanes for existing tanker traffic and of the voluntary system in Kachemak Bay will prove useful in later efforts.

Issues. The major issues for the mean OCS case concern new facilities, specifically the timing of their construction, their size, and their location. Adherence to the schedule used in the scenarios, construction to sizes that meet peak demands, and construction at locations that will reduce interference with other port and harbor traffic will help keep impacts to a minimum. Further development of an effective mechanism for establishing shipping lanes that will consider input from fishing, petroleum, and maritime safety interests should be encouraged. For facilities that handle primarily population-induced tonnage, the issues are the same as in the mean base case but are slightly accentuated. Anchorage's facilities received a greater justification for expansion and Yakutat has a significantly greater need for developing adequate basic port terminal facilities.

4.3.3 AIR MODE

4.3.3.1 Description of Activities

Employee Movements

Helicopters. All offshore employees in the Yakutat and Middleton fields, respectively, rotate through Yakutat and Cordova. The greater level of activity produces larger demands for helicopters in Yakutat. The peak in that community is an estimated 63 helicopter trips per week in 1990 compared to 19 for Cordova in 1989 and 1986. At least 40 trips per week are required in Yakutat for four consecutive years, 1988 to 1991.

Interstate and Interstate Carriers. All nonlocal employees are assumed to travel from their place of work to home residences while off-duty. The number of trips depends upon employment, the ratio of local to nonlocal employees, and the number of rotations per month for jobs having nonlocal employees. The resulting trips have been assigned to one of seven links based on assumptions in Table A-7. The northbound links are Cordova-Anchorage, Yakutat-Cordova, Seward-Anchorage; and the southbound links are Cordova-Yakutat, Yakutat-Southeastern (Juneau), Southeastern (Juneau)-Seattle, and Anchorage-Seattle. Table 4-18 shows the direct OCS trips on these links for the mean base case. Yakutat-Cordova is not shown since the figures are identical to those for Cordova-Yakutat. Peak OCS demands on all of the links except Seward-Anchorage are in excess of 300 one-way trips per week. Yakutat-Southeast has the highest figure with 520 trips per week, followed by Southeast-Seattle (486 trips per week), Cordova-Anchorage (456 trips per week), Yakutat-Cordova (304 trips per week), and Anchorage-Seattle (303 trips per week). For these links, the peaks all occur in 1989.

Population Movements and Total Passenger Traffic. Table 4-20 shows for the Anchorage-Seattle link the induced OCS and total additional passenger travel estimates above the base period figures. For the other links, Table 4-19 contains OCS trips by originating city, induced trips above the base level figure, and the total of the two figures. A steady increase occurs on the Anchorage-Seattle line except for a slight decline in the mid-1980's when construction of the Northwest pipeline will be completed. Doubling of the present patronage on the link is forecast by 1997, which is the same year as in the mean base case. The largest difference in additional passengers from the base mean case is 560 weekly passengers, an increase of only 7 percent. More substantial differences from the base mean case occur for the other links.

The link showing the greatest increase in traffic is Yakutat-Southeast. The peak increase for the BM case, which was an additional 202 trips per week at the end of the study period, is exceeded in the third year of exploration in the MBM case. A peak of 1,027 weekly trips above the base level figure of 331 trips occurs in 1990. The figure in 2000 is 662 as the additional induced traffic does not offset the loss of direct OCS traffic. The situation where peaks in the middle of the study period exceed figures at the end of the study period is true for the remaining links as well, except for Seward-Anchorage where the year 2000 figure barely surpasses the peak of 167 trips in 1985. For Cordova-Anchorage, the discrepancy is even more than for Yakutat-Southeast, as the 1990 peak of 803 is 166% of the 2000 figure. Cordova-Yakutat because of greater induced traffic has higher figures than the corresponding ones for Yakutat-Cordova.

For the Southeastern-Seattle link, the peak of 796 trips per week is 194 percent greater than the period ending figure.

4.3.3.2 Summary of Impacts.

Terminals. The timing and extent of terminal improvements required at Anchorage International Airport does not change from the mean base case. For Seward, additional traffic at the airport is less than that estimated for the base period, but the 70 percent increase will heighten the need for an adequate passenger and baggage terminal. Total passenger movements at the Yakutat airport are the sum of Yakutat-generated OCS and induced traffic multiplied by two to account for inbound and outbound traffic. The peak increase over the base level figure of 544 movements is 531 percent, or 2,888, of which 52 percent are induced and the remaining 48 percent out-of-town employees. Although a new terminal has been recently constructed at Yakutat, by the middle of the study period a need will exist for a larger facility. The problem is that facility needs will be substantially less at the end of the study period. Passenger movements per week are reduced to 1,822, or a 37 percent reduction from the 1990 peak period for two reasons. The usage figures are lower, as is the difference between the figures for peak development and the end of the study period.

The potential impacts at Cordova are considerably less pronounced than at Yakutat. The peak number of Cordova-originating weekly trips above the base figure of 461 is 389 and occurs in 1989. This peak is only 27 percent of that for Yakutat. The figure at the end of the. study period 11 years later is 232, a decrease of 40 percent. Providing for peak demands will not create substantial overbuilding which would be the case at Yakutat.

The large amount of helicopter activity at Yakutat will produce the need for a large maintenance and storage facility. Assuming one trip per stationed aircraft would create the need for nine helicopters during peak activity.

Yakutat's distance from major communities suggests the need for facilities and personnel to handle more than routine maintenance. Helicopter operations will be greater than those of fixed-wing aircraft but these operations can be easily accommodated.

Carriers. For the Anchorage-Seattle route, the small percentage increase in traffic over the BM case can easily be accommodated by existing carriers. The forecast doubling of demand should create opportunities for additional carriers to enter the market.

On the Seward-Anchorage route, existing service of three flights per day is forecast to be adequate through 1984, and an additional flight per day will be adequate for the remainder of the study period.

The remainder of the links fall on Alaska Airlines' route between Anchorage and Seattle that stops at Cordova, Yakutat, and Juneau. The threshold for the existing service of one flight per day is reached in 1986 for two links in the southbound direction and for one link in the northern direction. The critical northbound link is Cordova-Anchorage and the one southbound is Yakutat-Southeast. It is easier to add service to meet increased traffic demand on the Cordova-Anchorage link because of its short length and its location at one end of the route. The least critical links are those between Yakutat and Cordova but by 1988 even thresholds on these links are reached. The next threshold level, which signifies that two flights per day are inadequate, is reached only on the Yakutat-Southeast link. It is exceeded first in 1988, only two years after the one flight per day threshold was reached, and traffic remains above it for the remainder of the study period.

Increases in traffic until 1988 occur throughout, which suggests that a second daily flight if initiated in 1986 would most likely follow the same route as existing flights. However, forecast traffic increases thereafter are greater on the links south of Yakutat, and a third flight might only serve points between Yakutat and Seattle.

Only Alaska Airlines at the present time has authority to operate scheduled service to Yakutat. This carrier most likely would decide to provide the additional service requirements as needed, but with deregulation another carrier must also decide to operate between Yakutat and Seattle for the second half of the study period.

Issues. The need for air terminal improvements is evident at all four communities sometime during the study period -- Anchorage, Seward, Yakutat, and Cordova. At Yakutat, peak demands on the facilities are short-lived and do not occur again by the end of the study period. At issue is whether overbuilding can be justified. Needs are not as great at Seward and Yakutat, and improvements at Anchorage are already programmed.

At the most, two additional flights will be required to handle anticipated traffic on all links except Anchorage-Seattle. It has been assumed that OCS employees will travel to and from work sites on scheduled flights. If this is not true and contract flights are used, scheduled carriers will not increase their frequency of service, and local residents will not receive the benefits of additional service and may find, in fact, travel more difficult than at present.

4.3.4 LAND MODES

4.3.4.1 Roads

Low additional population growth in the MBM case compared to the mean base case will result in congestion on the Seward Highway at approximately the same time. Additional local truck traffic can be expected in Yakutat and Cordova, especially the former, but this traffic is limited to local streets, which are beyond the scope of this study. With the possible exception of the period when a support base is under construction, the existing interurban bus service to Seward is expected to continue at its present level of service, since all offshore personnel are rotated through Yakutat and Cordova. The need for additional service would come from changes in the supply and cost of gasoline more so than the population and employment levels in Seward.

4.3.4.2 Railroad

The mean OCS scenario will not cause an impact of an incremental or even cumulative nature on the activities of the Alaska Railroad. Virtually all OCS cargo will go directly to the support bases or onshore construction sites. The only possible impact on railroad operations would be that OCS activities at the railroad dock before a support base is constructed would restrict unloading of freight to be handled by the railroad. Such impacts would be slight considering the small amount of projected railroad traffic in and out of Seward.

4.3.5 SUMMARY COMPARISON OF MEAN OCS - MEAN BASE CASE (MBM) AND MEAN BASE CASE (BM)

Differences between transportation facility requirements in the MBM and BM cases center on the need for marine facilities to handle OCS logistics at Seward and Yakutat, especially during the years of peak development activities, and on the need for air terminal improvements. The scenarios call for construction of support bases at Seward and Yakutat in addition to an oil terminal and LNG plant at both Yakutat and Hinchinbrook Island. Keeping impacts to a minimum, the forecast minimum size of support base marine facilities is five berths for Yakutat and four berths for Seward. A single loading pier for oil tankers will be adequate at Hinchinbrook but two will be required at Yakutat. Forecast use of air terminals will be greater at Seward, Cordova, and Yakutat, especially the latter where peak movements are five times those of the peak in the base case. No significant increases in traffic *are* anticipated for land modes.

Carrier impacts are more likely for the air mode than the marine mode. Direct OCS marine transportation demands will be handled almost *exclusively* by contract carriers who have experience working with the oil industry throughout the world. Existing scheduled marine carriers will see only small increases due to Northern Gulf of Alaska OCS activity.

Table 4-1

Regional Population Projections: Mean OCS - Mean Base Case (MBM) (1)
Factors to Produce Incremental Changes from Mean Base Case (BM)

Year	Statewide	Anchorage	Southcentral	Fairbanks
1977	0	0	0	
1978	0	0	0	
1979	0	0	0	
1980	0	0	0	
1981	0.001	0.001	0.009	-0.001
1982	0.003	0.002	0.015	-0.001
1983	0.005	0.003	0.025	-0.007
1984	0.006	0.004	0.027	0
1985	0.011	0.009	0,039	0.006
1986	0.019	0.018	0.059	0.016
1987	0.031	0.032	0.073	0.032
1988	0.039	0.041	0.087	0.039
1989	0.044	0.046	0.102	0.040
1990	0.051.	0.054	0.115	0.045
1991	0.047	0.049	0.111	0.033
1992	0.040	0.044	0.084	0.028
1993	0.037	0.041	0.080	0.024
1994	0.035	0.039	0.075	0.024
1995	0.035	0.039	0.076	0.023
1996	0.036	0.039	0.082	0.024
1997	0.037	0.040	0.083	0.025
1998	0.038	0.042	0.085	0.027
1999	0.039	0.043	0.085	0.028
2000	0.040	0.044	0.085	0.029

Note: (1) F_1 = incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: ISER, 1979,

Table 4-2

Community Areawide Population Forecasts for Base and OCS Cases

	Seward[1]				Yakutat[2]				Cordova[3]			
Year	Non-OCS	Low OCS(4)	Mean OCS(4)	High OCS(4)	Non-OCS	Low OCS(4)	Mean OCS(4)	High OCS(4)	Non-OCS	Low OCS(4)	Mean OCS(4)	High OCS(4)
1978	2,600				567				2,762			
1979	2,612				576				2,844			
1980	2,658				604				2,872			
1981	2,696	2,736	2,720	2,726	604	708	690	708	3,002	3,014	3,010	3,014
1982	2,732	2,796	2,764	2,784	622	692	726	804	3,054	3,076	3,068	3,076
1983	2,786	2,838	2,846	2,862	634	670	810	852	3,104	3,126	3,126	3,136
1984	2,896	2,912	2,964	3,072	634	642	810	1,020	3,156	3,162	3,182	3,200
1985	3,041		3,209	3,167	639		815	1,239	3,208		3,240	3,252
1986	3,052		3,186	3,180	651		949	1,285	3,264		3,318	3,300
1987	3,064		3,202	3,364	677		1,047	1,247	3,322		3,388	3,436
1988	3,077		3,291	3,761	693		1,105	1,937	3,382		3,938	3,594
1989	3,242		3,628	3,978	695		1,487	2,687	3,440		4,038	4,032
1990	3,384		3,744	4,098	746		2,148	3,420	3,498		4,098	4,834
1991	3,416		3,626	4,144	765		2,221	3,601	3,568		4,214	4,900
1992	3,449		3,539	3,861	787		2,153	3,501	3,642		4,290	4,918
1993	3,553		3,607	3,855	828		2,154	3,580	3,714		4,378	4,990
1994	3,660		3,696	3,816	847		2,131	3,591	3,794		4,458	5,114
1995	3,771		3,907	3,991	877		2,175	3,519	3,872		4,536	5,222
1996	3,887		3,923	3,995	894		2,238	3,540	3,954		4,632	5,318
1997	4,008		4,044	4,116	902		2,260	3,608	4,044		4,722	5,408
1998	4,130		4,166	4,238	927		2,299	3,663	4,130		4,812	5,498
1999	4,258		4,294	4,366	927		2,299	3,663	4,220		4,898	5,584
2000	4,393		4,429	4,493	934		2,306	3,670	4,322		5,000	5,666

Notes: (1) Seward and Seward fringe area.
(2) Yakutat and area connected by roads to Yakutat.
(3) Cordova and area connected by roads Cordova.
(4) For OCS cases, only numbers are shown that are different from non-OCS case.

Source: Alaska Consultants, 1979.

Table 4-3

Community Areawide Population Forecasts for OCS Cases Factors to Produce Incremental Changes from Base Case (1)

Year	Seward Low OCS	Seward Mean OCS	Seward High OCS	Yakutat Low OCS	Yakutat Mean OCS	Yakutat High OCS	Cordova Low OCS	Cordova Mean OCS	Cordova High OCS
1978									
1979									
1980									
1981	0.015	0.009	0.012	0.183	0.152	0.183	0.004	0.003	0.004
1982	0.025	0.012	0.020	0.123	0.183	0.321	0.008	0.005	0.008
1983	0.020	0.023	0.029	0.063	0.310	0.384	0.008	0.008	0.012
1984	0.006	0.026	0.068	0.014	0.310	0.681	0.002	0.009	0.016
1985		0.065	0.048		0.310	1.058		0.012	0.016
1986		0.052	0.049		0.526	1.118		0.020	0.013
1987		0.053	0.115		0.653	1.005		0.024	0.041
1988		0.082	0.263		0.727	2.194		0.201	0.077
1989		0.148	0.283		1.397	3.513		0.217	0.214
1990		0.138	0.275		2.473	4.716		0.217	0.484
1991		0.081	0.280		2.568	5.002		0.234	0.482
1992		0.035	0.158		2.409	4.787		0.235	0.462
1993		0.021	0.116		2.339	4.854		0.240	0.462
1994		0.014	0.060		2.265	4.840		0.240	0.478
1995		0.052	0.085		2.289	4.660		0.240	0.489
1996		0.014	0.042		2.370	4.667		0.245	0.494
1997		0.014	0.042		2.395	4.772		0.245	0.494
1998		0.014	0.042		2.420	4.825		0.247	0.495
1999		0.014	0.042		2.420	4.825		0.245	0.494
2000		0.014	0.038		2.420	4.825		0.245	0.487

Note: (1) F_I = Incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: Alaska Consultants, 1979.

Table 4-4

Yakutat Field - Statistical Mean Resource Level Scenario,
Transportation-Related Activities

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed (1)	Rigs Jan.	Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	Oil Production Wells (2) Offshore Loading	Oil Production Wells (2) Onshore Loading	Gas Production Wells (2) (Non-Assoc./Assoc.)	Onshore Facility Construction (3)
1981	1	3				6								
1982	2	3				7								
1983	3	5				12								
1984	4	5				12								
1985	5	5				12								
1986	6	4				9								YCSB(1/1), YLNG(0.5/2.5)
1987	7	4	1s			9								YLNG(1.5/2.5), YOIL(0.5/2.5)
1988	8	4	2s		1	8		2	20.5	29.6				YLNG(2.5/2.5), YOIL(1.5/2.5)
19s9	9	2	2s	1	5	5	16	4	31.6	41.3			4	YOIL(2.5/2.5)
1990	10	1	is, 1C	5	13	2	42	6			14	14	e/14	
1991	11			10	12		72	8			29	43	16/43	
1992	12			12	6		49	6			40	84	24/70	
1993	13			4	2		19				80	100	24/70	
1994	14										80	100	24/70	
1995	15										80	100	24/70	
1996	16										80	100	24/70	
1997	17										80	100	24/70	
1998	18										80	100	24/70	
1999	19										80	100	24/70	
2000	20										80	100	212/70	

Notes : (1) S = Steel; C = Concrete.
(2) Based on estimated wells drilled by July of each year.
(3) YCSB(1/1) = Facility (Years under Construction/Years to Construct);
YCSB = Yakutat Construction Service Base; YLNG = Yakutat LNG Terminal;
YOIL = Yakutat 011 Terminal.

Source : Dames & Moore, 1978.

Table 4-5

Middleton Field - Statistical Mean Resource Level Scenario,
Transportation-Related Activities

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed (1)	Dev. Rigs Jan.	Dev. Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	Oil Production Wells (2) Offshore Loading	Oil Production Wells (2) Onshore Loading	Gas Production Wells (2) (Non-Assoc./Assoc.)	Onshore Facility Construction (3)
1981	1	1				2								
1982	2	1				3								
1983	3	2				5								
1984	4	2				6								
1985	5	3				7								SCSB (1/1)
1986	6	2	1s			6			4.7	33.9				HOIL (1/2)
1987	7	1			2	2	8							HOIL (2/2)
1988	8			2	2		16					4		
1989	9		1s	2	2		16		4.7	46.5		29		HLNG (1/2)
1990	10			2	1		4	2				40		HLNG (2/2)
1991	11			1	1			4				40	4/40	
1992	12			1	1			3				40	8/40	
1993	13											40	8/40	
1994	14											40	8/40	
1995	15											40	e/40	
1996	16											40	8/40	
1997	17											40	B/40	
1998	18											40	8/40	
1999	19											40	8/40	
2000	20											40	8/40	
												40	0/40	

Notes: (1) S = Steel.
(2) Based on estimated wells drilled by July of each year.
(3) SCSB (1/1) = Facility (Years under Construction/Years to Construct);
SCSB = Seward Construction Support Base ; NOIL = Hinchinbrook Oil Terminal;
HLNG = Hinchinbrook LNG Terminal.

Source: Dames & Moore, 1978,

Table 4-6

Logistics Requirements for Yakutat-Based Drilling - Mean Scenario

Calendar Year	Years After Lease Sale	Yakutat Shelf Tonnage (Short Tons) Drill Pipe	Dry Bulk	Fuel	Drill Water	Inbound Dry Goods Barges (1)	Fuel Tankers (2)	Outbound Supply Boats (3)	Base Year Factors (4) Dry Freight	Fuel
1981	1	2,749	7,812	13,884	21,696	2	3	62	7.2	1.6
1982	2	3,207	9,114	16,198	25,312	3	3	72	8.3	1.9
1983	3	5,498	15,624	27,768	43,392	4	6	123	14.3	3.2
1984	4	5,498	15,624	27,768	43,392	4	6	123	14.3	3.2
1985	5	5,498	15,624	27,768	43,392	4	6	123	14.3	3.2
1986	6	4,124	11,718	20,825	32,544	3	5	93	10.7	2.4
1987	7	4,124	11,718	20,825	32,544	3	5	93	10.7	2.4
1988	8	4,672	12,268	21,804	35,356	3	5	97	11.5	2.5
1989	9	9,824	19,478	34.618	63,080	5	7	154	19.8	4.0
1990	10	18,426	32,478	57,722	110,894	9	12	256	34.5	6.7
1991	11	28,866	49,096	87,255	170,360	13	18	387	52.8	10.1
1992	12	19,924	33,927	60,297	117,725	9	13	267	36.5	7.0
1993	13	6,555	11,001	19,551	38,171	3	4	87	7.5	2.3
1994	14									
1995	15									
1996	16									
1997	17									
1998	18									
1999	19									
2000	20									

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-7

Logistics Requirements for Seward-Based Drilling - Mean Scenario

Calendar Year	Years After Lease Sale	Middleton Shelf Tonnage (Short Tons): Drill Pipe	Dry Bulk	Fuel	Drill Water	Inbound: Dry Goods Barges (1)	Fuel Tankers (2)	Outbound: Supply Boats (3)	Base Year Factors (4): Dry Freight	Fuel
1981	1	916	2,604	4,628	7,232	1	1	21	0.1	0.2
1982	2	1,375	3,906	6,942	10,848	1	2	31	0.1	0.3
1983	3	2,291	6,510	11,570	18,080	2	3	52	0.1	0.5
1984	4	2,749	7,812	13,884	21,696	2	3	62	0.2	0.6
1985	5	3,207	9,114	16,198	25,312	3	4	72	0.2	0.7
1986	6	2,749	7,812	18,000	21,696	2	4	62	0.2	0.8
1987	7	3,676	7,235	12,860	23,304	2	3	57	0.2	0.6
1988	8	5,520	9,264	16,464	32,144	3	4	73	0.2	0.8
1989	9	5,520	9,264	16,464	32,144	3	4	73	0.2	0.8
1990	10	2,386	4,168	7,408	14,464	2	2	33	0.1	0.3
1991	11	2,013	3,704	6,584	12,856	1	2	30	0.1	0.3
1992	12	1,510	2,778	4,938	9,642	1	1	22	0.1	0.2
1993	13									
1994	14									
1995	15									
1996	16									
1997	17									
1998	18									
1999	19									
2000	20									

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per-supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages. "

Source: Peter Eakland and Associates, 1979.

Table 4-8

Seward Tonnage Related to Pipe-Coating Plant - Mean Scenario

Year	Field	Inbound Pipe (Tons)(1)	Outbound Pipe (Tons)(2)	Cement (Tons)(3)	Throughput Tonnage (Tons)	Base Year Factor(4)
1985	Middleton	4,407		549	4,956	0.07
1986	Middleton		8,780		8,780	0.13
1987	Yakutat	11,385		1,558	12,943	0.19
1988	Yakutat	9,076	23,787	1,956	46,288	0.69
	Middleton	11,469				
1989	Yakutat		16,743		36,108	0.54
	Middleton		19,365			

Notes: (1) Offshore uncoated pipeline for Middleton and Yakutat shelves. Inbound tonnage one year before laying operation scheduled.
(2) Cement for coating of offshore pipeline pipe. Arrives one year before laying operations.
(3) Coated pipe weight computed on weight required to offset buoyant forces for a given diameter pipe.
(4) For Seward, base year (1977) dry bulk tonnage was 60,726 metric tons (66,939 short tons).

Source: Peter Eakland and Associates, 1979.

Table 4-9

Estimated Barges and Tonnage for Construction Activities - Mean Scenario

Location	Facility	1985	1986	1987	1988	1989	1990	1991
Yakutat	Construction Camp		5					
	Support Base		3					
	LNG Plant - 1 BCFD		8	16	16			
	Oil Terminal - 250,000 bbls/day			2	4	2		
	Onshore Pipeline			1.5	1.5			
	Construction Equipment		4	4				
	Total Barges		20	24	22	2		
	Est. Tonnage at 6,000 Short Tons/Barge		120,000	144,000	132,000	12,000		
Seward	Construction Camp	3						
	Support Base	1						
	Inbound Uncoated Pipe	1		2	4			
	Outbound Coated Pipe				4	6		
	Total Barges	5	2	2	8	6		
	Est. Tonnage at 6,000 Short Tons/Barge	30,000	12",000	12,000	48,000	36,000		
Hinchinbrook	Construction Camp	1						
	LNG Plant - 312 MMCFD					7	4	2
	Oil Terminal - 100,000 bbls/day		2	2				
	Onshore Pipeline	0.1						
	Construction Equipment		2					
	Total Barges	1	4	2		7	4	2
	Est. Tonnage at 6,000 Short Tons/Barge	6,000	24,000	12,000		42,000	24,000	12,000

Source: Peter Eakland and Associates, 1979.

Table 4-10

Average Monthly Consumable Demands - Mean Scenario

Calendar Year	Years After Lease Sale	Tons (1) Yakutat	Tons (1) Cordova	Tons (1) Seward	Containers (2) Yakutat	Containers (2) Cordova	Containers (2) Seward
1981	1	43.8	12.0	7.1	3	1	1
1982	2	68.3	16.2	12.2	5	2	1
1983	3 "	82.1	24.9	17.4	6	2	2
1984	4	240.8	38.6	78.2	17	3	6
1985	5	723.3	75.9	39.6	49	3	3
1986	6	1,185.6	35.6	16.5	80	3	2
1987	7	381.2	211.5	17.1	26	15	2
1988	8	453.9	409.8	34.4	31	28	3
1989	9	468.6	208.7	26.6	32	14	2
1990	10	,393.8	107.1	28.2	27	8	2
1991	11	423.3	89.3	21.8	29	6	2
1992	12	277.4	20.3	12.3	19	2	1
1993	13	188.1	20.3	6.0	13	2	1
1994	14	157.2	31.5	6.0	11	3	1
1995	15	120.5	39.0	6.0	9	3	1
1996	16	119.1	42.8	6.0	8	3	1
1997	17	134.1	42.8	6.0	9	3	1
1998	18	141.6	42.8	6.0	10	3	1
1999	19	141.6	42.8	6.0	10	3	1
2000	20	141.6	42.8	5.3	10	3	1

Notes: (1) Tons = (Offshore onsite + Onshore onsite non-local) x (300 lbs./person) ÷ (2,000 lbs./ton).
(2) Containers = Tons/(15 tons/container).

Source: Peter Eakland and Associates, 1979.

Table 4-11

Monthly Supply Boa t Round-Trips by Service Base -
Mean Resource Level Scenario

Calendar Year	Years After Lease Sale	Middle ton Shelf Exploration	Middle ton Shelf Development	Middle ton Shelf Production	Total Seward-Based Trips	Berth Requirements	Total Cordova-Based Trips	Berth Requirements	Yakutat Shelf Exploration	Yakutat Shelf Development	Yakutat Shelf Production	Total Yakutat-Based Trips	Berth Requirements (1)
1981	1	12			12	1			36			36	2
1982	2	12			12	1			36			36	2
1983	3	24			24	1			60			60	2
1984	4	24			24	1			60			60	2
1985	5	36			36	1			60			60	2
1986	6	24	107		131	4			48			4a	2
1987	7	12	40		52	2			48	24		64	2
1988	8		40	8	48	2	4	1	48	111		159	3
1989	9		107	8	115	3	4	1	24	191	4	219	4
1990	10		20	8	2s	1	4	1	12	208	12	232	4
1991	11		20	12	32	1	6	1		240	24	264	5
1992	12		20	12	32	1	6	1		120	28	148	3
1993	13			12	6	1	6	1		40	28	6a	2
1994	14			12	6	1	6	1			28	2a	1
1995	15			12	6	1	6	1			28	2a	1
1996	16			12	6	1	6	1			2a	2a	1
1997	17			12	6	1	6	1			2a	2a	1
1998	18			12	6	1	6	1			2a	2a	1
1999	19			12	6	1	6	1			28	2a	1
2000	20			12	6	1	6	1			2a	28	1

Notes: (1) 30% berth occupancy assumed for 1-2 berths. For 3 berths Or more, 50% berth occupancy assumed all-day.

Source : Peter Eakland and Associates, 1979.

Table 4-12

Base-Year Growth Factors for OCS-Induced Freight Tonnage - Mean-Base Mean (MBM) Case (1)

Calendar Years	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petroleum	Seward Dry Bulk	Seward Petroleum	Whittier Dry Bulk	Whittier Petroleum	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry Bulk	Yakutat Petroleum	Valdez Dry Bulk	Valdez Petroleum
1981	1				1.05					1.09	1.22		
1982	2				1.06			1.12	1.12	1.28	1.28	0.40	1.11
1983	3				1.09			1.23	1.13	1.43	J-43	6.03	1.12
1984	4			1.85	1.14	1.80		1.15	1.1s	1.43	1.43	6.00	1.34
1985	5	1.34	1.29	1.33	1.24	1.31		1.17	1.17	1.44	1.44	k.25	3.12
19136	6	1.38	1.33	1.38	1.22	1.31		1.20	1.20	1.68	1.68	1.30	1.16
1987	7	1.44	1.30	1.51	1.23	1.44		3.22	1.22	1.84	1.84	1.35	1.18
1988	8	1.51	1.44	.1.65	1.26	1.52		1.42	1.44	1.75	1.95	1.41	1.23
1989	9	1.57	1.50	1.69	1.40	1.51		1.47	1.46	2.63	2.63	1.47	1.26
1990	la	1.63	1.56	1.74	1.44	1.62		1.49	1.49	3.79	3.79	1.52	1.31
1991	11	1.69	1.60	1.70	1.39	1.65		1.52	1.52	3.92	3.92	1.54	1.29
1992	12	1.73	1.65	1.74	1.37	1.70		3.56	1.56	3.80	3.80	1.57	1.20
1993	13	1.79	1.70	1.76	1.39	1.74		1.59	1.59	3.80	3.00	1.61	1.30
1994	14	1.86	1.76	1.82	1.42	1.80		1.61	1.61	3.76	3.76	1.65	1.32
1995	15	1.92	1.02	1.88	1.50	1.86		1.64	1.64	3.84	3.84	1.70	1.34
1996	16	1.99'	1.00	1.95	1.51	3.93		1.68	1.68	3.95	3.95	1.75	1.37
1997	17	2.07*	1.95	2.01	1.55	2.00		1.71	1.71	3.99	3.99	1.80	3,39
1998	18	2.14	2.02	2.07	1.60	2.07		).75	1.75	4.06	4.06	1.87	1.42
1999	19	2.23*	2.10	2.15	1.65	2,15		1.78	1.78	4.06	4.06	1.93	1.44
2000	20	2.31*	2.18	2.24	1.70	2.24		1.82	1.82	4.07	4.07	1 .99	1. 47
Threshold value for low cap.		1.92	2.24	3.7a	3.26	2.74	No	3.23	2.15	9.09	11.20	39.90	3.09
Threshold value for high cap.		2.70	3.54	5.42	4.64	3.90	increase	3.45	4.55	20.00	23.44	41.40	6.25
Low value (year)		1.15 (1981)	1.15 (1981)	1.14 (1981)	1.05 (1981)	1.14 (1981)	expected	1.09 (1981)	1.09 (1981)	i.09 (1981)	3.32 119131)	1.09 (19131)	1.04 (1981)
High value (year)		2.31 (2000)	2.18 (2000)	2.24 (2000)	1.70 (2000)	2.24 (2000)		1.82 (2000)	1.82 (2000)	4.01 (2000)	4.07 (2000)	1.99 (2000)	1.47 (2000)
Value exceeding low capacity		*											
high capacity		**											

Note: (1) Values not shown . . . unchanged from the mean cam. Factors shown are cumulative and includes base case.

Source: Peter Eakland and Associates, 1979.

Table 4-13

Base Year Factors for Freight Categories by Service Base -[1,3]
Mean-Base Mean (MBM) Case

Calendar Year	Yakutat Fuel: Induced (Throughput)	Yakutat Fuel: Drilling[2] (Throughput)	Yakutat Dry Freight: Induced (Throughput)	Yakutat Dry Freight: Consumables (Inbound)	Yakutat Dry Freight: Drilling[2] (Throughput)	Yakutat Dry Freight: Construction (Inbound)	Seward Fuel: Induced (Throughput)	Seward Fuel: Drilling[2] (Throughput)	Seward Dry Freight: Induced & Base Dev. (Throughput) MBM Case	Seward Dry Freight: Consumables (Inbound)	Seward Dry Freight: Drilling[2] (Throughput)	Seward Dry Freight: Construction (Throughput)	coda"! Dry Freight: Induced (Throughput)	coda"! Dry Freight: Consumables (Inbound)
1981	1.2	3.2	1.2	.1	14.4		1.1	0.4	2.4	0	0.2		1.1	0
1982	1.3	3.0	1.3	.2	16.3		3.1	0.6	2.5	0	0.2		1.1	0
1983	1.4	6.4	1.4	.3	2%.6		3.1	1.0	1.8	0	0.2		1.1	0
1984	1.4	6.4	1.4	.3	2(3.6		1.1	1.2	1.8	0	0.4		1.2	0
1985	1.4	6.4	1.4	.3	2a.6		1.2	1.4	1.3	0	0.4	0.4	1.2	0
1986	1.7	4.0	1.7	1.1	21.4	81.2	1.2	1.6	1.4	0	0.4	0.2	1.2	0
1987	1.8	4.8	1.8	1.7	21.4	97.5	3.2	1.2	1.4	0	0.4	0.2	1.2	o
1988	2.0	5.0	2.0	1. a	23.0	89.4	1.2	1.6	1.5	0	0.4	0.2	1.4	0
1989	2.6	8.0	2.6	1.0	39,6	8.1	1.3	1.6	1.6	0	0.4	0.2	1.5	0.1
1990	3.8	13.4	3.0	.7	69.0		1.3	0.6	1.6	0	0.2		1.5	0.1
1991	3.9	20.2	3.9	.7	105.6		1.3	0.6	1.6	o	0.2		1.5	0
1992	3.8	14.0	3.8	..4	73.0		1.3	0.4	L.?	0	0.2		1.6	0
1993	3.8	4.6	3.8	.3	15.0		1.4		1.7	0			1.6·	O
1994	3.33		3.8	.3			1.4		1.8	0			1.6	0
1995	3.s		3.8	.3			1.5		1.8	0			1.6	0
1996	4.0		4.0	. 4			1.5		3.9	0			1.7	0
1997	4.0		4.0	..2			1.5		1.9	0			1.7	0
1998	4.1		4.1	.4			1.6		2.0	0			1.8	0
1999	4.1		4.1	.4			1.6		2.1 .	0			1.8	0
2000	4.1		4.1	4			1.7		2.2	0			1.8	o
	Bane Value (1. 0) = 7,85a metric tons (8,662 tons)		Base Value (1.0) = 1,340 metric tons (1,477 tons)				Base Value (1.0) = 19,760 metric tons (21,782 tons)		Base Value (1.0) = 60,726 metric tons (66,939 tons)				Base Value (1.0) . 14,861 metric tons (16,382 tons)	

Notes: (1) Factors are related to base year tonnages for the individual -unity. h comparison of factors for different communities is not meaningful. Care should be observed in combining the figures. Some are throughput tonnages, and others are inbound only where they are considered more ❑ eaningful. No common type of vessels or landside facilities are implied.

(2) Fuel and dry freight tonnage required for drilling has been doubled to provide throughput figures.

(3) The use of the same facilities for all dry freight is not implied.

source, Peter Eakland and Associates, 1979.

Table 4-14

Daily Vessel Arrivals by Type

	Fishing Boats	Tug and Tugboat	Government Vessels	Supply Boats: Low Scenario Min.	Supply Boats: Low Scenario Max.	Supply Boats: Mean Scenario Min.	Supply Boats: Mean Scenario Max.	Supply Boats: High Scenario Min.	Supply Boats: High Scenario Max.
Seward	80	1	2	1	1	1	4	1	7
Cordova	80	1	2	0	0	0	1	0	1
Yakutat	10	1	0	1	2	1	9	2	16

Source: Peter Eak and and Associates, 1979, for supply boats, otherwise, ERCO, 1978.

Table 4-15

Mean Resource Level Scenario - Oil and Gas Production and Transportation

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oil and Gas Production													
Yakutat Shelf													
Oil Terminal (MMBBL)	0	0	14.0	40.3	75.3	81.5	68.9	49.4	37.6	27.8	20.7	15.2	11.4
Offshore Loading (MMBBL)			14.0	40.3	61.3	70.1	69.7	61.1	49.4	40.0	32.3	26.2	21.2
Total (MMBBL)	0	0	20.0	80.6	136.6	151.6	138.6	110.5	87.0	67.8	53.0	41.4	32.6
LNG Terminal (BCF)	0	140.2	168.2	295.5	341.6	336.1	321.1	288.5	270.1	254.2	242.8	234.0	228.1
Middleton Shelf													
Oil Terminal (MMBBL)	14.0	26.3	35.0	35.0	35.0	33.2	27.3	23.1	19.6	16.6	14.0	11.7	10.0
LNG Terminal (BCF)	0	0	0	80.1	88.9	95.1	95.1	95.1	93.8	89.6	86.6	84.1	81.9
Oil Tanker and LNG Ship Traffic (1)													
Yakutat Shelf													
Oil Terminal (Oil Tankers/Year)	0	0	15	43	81	88	74	53	40	30	22	16	12
Offshore Loading (Oil Tankers/Year)	0	0	15	43	66	75	75	66	53	43	35	28	23
Total (Oil Tankers/Year)	0	0	30	86	147	163	149	119	93	73	57	44	35
LNG Terminal (LNG Ships/Year)	0	50	60	106	122	120	115	103	96	91	87	84	81
Middleton Shelf													
Oil Terminal (Oil Tankers/Year)	15	28	38	38	38	36	29	25	21	18	15	13	11
LNG Terminal (LNG Ships/Year)	0	0	0	29	32	34	34	34	34	32	31	30	29

Notes: (1) Oil Tanker Trips/Day = Total Production/Year)/ (7. 74) (120,000) . Assumes average tanker fleet size of 120,000 DWT. 7.74 bbls = 1 long ton.
LNG Ship Trips/Day = (Total ProductIon/Year) / (2.8 BCF) , where 2.8 BCF of natural gas is equivalent to 130,000 m^3, the capacity of LNG vessels designed for the Cook Inlet.

Source: Bill Wade, petroleum economist, Dames & Moore, 1978, raw data on oil and gas production; otherwise Peter Eakland and Associates, 1979.

Table 4-16

Cumulative Outbound Oil Tanker and LNG Traffic Density
for Base Cases and OCS Scenarios
(Vessels/Week)

	(1) Valdez to Middleton Shelf				(2) Middleton Shelf to Yakataga Shelf				(3) Yakataga Shelf to Yakutat Shelf				(4) South of Yakutat Shelf			
	Oil Tankers			LNG	Oil Tankers		LNG Ships		Oil Tankers		LNG Ships		Oil Tankers		LNG Ships	
Year	High	Mean	Low	Ships	High	Mean	High	Mean	High	Mean	High	Mean	High	Mean	High	Mean
1981	12.3	12.3	12.3	0												
1982	12.6	12.6	12.6	0												
1983	12.8	12.8	12.8	0												
1984	13.1	13.1	13.1	0	Same as for Valdez to Middleton Shelf											
1985	13.3	13.3	13.3	0												
1986	12.7	12.7	12.7	0												
1987	11.3	11.3	11.3	0												
1988	10.6	10.6	10.6	0	+0.3	+0.3	0	0	+0.3	+0.3	0	0	+0.3	+0.3	+1.0	0
1989	10.8	10.2	10.1	0	+0.8	+0.5	0	0	+1.1	+0.5	0	0	+1.4	+0.5	+1.0	+1.0
1990	10.0	9.3	9.0	0	+1.6	+0.7	+1.1	0	+1.7	+0.7	+1.1	0	+3.2	+1.3	+3.2	+1.2
1991	9.5	8.7	8.3	0	+1.8	+0.7	+1.3	+0.6	+2.0	+0.7	+1.3	+0.6	+5.2	+2.4	+4.6	+2.6
1992	9.1	8.3	8.1	0	+1.9	+0.7	+1.9	+0.6	+2.6	+0.7	+1.9	+0.6	+7.3	+3.6	+6.0	+3.0
1993	8.7	8.7	7.7	0	+1.7	+0.7	+1.9	+0.7	+2.6	+0.7	+1.9	+0.7	+9.2	+3.8	+6.3	+3.0
1994	8.1	7.3	7.1	0	+1.4	+0.6	+1.9	+0.7	+2.6	+0.6	+1.9	+0.7	+10.0	+3.4	+6.4	+2.9
1995	7.4	6.7	6.4	0	+1.1	+0.5	+1.9	+0.7	+2.5	+0.5	+1.9	+0.7	+9.9	+2.8	+6.4	+2.6
1996	7.0	7.0	5.9	0	+0.9	+0.4	+1.8	+0.7	+2.4	+0.4	+1.8	+0.7	+9.2	+2.2	+6.2	+2.5
1997	6.6	6.6	5.5	0	+0.7	+0.3	+1.7	+0.6	+2.2	+0.3	+1.7	+0.6	+8.0	+1.8	+5.9	+2.4
1998	6.1	5.4	5.1	0	+0.5	+0.3	+1.7	+0.6	+2.1	+0.3	+1.7	+0.6	+6.7	+1.4	+5.8	+2.3
1999	5.5	5.0	4.8	0	+0.3	+0.3	+1.5	+0.6	+1.9	+0.3	+1.5	+0.6	+6.2	+1.1	+5.4	+2.2
2000	5.0	4.6	4.4	0	+0.2	+0.2	+1.2	+0.6	+1.6	+0.2	+1.2	+0.6	+4.5	+0.9	+5.1	+2.1

Source: Peter Eakland and Associates, 1979.

Table 4-17

Weekly Helicopter Round Trips from Service Bases in Northern Gulf of Alaska - Mean Scenario

Calendar Year	Yakutat: Total Offshore Average Monthly Employment (1)	Yakutat: Peak Weekly Round Trips (2)	Yakutat: Helicopter Trips per Week (3)	Cordova: Total Offshore Average Monthly Employment (1)	Cordova: Peak Weekly Round Trips (2)	Cordova: Helicopter Trips per Week (3)
1981	278	93	7	92	31	3
1982	328	110	8	142	48	4
1983	560	187	14	236	79	6
1984	560	187	14	280	94	7
1985	560	187	14	336	112	8
1986	420	140	10	788	263	19
1987	886	296	22	676	226	17
1988	1,892	631	46	216	72	6
1989	2,506	836	60	784	262	19
1990	2,636	879	63	606	202	15
1991	1,792	598	43	32	11	1
1992	768	256	19	32	11	1
1993	381	127	10	57	19	2
1994	137	46	4	57	19	2
1995	162	54	4	57	19	2
1996	233	78	6	82	28	2
1997	262	88	7	82	28	2
1998	287	96	7	82	28	2
1999	287	96	7	82	28	2
2000	287	96	7	82	28	2

Notes: (1) Total employment equals offsite plus onsite employments. All offshore tasks have been included except supply/anchor/tug boats and include surveys, rigs, platforms, platform installation, and offshore pipeline construction.
(2) Peak weekly trips = (0.717 round trips/month) x (2.0 peak factor) ÷ 4.3 weeks/month.
(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979.

Table 4-18

OCS Employment-Related Weekly Air Trips by Trip Segment - Mean Scenario

Northbound Links

Calendar Year	Years After Lease Sale	Yakutat-Cordova: CDV Inter (R)[1] .25	Yakutat-Cordova: YAK Intra .75	Yakutat-Cordova: YAK Inter .25	Total Weekly One-Way Trips	Jet Plane Equiv.[2]	Cordova-Anchorage: CDV Intra 1.0	Cordova-Anchorage: CDV Inter .75	Cordova-Anchorage: YAK Intra .75	Cordova-Anchorage: YAK Inter .25	Total Weekly Trips	Plane Equivalent: Jet[2]	Plane Equivalent: Commuter[3,4]	Seward-Anchorage: SWO Intra 1.0	Seward-Anchorage: SWO Inter 1.0	Tots 1 Weekly Trips	Plane Equivalent: Jet[2]	Plane Equivalent: Commuter[3]
1981	1	5	20	19	44	.4	6	15	20	19	60	.6	1.1	4	8	12	.1	.6
1982	2	6	24	22	52	.4	9	23	24	22	78	.8	1.7	6	12	18	.2	.9
1983	3	10	40	37	87	.7	14	38	40	37	129	1.2	2.7	10	20	30	.3	1.6
1984	4	15	40	37	92	.7	17	45	40	37	139	1.3	3.3	12	22	34	.3	1.8
1985	5	18	42	37	97	.7	22	53	42	37	154	1.4	3.9	52	60	112	0	5.9
1986	6	46	75	40	161	1.0	45	138	75	40	298	2.7	9.6	20	26	46	.4	2.4
1987	7	35	113	74	222	1.7	4a	103	113	74	338	3.1	7.9	12	10	22	.2	1.2
1988	8	10	132	129	271	2.4	18	28	132	129	307	2.8	2.4	16	12	28	.3	1.5
1989	9	47	111	146	304	2.3	59	140	111	146	456	4.1	10.5	27	17	44	.4	2.3
1990	10	40	110	137	287	2.2	77	120	110	137	444	4.0	10.4	22	2	24	.2	1.3
1991	11	3	101	137	241	2.2	25	9	101	137	272	2.5	1.8	9	1	10	.1	.5
1992	12	0	69	29	98	.9	11		69	29	109	1.0	.6	4		4	0	.2
1993	13	0	52	15	67	.6	16		52	15	83	.8	.8	4		4	0	.2
1994	14	0	43	1	44	.4	16		43	1	60	.5	.8	4		4	0	.2
1995	15	0	47	1	48	.4	16		47	1	64	.6	.8	4		4	0	.2
1996	16	0	58	1	59	.5	21		58	1	80	.7	1.1	4		4	0	.2
1997	17	0	62	1	63	.6	21		62	1	134	.8	1.1	4		4	0	.2
1998	18	0	65	1	66	.6	21		65	1	87	.8	1.1	4		4	0	.2
1999	19	0	65	1	66	.6	21		65	1	137	.8	1.1	4		4	0	.2
2000	20	0	65	1	66	.6	21		65	1	87	.S	1.1	4		4	0	.2

Notes: (1) (R) represents return or inbound trips. Yakutat-Cordova is the only link on which both inbound and Outbound trips occur .

(2) Jet aircraft assumed to have capacity of 110 passengers.

(3) Commuter aircraf t assumed to have capacity of 19 passengers. Feasible on Seward-Anchorage and Cordova-Anchorage 1 inks.

(4) Commuter plane equivalents based only on Cordova-originat ing trips.

Source : Peter Eakland and Associates, 1979,

Table 4-18 (cont.)

OCS Employment-Related Weekly Air Trips by Trip Segment - Mean Scenario

Southbound Links

Calendar Year	Yakutat-S.E. YAK Intra .25	Yakutat-S.E. YAK Inter .75	Yakutat-S.E. CDV Inter .25	Total Weekly Trips	Jet Plane Equiv.(2)	S.E.-Seattle CDV Inter .25	S.E.-Seattle YAK Inter .75	Total Weekly Trips	Jet Plane Equiv.(2)	Anchorage-Seattle YAK Inter .25	Anchorage-Seattle CDV Inter .75	Anchorage-Seattle SWD Inter 1.0	Total Weekly Trips	Jet Plane Equiv.(2)
1981	7	56	5	68	.6	5	56	60	.5	19	15	8	42	
1982	8	66	6	80	.7	6	66	72	.7	22	23	12	57	.5
1983	13	111	10	134	1.2	10	111	121	1.1	37	38	20	95	.9
1984	13	111	15	139	1.3	15	111	126	1.1	37	45	22	104	1.0
1985	14	110	18	142	1.3	18	110	128	1.2	37	53	60	150	1.4
1986	25	119	46	190	1.7	46	119	165	1.5	40	138	26	205	1.9
1987	38	22	35	295	2.7	35	222	257	2.3	74	103	10	187	1.7
1988	44	385	10	439	4.0	10	385	395	4.4	129	28	12	169	1.5
1989	37	436	47	520	4.7	47	436	483	3.6	146	140	17	303	2.8
1990	37	411	40	488	4.4	40	411	451	4.1	137	120	2	259	2.4
1991	34	410	3	447	4.1	3	410	413	3.8	137	9	1	147	1.3
1992	23	86		109	1.0		86	86	.8	29			98	.9
1993	17	43		60	.5		43	43	.4	15			67	.6
1994	14	1		15	.1		1	1	0	1			1	.0
1995	16	1		17	.2		1	1	0	1			1	.0
1996	19	1		20	.2		1	1	0	1			1	.0
1997	21	1		22	.2		1	1	0	1			1	.0
1998	22	1		23	.2		1	1	0	1			1	.0
1999	22	1		23	.2		1	1	0	1			1	.0
2000	22	1		23	.2		1	1	0	1			1	.0

Source: Peter Eakland and Associates, 1979.

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Table 4-19

Induced and OCS-Related Weekly Air Travel - Mean-Base Mean (MBM) Case

Northbound Links

Calendar Year	Years After Lease Sale	Cordova-Anchorage Induced YAK	Cordova-Anchorage Induced CDV	Cordova-Anchorage Mean OCS	Cordova-Anchorage Total Weekly Trips	Yakutat-Cordova Induced YAK	Yakutat-Cordova Induced CDV	Yakutat-Cordova Mean OCS	Yakutat-Cordova Total Weekly Trips	Seward-Anchorage Induced	Seward-Anchorage Mean OCS	Seward-Anchorage Total Weekly Trips
1981	1	23	1	60	84	23	9	44	76	11	12	23
1982	2	30	2	78	110	30	10	52	92	15	18	33
1983	3	46	3	129	178	45	12	87	144	23	30	53
1984	4	46	3	139	188	45	14	92	151	33	34	67
1985	5	47	4	154	205	46	16	97	159	55	112	167
1986	6	72	6	298	376	71	19	161	251	53	46	99
1987	7	90	7	338	435	89	21	222	322	55	22	77
1988	8	101	59	307	467	99	39	271	409	63	28	91
1989	9	173	63	456	692	169	42	304	515	93	44	137
1990	10	296	63	444	803	291	44	287	622	103	24	127
1991	11	310	68	272	650	304	48	241	593	93	10	103
1992	12	297	69	109	475	291	50	98	439	85	4	89
1993	13	297	70	83	450	292	53	67	412	91	4	95
1994	14	293	70	60	423	287	56	44	387	99	4	103
1995	15	301	70	64	435	295	58	48	401	118	4	122
1996	16	313	72	80	465	307	61	59	427	120	4	124
1997	17	317	72	84	473	311	64	63	438	131	4	135
1998	18	324	72	87	483	318	67	66	451	141	4	145
1999	19	324	72	87	483	318	70	66	454	153	4	157
2000	20	326	72	87	485	319	73	66	458	165	4	169
Lowest % Induced (year)					20.7% (1986)				33.1% (1987)			32.9% (1985)
1 Flt/Day Threshold (jet)					296				349			
2 Flt/Day Threshold (jet)					929				994			
3 Flt/Day Threshold (commuter)												80
4 Flt/Day Threshold (commuter)												213

Source: Peter Eakland and Associates, 1979.

Table 4-19 (cont.)

Induced and OCS-Related Weekly Air Travel - Mean-Base Mean (MBM) Case

Southbound Links

Calendar Year	Years After Lease Sale	Cordova-Yakutat Induced YAK	Cordova-Yakutat Induced CDV	Cordova-Yakutat Mean OCS	Cordova-Yakutat Total Weekly Trips	Yakutat-Southeastern Induced YAK	Yakutat-Southeastern Induced CDV	Yakutat-Southeastern Mean OCS	Yakutat-Southeastern Total Weekly Trips	Southeastern-Seattle Induced YAK	Southeastern-Seattle Induced CDV	Southeastern-Seattle Mean OCS	Southeastern-Seattle Total Weekly ZQl?&-
1981	1	24	16	44	84	36	16	68	120	23	11	60	94
1982	2	31	19	52	102	46	19	80	145	29	13	72	114
1983	3	47	23	87	157	71	23	134	228	45	16	121	182
1984	4	47	26	92	165	71	26	139	236	45	18	126	189
1985	5	48	30	97	175	72	29	142	243	46	21	128	195
1986	6	73	35	161	269	111	34	190	335	70	24	165	259
1987	7	92	39	222	353	139	38	295	472	88	27	257	372
1988	8	103	75	271	449	’156	71	439	666	98	50	395	543
1989	9	176	80	304	560	267	78	520	865	168	54	483	705
1990	10	302	83	287	672	458	81	488	1,027	288	57	451	796
1991	11	316	90	241	647	479	88	447	1,014	301	62	413	776
1992	12	303	95	98	496	459	93	109	661	289	65	86	440
1993	13	303	101	67	471	460	98	60	618	289	68	43	400
1994	14	298	105	44	447	453	103	15	571	285	72	1	358
1995	15	307	110	48	465	466	108	17	591	293	75	1	369
1996	16	319	116	59	494	484	114	20	618	304	79	1	384
1997	17	323	122	63	508	490	119	22	631	308	83	1	392
1998	18	330	127	66	523	502	124	23	649	315	87	1	403
1999	19	330	133	66	529	502	130	23	655	315	90	1	406
2000	20	332	139	66	537	503	136	23	662	316	94	1	411

	Cordova-Yakutat	Yakutat-Southeastern	Southeastern-Seattle
Lowest % Induced (year)	37.1% (1987)	37.5% (1988)	27.2% (1988)
1 Fit/Day Threshold	349	287	221
2 Fit/Day Threshold	994	538	837
3 Flt/Day Threshold		1,597	

Source: “Peter Eakland and Associates, 1979.

Table 4-20

Additional Anchorage-Seattle Weekly Air Travel - OCS and Mean Base Cases

Calendar Year	Years After Lease Sale	Low-Base Mean (LBM) Induced	Low-Base Mean (LBM) Mean Ocs Inter	Low-Base Mean (LBM) Mean Devel. Inter	Low-Base Mean (LBM) Total	Mean-Base Mean (MBM) Induced	Mean-Base Mean (MBM) Mean (3CS Inter	Mean-Base Mean (MBM) Mean Devel. Inter	Mean-Base Mean (MBM) Total	High-Base Mean (lIBM) Induced	High-Base Mean (lIBM) Mean (3CS Inter	High-Base Mean (lIBM) Mean Devel. Inter	High-Base Mean (lIBM) Total
1981	1	1,918	42	915	2,875	1,918	42	915	2,875	1,918	42	915	2,875
1982	2	3,063	57	1,105	4,225	3,063	57	1,105	4,225	3,063	57	1,105	4,225
1983	3	3,719	95	1,440	5,254	3,732	95	1,440	5,267	3,745	95	1,440	5,280
1984	4	3,654	104	1,416	5,174	3,680	104	1,416	5,200	3,860	104	1,416	5,380
1985	5	3,950	150	533	4,635	4,040	150	533	4,723	4,542	150	533	5,225
1986	6	4,478	205	573	5,256	4,697	205	573	5,475	5,404	205	573	6,182
1987	7	5,095	187	441	5,723	5,494	187	441	6,122	6,253	187	441	6,881
1988	8	5,790	169	728	6,687	6,305	169	728	7,202	7,077	169	728	7,974
1989	9	6,511	303	885	7,699	7,090	303	885	8,278	7,704	303	885	8,972
1990	10	7,141	259	760	8,160	7,823	259	760	8,842	8,351	259	760	9,370
1991	11	7,823	147	673	8,643	8,441	147	673	9,261	9,097	147	673	9,917
1992	12	8,492	98	624	9,214	9,045	9a	624	9,167	9,714	98	624	10,436
1993	13	9,251	67	561	9,879	9,766	67	561	10,394	10,409	67	561	11,037
1994	14	10,223	1	46	10,270	10,512	1	46	10,559	11,142	1	46	11,189
1995	15	10,859	1	23	10,883	11,348	1	23	11,372	11,953	1	23	11,977
1996	16	11,747	1	7	11,755	12,236	1	7	12,244	12,841	1	7	12,842
1997	17	12,661	1		12,662	13,162	1		13,163	13,780	1		13,781
1998	18	13,600	1		13,601	14,140	1		14,141	14,758	1		14,759
1999	19	14,681	1		14,682	15,234	1		15,235	15,(364	1		15,865
2000	20	15,723	1		15,724	16,2(79	1		16,290	16.932	1		16,933
Lowest % Induced (year)					70.8 % (1983)				70.9% (1983)				70.9% (1983)
Existing Passengers					12,1366				12,866				12,866
Year Service Will Double					1998				1997				1996

Source: Peter Eakland and Associates, 1979.

ocs requirements for the air mode, particularly the movement of personnel, are more likely to be accomplished with the use of existing carriers operating in Alaska. The combination of increased population and OCS demands will create the need for additional flights to all communities. The increase from the mean base case is most pronounced at Yakutat, where beginning in 1990 a need exists for an additional flight between Anchorage and Seattle serving Cordova and Yakutat and a new daily flight operating south of Yakutat. In the mean base case, existing service to both Cordova and Yakutat was forecast to be adequate for the entire study period.

4.4 Low OCS-Mean Base Case (LBM)

4.4.1 FACTORS CALLSING GROWTH

The low OCS scenario is limited to exploration drilling activities from 1981 to 1984, since no economic discoveries are made. Thus, the low OCS and exploration-only scenarios are treated together. Exploration takes place in all three *shelves* -- the Yakutat, Yakataga, and Middleton. The maximum level of activity is four rigs drilling a total of 9.6 wells in each of the first two years (Table 4-22). A total of 28 wells are drilled during the four years.

Increases in population over the mean base case occur during the four years of exploration but then quickly recede. As shown in Tables 4-3 and 4-21, no population effects of the low scenario occur after 1984 in either Seward, Yakutat, Cordova, or the Southcentral region. In 1981, the LBM incremental base year growth factors are slightly greater than those for the MBM case, but for all three communities they fall even with or behind the MBM figures by 1983 (Table 4-3). For Anchorage, residual population effects occur until 1997 but beginning in 1986 they are only 0.1 percent of the base year population. The largest increase is only 0.2 percent.

4.4.2 WATER MODE

4.4.2.1 Description of Activities

Industrial Freight. Four rigs drill a total of 9.6 wells in each of the first two years. This compares with a total of 8 and 10 wells for the first two years of the mean OCS scenario. By the third year, the level of activity decreases in the LBM case to 7.2 wells but increases in the MBM case to 17 wells. For Seward, the peak LBM activity is in 1982 and inbound tonnage is forecast to be handled by two barges and three fuel tankers (Table 4-24). For Yakutat, the peak is in 1981 and the inbound traffic for OCS supplies is three barges and four fuel tankers (Table 4-25). By the third year, the MBM has at least as much activity as the LBM case. The LBM case does not include any construction activities. Demand for consumables is an equivalent of three container shipments per month for Yakutat in 1981, two for Cordova in 1982, and one for Seward throughout the exploration phase (Table 4-23).

Supply Boat Movements and Berths. Estimated monthly supply boat round trips during exploration are shown in Table 4-26. Yakutat has a peak of 36 monthly round trips in 1981, and at Seward the peak is 24. Movements at each of the sites can be accommodated by a single berth (Table 4-29).

Induced Freight. Table 4-27 shows the base year growth factors for induced freight at each of the ports. Figures listed are those which are different from the LBM case. No effects last beyond 1984, and those increases that do occur are only slightly above those forecast for the BM case.

Oil and Gas Production. Tanker movements are the same as those for the BM case (Table 3-5).

4.4.2.2 Summary of Impacts.

Terminals. The first two years of exploration are approximately the same for all scenarios. Existing facilities in Yakutat and Seward should be able to easily handle the equivalent of one supply berth. Unlike the MBM case, the LBM case does not create any demand for OCS-related facilities. No changes from the BM case-exist in peak requirements for ports that handle induced freight or petroleum products. Table 4-28 shows the base year factors for induced freight and petroleum, drilling tonnage, and consumables. 4

Carriers. Carrier requirements resemble those of the BM case more closely than those of the MBM case because of the lack of significant population increases at either the local or regional level after the exploration phase. A smaller demand for contract carriers compared to the MBM case occurs during the late 1980's and 1990's because of the absence of development and production phases in the Northern Gulf of Alaska. Smaller populations in Seward and Cordova compared to the MBM will produce a lessened demand for expansion of Marine Highway System services.

Issues. The issues for this case resemble those of the BM rather than the MBM case because of the low level of OCS activities. No new facilities have been scheduled for construction, but then no impacts are forecast for existing facilities. An issue in Yakutat that exists also for the mean base case is when will ARCO decide that it no longer has any further use for the existing support base facility and then turn it over to the community.

4.4.3 AIR MODE

4.4.3.1 Description of Activities

Employee Movements

- Helicopters. Offshore employees will be rotated through Yakutat and Cordova. Maximum activity is forecast to be 112 passenger round trips per week in 1981 for Yakutat-based aircraft and 75 for Cordova in 1982-83 (Table 4-29). Corresponding weekly helicopter flights are eight and six, respectively. As with OCS marine tonnage, activity is limited to the period 1981-1984. The peaks are considerably smaller than the MBM peaks of 63 weekly helicopter flights from Yakutat and 19 from Cordova (Table 4-17).

- Intrastate and Interstate Movements. Table 4-30 shows the assignment of interstate (non-Alaskan) and intrastate (nonlocal Alaskan) weekly trips to six links. Cordova-Anchorage and Yakutat-Southeast (Juneau) lead with a total of 82 trips per week. The Seward-Anchorage link has the smallest peak with 42 trips per week.

- Induced Growth and Total Traffic. Table 4-31 shows for all links connecting Yakutat, Seward, and Cordova the induced trips originating at each community, the low scenario OCS trips, and totals. The figures for the Anchorage-Seattle link are found on Table 4-20.

Induced trips and those for mean base case development activities on the Anchorage-Seattle link overshadow traffic related to Northern Gulf of Alaska OCS activities. Induced traffic increases alone never fall below 71.3 percent of the total increase. On the other links studied, OCS travel in the LBM case has a greater contribution than induced travel in the first two years of exploration but the reverse situation generally exists in the last two years. Except for the Anchorage-Seattle link, the largest traffic increase over the BM case is 140 total weekly trips in 1982 on the Cordova-Anchorage link. This figure is closely followed by 134 total trips in 1981 on the Yakutat-Southeast (Juneau) link. Significantly, all peaks recorded during the exploration period are exceeded later in the study period. For the Anchorage-Seattle link, only four years are required. For the Cordova-Anchorage and Yakutat-Southeast (Juneau) links., the figures are not reached again until 1993, more than a decade later in each case.

Traffic levels on links serving Yakutat, Cordova, and Seward do not exceed the thresholds for existing service, which was the case in the BM case but not the MBM case.

4.4.3.2 Summary of Impacts

Terminals. The significantly lower level of passenger and helicopter activity in the LBM case compared to the MBM case does not generate any significant impacts on existing facilities. Impacts on facilities are limited to those which have been identified for the mean base case, namely air terminal improvements at Anchorage and Seward.

Carriers. Traffic forecasts for the LBM case approximate those of the MBM case for the first two years but thereafter those of the LBM case. Peak traffic levels are the same as those forecast for the BM case, and they can be handled by existing flights except on the Anchorage-Seattle link, which will require doubling of base level service by 1997.

Issues. Relevant issues are the same as those discussed for the BM case. The build-up of activity that occurred in both Seward and Yakutat for exploration activities after the first lease sale in the Northern Gulf of Alaska likely will not reoccur until economic discoveries are made. Overbuilding becomes likely in a low scenario only when expectations are high and are not realized.

4.4.4 LAND MODE

4.4.4.1 Roads

The absence of development activity in the LBM case makes traffic forecasts for the Seward Highway virtually identical to those of the BM case.

4.4.4.2 Railroad

No changes from the BM case are anticipated.

4.4.4.3 Issues

No issues for the land mode have been identified which are different from the BM mode.

Table 4-21

Regional Population Projections: Low OCS - Mean Base Case (LBM)
Factors to Produce Incremental Changes from Mean Base Case (BM)[1]

Year	Statewide	Anchorage	Southcentral	Fairbanks
1977	0	0	0	
1978	0	0	0	
1979	0	0	0	
1980	0	0	0	
1981	0.002	0.001	0.013	-0.001
1982	0.003	0.002	0.013	0
1983	0.003	0.002	0.010	0
1984	0.002	0.002	0.003	0.001
1985	0.001	0.002	0	0.001
1986	0.001	0.001	0	0.001
1987	0.001	0.001	0	0.001
1988	0.001	0.001	0	0.001
1989	0.001	0.001	0	0.001
1990	0.001	0.001	0	0.001
1991	0.001	0.001	0	0.001
1992	0.001	0.001	0	0.001
1993	0.001	0.001	0	0.001
1994	0.001	0.001	0	0.001
1995	0.001	0.001	0	0.001
1996	0	0.001	0	0.001
1997	0	0.001	0	0.001
1998	0	0	0	0.001
1999	0	0	0	0.001
2000	0	0	0	0.001

Note: (1) F_I = Incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: ISER, 1979,

Table 4-22

Exploration and 95% Resource Level Scenario, Transportation-Related Activities

Calendar Year	Year After Lease Sale	Yakutat Field Rigs	Yakutat Field Wells	Yakataga Field Rigs	Yakataga Field Wells	Middleton Field Rigs	Middleton Field Wells
1981	1	3	7.2			1	2.4
1982	2	2	4.8	1	2.4	1	2.4
1983	3	1	2.4	1	2.4	1	2.4
1984	4	1	0.6	1	0.2	1	0.8

Source: Dames & Moore, 1978.

Table 4-23

Average Monthly Consumable Demands - Exploration Scenario

Calendar Year	Year	Tons[1] Yakutat	Tons[1] Cordova	Tons[1] Seward	Containers[2] Yakutat	Containers[2] Cordova	Containers[2] Seward
1981	1	39.1	9.2	7.1	3	1	1
1982	2	26.1	18.3	11.0	2	2	1
1983	3	13.1	18.3	10.1	1	2	1
1984	4	4.1	4.8	2.7	1	1	1
1985	5						
1986	6						
1987	7						
1988	8						
1989	9						
1990	10						
1991	11						
1992	12						
1993	13						
1994	14						
1995	15						
1996	16						
1997	17						
1998	18						
1999	19						
2000	20						

Notes: (1) Tons = (Offshore onsite + Onshore onsite non-local) x (300 lbs./person) ÷ (2,000 lbs./ton).
(2) Containers = Tons/(15 tons/container).

Source: Peter Eakland and Associates, 1979.

Table 4-24

Logistics Requirements for Yakutat-Based Drilling - Exploration Scenario

Calendar Year	Yakutat Shelf Tonnage (Short Tons) Drill Pipe	Dry Bulk	Fuel	Drill Water	Inbound Dry Goods Barges (1)	Fuel Tankers (2)	Outbound Supply Boats (3)	Base Year Factors (4) Dry Freight	Fuel
1981	3,299	9,374	16,661	26,035	3	4	74	8.6	1.9
1982	2,199	6,250	11,107	17,357	2	3	50	5.7	1.3
1983	1,100	3,125	5,554	8,678	1	2	25	2.9	0.6
1984	275	781	1,388	2,170	1	1	11	0.7	0.2
1985									
1986									
1987									
1988									
1989									
1990									
1991									
1992									
1993									
1994									
1995									
1996									
1997									
1998									
1999									
2000									

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-25

Logistics Requirements for Seward-Based Drilling - Exploration Scenario

Calendar Year	Yakataga Shelf Tonnage (Short Tons)				Middleton Shelf Tonnage (Short Tons)				Inbound		Outbound	Base Year, b, Factors (4)	
	Drill Pipe	Dry Bulk	Fuel	Drill Water	Drill *	Dry Bulk	Fuel	Drill Water	Dry Goods Barges (1)	Fuel Tankers (2)	Supply Boats (3)	Dry Freight	Fuel
1981					1,100	3,125	5,554	8,678	1	2	25	0.1	0.3
1982	1,100	3,125	5,554	8,678	1,100	3,125	5,554	8,678	2	3	50	0.1	0.5
1983	1,100	3,125	8,678	1,100	1,100	3,125	5,554	8,678	2	3	50	0.1	0.7
1984	92	260	463	723	367	1,042	1,851	2,893	1	1	11	0.0	0.1
1985													
1986													
1987													
1988													
1989													
1990													
1991													
1992													
1993													
1994													
1995													
1996													
1997													
1998													
1999													
2000													

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-26

Monthly Supply Boat Round-Trips by Service Base - Exploration scenario

Calendar Year	Middleton Shelf Exploration	Yakataga Shelf Exploration	Total Seward-Based Trips	Berth[1] Requirements	Yakutat Exploration	Yakutat Based Trips	Berth[1] Requirements
1981	12		12	1	36	36	1
1982	12	12	24	1	24	24	1
1983	12	12	24	1	12	12	1
1984	12	12	24	1	12	12	1
1985							
1986							
1987							
1988							
1989							
1990							
1991							
1992							
1993							
199,4							
1995							
1996							
1997							
1998							
1999							
2000							

Note: (1) 30% berth occupancy assumed all-day for 1-2 berths.

Source: Peter Eakland and Associates, 1979.

Table 4-27

Base-Year Growth Factors for OCS-Induced Freight Tonnage - Low-Base Mean (LBM) Case[1]

Calendar Year	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petro-leum	Seward Dry Bulk	Seward Petro-leum	Whittier Dry Bulk	Whittier Petro-leum	Cordova Dry Bulk	Cordova Petro-leum	Yakutat Dry Bulk	Yakutat Petro-leum	Valdez Dry Bulk	Valdez Petro-leum
1981	1				1.06					1.25	1.25	8.29	1.05
1982	2				1.08			1.12	1.12	1.22	1.22	8.51	1.07
1983	3				1.09			1.13	1.13	1.18	1.18	6.03	1.06
1984	4				1.12					1.13	1.13		
1985	5												
1986	6												
1987	7												
1988	8												
1989	9												
1990	10												
1991	11												
1992	12												
1993	13												
1994	14												
1995	15												
1996	16												
1997	17												
1998	18												
1999	19												
2000	20												

Note: (1) Values not shown are unchanged from the mean base (BM) case. Factors shown are cumulative and include base case.

Source: Peter Eakland and Associates, 1979.

Table 4-28

Base Year Factors for Freight Categories by Service Means - (1,3)
Low-Base Low and Low-Base Mean Cases

Calendar Year	Yakutat Fuel Induced (Throughput)	Yakutat Fuel Drilling(2) (Throughput)	Yakutat Dry Freight Induced (Throughput)	Yakutat Dry Freight Consumables (Inbound)	Yakutat Dry Freight Drilling(2) (Throughput)	Fuel Induced (Throughput)	Fuel Drilling(2) (Throughput)	Seward Dry Freight Induced & Base Dev. (Throughput) LBL Case	Seward Dry Freight Induced & Base Dev. (Throughput) LBM Case	Seward Dry Freight Consumables (inbound)	Seward Dry Freight Drilling(2) (Throughput)	Cordova Dry Freight Induced (Throughput)	Cordova Dry Freight Consumables (Inbound)
1981	1.3	3.8	1.3	0.3	17.2	1.1	0.6	2.4	2.4	0	0.2	1.1	0
1982	1.2	2.6	1.2	0.2	11.4	1.1	1.0	2.5	2.5	0	1.2	1.1	0
1983	1.2	1.2	1.2	0.1	5.13	1.1	1.4	1.0	1.9	0	0.2	1.1	0
1984	1.1	0.4	1.1	0	1.4	1.1	0.2	1.0	1.8	o		1.1	0
1985	1.1		1.1			1.2		1.3	1.3			1.2	
1986	1.2		1.2			1.2		1.4	1.4			1.2	
1987	1.2		1.2			1.2		1.4	1.5			1.2	
1988	1.2		1.2			1.2		1.5	1.6			3.2	
1989	1.2		1.2			1.3		1.6	1.6			1.3	
1990	1.3		1.3			1.3		1.6	1.7			1.3	
1991	1.4		1.4			1.3		1.6	1.7			1.3	
1992	1.4		1.4			1.3		1.7	1.?			1.3	
1993	1.5		3.5			1.4		1.1	1.7			1.4	
1994	1.5		1.5			1.4		1.8	1.8			1.4	
1995	1.6		1.6			1.5		1.8	1.8			1.4	
1996	1.6		1.6			1.5		1.9	1.9			1.4	
1997	1.6		1.6			1.5		1.9	2.0			1.5	
1998	1.6		1.6			1.6		2.0	2.0			1.5	
1999	1.6		1.6			1.6		2.3	2.1			1.5	
2000	1.7		1.7			1.7		2.2	2.2			1.6	
	Base Value 11.0) = 7,058 metric tons (13,662 tons)		Base Value (1.0) = 1,340 metric tons (1, 477 tons)			Base Value (1.0) = 19,760 metric tons (21,782 tons)		Base Value (1.0) = 60,726 metric tons (66, 939 tons)				Base Value (1.0) = 14,861 metric tons (16, 3B2 tons)	

Notes: (1) Factors are related to base year tonnages for the individual communi ty. A comparison of f actors for different communities is not meaningful. Care should be observed in combining the f igures. Some are throughput tonnages, and others are inbound only where they are considered more meaningful. No common type of vessels or landside facilities are implied.

(2) Fuel and dry f reight tonnage required for drilling has been doubled to provide throughput figures.

(3) The use of the same facilities for all dry freight is not implied.

Source: Peter Eakland and Associates, 1979.

Table" 4-29

Weekly Helicopter Round Trips from Service Bases in Northern Gulf of Alaska - Exploration Scenario

Calendar Year	Yakutat: Total Offshore Average Monthly Employment (1)	Yakutat: Peak Weekly Round Trips (2)	Yakutat: Helicopter Trips per Week (3)	Cordova: Total Offshore Average Monthly Employment (1)	Cordova: Peak Weekly Round Trips (2)	Cordova: Helicopter Trips per Week (3)
1981	336	112	8	112	38	3
1982	224	75	6	224	75	6
1983	112	38	3	224	75	6
1984	36	12	1	58	20	2
1985						
1986						
1987						
1988						
1989						
1990						
1991						
1992						
1993						
1994						
1995						
1996						
1997						
1998						
1999						
2000						

Notes: (1) Total employment equals offsite plus onsite employments. All offshore tasks have been included except supply/anchor/tug boats and include surveys, rigs, platforms, platform installation, and offshore pipeline construction.

(2) Peak weekly trips = (0.717 round trips/month) x (2.0 peak factor) – 4.3 weeks/month.

(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979.

Table 4-30

OCS Employment-Related Weekly Air Trips by Trip Segment - Exploration Scenario

Northbound Links

Year	Yakutat-Cordova: CDV Inter (R)[1] .25	Yakutat-Cordova: YAK Intra .75	Yakutat-Cordova: YAK Inter .25	Total Weekly One-Way Trips	Jet Plane Equiv.[2]	Cordova-Anchorage: CDV Intra 1.0	Cordova-Anchorage: CDV Inter .75	Cordova-Anchorage: YAK Intra .75	Cordova-Anchorage: YAK Inter .25	Total Weekly Trips	Plane Equivalent: Jet[2]	Plane Equivalent: Commuter[3,4]	Seward-Anchorage: SWD Intra 1.0	Seward-Anchorage: SWD Inter 1.0	Total Weekly Trips	Plane Equivalent: Jet[2]	Plane Equivalent: Commuter[3]
1	7	24	23	54	.5	4	21	24	23	12	.7	1.3	32	10	42	.4	2.2
2	6	17	15	38	.4	14	36	17	15	82	.7	2.6	32	16	38	.3	2.0
3	9	9	8	26	.3	14	36	9	8	67	.6	2.6	11	15	26	.2	1.4
4	8	3	3	14	.1	4	10	3	3	20	.2	.7	3	4	7	.1	.4
5																	
6																	
7																	
8																	
9																	
10																	
11																	
12																	
13																	
14																	
15																	
16																	
17																	
18																	
19																	
20																	

Notes: (1) (R) represents return or inbound trips. Yakutat-Cordova is the only link on which both inbound and outbound trips occur.
(2) Jet aircraft assumed to have capacity of 110 passengers.
(3) Commuter aircraft assumed to have capacity of 19 passengers. Feasible on Seward-Anchorage and Cordova-Anchorage links.
(4) Commuter plane equivalents based only on Cordova-originating trips.

Source: Peter Eakland and Associates, 1979.

Table 4-30 (cont.)

OCS Employment-Related Weekly Air Trips' by Trip Segment - Exploration Scenario

Southbound Links

Calendar Year	Yakutat-S. E. YAK Intra .25	YAK Inter .75	CDV Inter .25	Total Weekly Trips	Jet Plane Equiv. (2)	S. E.-Seattle CDV Inter .25	YAK Inter .75	Total Weekly Trips	Jet Plane Equiv. (2)	Anchorage-Seattle YAK Inter .25	CDV Inter .75	SWD Inter 1.0	Total Weekly Trips	Jet Plane Equiv. (2)
1981	a	67	7	82	.8	7	67	74	.7	23	29	10	62	.6
1982	6	44	12	62	.6	12	44	56	.5	15	36	16	66	.6
1983	3	22	12	37	.3	12	22	34	.3	8	36	15	59	.5
1984	1	8	4	13	.1	4	8	12	.1	3	10	4	17	.2
1985														
1986														
1987														
1988														
1989														
1990														
1991														
1992														
1993														
1994														
1995														
1996														
1997														
1998														
1999														
2000														

Source: Peter Eakland and Associates, 1979.

Table 4-31

Induced and OCS-Related Weekly Air Travel - Low-Base Low (LBL) and Low-Base Mean (LBM) Cases (1,2)

Northbound Links

Calendar Year	Years After Lease Sale	Cordova-Anchorage Induced YAK	Cordova-Anchorage Induced CDV	Cordova-Anchorage High OCS	Cordova-Anchorage Total Weekly Trips	Yakutat-Cordova Induced YAK	Yakutat-Cordova Induced CDV	Yakutat-Cordova High Ocs	Yakutat-Cordova Total Weekly Trips	Seward-Anchorage Induced	Seward-Anchorage BH	Seward-Anchorage Total Weekly Trips.
1981	1	27	27	72	126	26	9	54	89	1.3	42	55
1982	2	24	34	82	140	23	11	44	78	18	38	56
1983	3	20	39	67	126	19	12	29	60	22	26	48
1984	4	14	43	20	77	14	14	10	38	29	7	36
1985	5											
1986	6											
1987	7											
1988	8											
1989	9											
1990	10											
1991	11											
1992	12											
1993	13											
1994	14											
1995	15											
1996	16											
1997	17											
1998	18											
1999	19											
2000	20											
Lowest % Induced (year)					41.4% (1982)				39.3% (1981)			23.6% (1981)
1 Fit/Day Threshold					296				349 .			
3 Fit/Day Threshold												66

Note: (1) A single forecast exists for the low scenario at the local level.
(2) Values not shown are unchanged from the base case.

Source: Peter Eakland and Associates, 1979.

Table 4-31 (cont.)

Induced and OCS-Related Weekly Air Travel - Low-Base Low (LBL) and Low-Base Mean (LBM) Cases (1,2)

Southbound Links

Calendar Year	Years After Lease Sale	Cordova-Yakutat Induced YAK	Cordova-Yakutat Induced CDV	Cordova-Yakutat High OCS	Cordova-Yakutat Total Weekly Trips	Yakutat-Southeastern Induced YAK	Yakutat-Southeastern Induced CDV	Yakutat-Southeastern High OCS	Yakutat-Southeastern Total Weekly Trips	Southeastern-Seattle Induced YAK	Southeastern-Seattle Induced CDV	Southeastern-Seattle High OCS	Southeastern-Seattle Total Weekly Trips
1981	1	27	16	54	97	36	16	82	134	26	11	74	111
1982	2	24	20	44	88	37	20	62	119	23	14	56	93
1983	3	20	23	29	72	30	23	37	90	19	16	34	69
1984	4	15	25	10	50	22	25	13	60	14	17	12	43
1985	5												
1986	6												
1987	7												
1988	8												
1989	9												
1990	10												
1991	11												
1992	12												
1993	13												
1994	14												
1995	15												
1996	16												
1997	17												
1998	18												
1999	19												
2000	20												
Lowest % Induced (year					44.3% (1981)				38.8% (1981)				33.3% (1981)
1 Fit/Day Threshold					349				287				221

Notes: (1) A single base forecast exists at the local level.
(2) Values not shown are unchanged from the base case.

Source: Peter Eakland and Associates, 1979.

4.4.5 SUMMARY COMPARISON OF LOW OCS-MEAN BASE CASE (LBM) AND MEAN OCS-MEAN BASE CASE (MBM)

Activities in the LBM case are significantly lower than those in the MBM case after the first two years of exploration. In fact, the forecasts for movements of goods and passengers more closely resemble those of the LBM case than the MBM case. None of the incremental impacts identified for the MBM case exist for the LBM case. In fact, increases in service or expansions of facilities that were identified for the BM case appear to be adequate also for the LBM case.

4.5 High OCS-Mean Base Case (HBM)

4.5.1 FACTORS CAUSING GROWTH

Activities in the HBM case are similar to those that have been outlined for the MBM case but they are of a larger magnitude and extend for a longer period of time. Tables 4-33 through 4-35 show the exploration, development, and production activities that generate transportation demands. All three phases occur in the Yakataga, Yakutat, and Middleton Shelves for the HBM case but only in the latter two for the MBM case. A maximum of 10 exploratory rigs are used and 21 platforms installed compared to four rigs and nine platforms in the MBM case. The higher levels of activity lead to greater direct OCS transportation demands in all categories, including movement of industrial freight, transpiration of employees, and transportation of oil and gas that is recovered.

Population increases at the local and regional levels will produce indirect increases in the demand for transportation services. Population increases are approximately double those that occur in the MBM case once the height of development is reached. Base year growth factors for regions are shown in Table 4-32.

The highest incremental base year growth factor for the Anchorage region is 10.1 percent in 1988, which compares to a peak of 5.4 percent in 1989 for the MBM case.

These figures represent population differences between the particular OCS case and the mean base case expressed as a percentage of the base population. The incremental base year factor at the end of the study period is 9.4 percent.

Similar incremental growth factor increases in the HBM case occur for the Southcentral region. The HBM peak incremental factor at the end of the study period falls slightly to 18.5 percent.

Forecast populations for local communities and the resulting incremental base year growth factors are shown, respectively, in Tables 4-2 and 4-3.

At Yakutat, the peak incremental factor is 5.002 in 1991 and the figure at the end of the study period is only slightly less, 4.825. The peak in the MBM case is 1.568. In the HBM case, doubling of population (incremental base year growth factor of 1.0) first occurs in 1985 compared to 1989 for the MBM case. The patterns of population growth are slightly different in Cordova and Yakutat. In Cordova, where OCS employment is negligible during exploration and development but considerable during production, the peak incremental factor occurs late in the study period. An incremental factor of 0.40 is first reached in 1990 and the peak is 0.495 in 1998. The MBM peak is 0.247 in the latter year. Finally, at Seward, impacts on population occur only during the exploration and development phases. The peak incremental factor of 0.283 which occurs in 1989 reduces to 0.038 by the end of the study period. The corresponding figures for the MBM case are 0.148 for the peak and 0.014 for the end of the study period.

The high resource level scenario contains economic oil and gas reserves significantly larger than those in the mean scenario. The 4,400 mmbbl of oil reserves that are forecast to be discovered and developed in the high scenario represent more than a threefold increase over the MBM figure (Dames and Moore, 1978). Three-fourths of these reserves are assumed to be located in the Yakutat Shelf. The remaining one-fourth is split among the Middleton (700 mmbbl) and the Yakutat (400 mmbbl) Shelves. The Yakutaga Shelf for the first time is assumed to contain some economic oil reserves. Otherwise, the ratio between reserves in each of the shelves is approximately the same as in the mean scenario. Total economic oil reserves are 13,000 Bcf, which compares to 5,000 Bcf for the mean scenario. Gas associated with oil reserves amounts to 2,600 Bcf, and 10,400 Bcf are non-associated. As with oil reserves, three-fourths are assumed to be located in the Yakutat Shelf. The remainder is assumed to be only in the Middleton Shelf.

4.5.2 WATER MODE

4.5.2.1 Description of Activities

Industrial Freight. Tables 4-36 through 4-40 shows the industrial freight for the high scenario broken down into four categories, as follows: (-1) drilling supplies; (2) pipeline materials; (3) onshore construction equipment and materials, and (4) consumables. Shore locations that are affected vary by category but are the same as in the MBM case. Seward and Yakutat will handle all drilling supplies, Seward will handle all offshore pipeline materials, and Yakutat and Hinchinbrook Island will be the location of onshore oil and gas processing facilities.

Significantly greater economic reserves of oil and gas in the high scenario compared to the mean scenario produces higher levels of industrial freight in all categories. The highest level of activity continues to be out of Yakutat, but percentage-wise the largest increase occurs for Seward. Drilling in the Yakutat Shelf occurs from 1981 to 1995. Peak activity is in 1992 when 22 inbound barges of dry freight and 29 fuel tankers are forecast. The MBM peak year forecast of 13 barges and 18 tankers for Yakutat is exceeded from 1990 to 1993. Seward's role in serving drilling activities takes place from 1981 to 1993. The peak is in 1990 when 10 dry freight barges and 14 fuel tankers are forecast. These figures represent more than a three-fold increase over those for the MBM case.

The scale of construction activities will be significantly greater in the high scenario than the mean scenario, but the types of activities and their location remain the same. LNG plants and oil terminals both will be constructed at Yakutat and on Hinchinbrook Island. Pipe coating will be done in Seward, and the principal supply base will be in Yakutat and Seward. At Yakutat, the peak year for movement of construction materials occurs in 1985 which is two years earlier than in the mean scenario. The estimated peak number of barges is 42, which is 75% greater than the peak in the mean scenario (Tables 4-19 and 4-39). At Hinchinbrook, construction activities are scheduled from 1986 to 1989. This period is three years in advance of the schedule for the mean scenario. The LNG plant is more than twice as large as that in the mean scenario, although the oil terminals in the scenarios are approximately the same.

At Seward, peak movements are due solely to movements of pipe for offshore pipelines. Peak tonnage in the high scenario occurs in 1988 and is more than twice as great as that for the mean scenario.

Forecasts for consumables by supply base are shown in Table 4-40. The peak number of containers per month is 22 for Yakutat in 1988, nine for Seward in 1990, and six for Cordova in 1985.

Supply Boat Movements and Berths. Supply boats are based out of Seward and Yakutat for the entire study period, 1981-2000. Cordova is used by supply boats only after production begins. The mean scenario peak in Yakutat of 264 monthly round-trips is first exceeded in the high scenario in 1989 and does not fall below this level until 1994 (Table 4-41). Peak activity of 468 monthly round-trips occurs in 1991 and requires a minimum of eight berths. At least four berths are required continuously from 1988 to 1994 (Table 4-41).

For Seward, which serves both the Middleton and Yakataga Shelves, peak supply boat activity occurs in 1988 which is soon after the development phase begins. The peak monthly round-trip figure of 250 is approximately double the peak value for the mean scenario. However, peak berth requirements increase only from four to five. At least four berths are required for three consecutive years, 1988-1990. At Cordova, peak monthly round trips are only twelve, which is an increase from six in the mean scenario. A single berth is adequate in both cases.

Induced Growth. Table 4-42 shows the base year growth factors for dry bulk and petroleum tonnage due to population increases. For the six ports studied, the highest dry bulk and petroleum factors are in all cases those at the end of the study period. Those ports whose throughput tonnage is dependent more on regional population growth than on local growth have factors only slightly greater than those occurring for the mean scenario. Such ports include Anchorage, Seward, Whittier, and Valdez. For Cordova, the increase in the factors for the year 2000 is from 1.82 in the MBM to 2.06 in the HBM case. The increase is even larger for Yakutat, as the factors go from 4.07 to 6.48.

Transportation of Oil and Gas. Oil will be produced from each of the three shelves and gas from the Middleton and Yakutat Shelves. Each of the shelves will have offshore production facilities, and the Middleton and Yakutat Shelves will also have onshore oil terminals.
Table 4-44 shows the oil and gas production figures and resulting vessel traffic for each shelf. The onshore facility at Yakutat has an estimated peak annual production of 266.0 mmbbl. When offshore production is

included, peak production for the Yakutat Shelf occurs a year later and totals 391.3 mmbbl. An estimated 422 tanker round-trips would be required to transport this level of production. For the Yakatega Shelf, peak offshore production of 35.0 mmbbl occurs from 1991 to 1994. In the Middleton Shelf, offshore production exceeds onshore production. Total production peaks in 1992 at 93.0 mmbbl, which is approximately one-quarter of that for the Yakutat Shelf. Onshore production from the Hinchinbrook oil terminal is the same in the high scenario as in the mean scenario. Increased production comes exclusively from offshore facilities. An estimated 38 tanker round-trips are required to handle peak production of the Yakataga Shelf and 100 for peak production of the Middleton Shelf. Peak LNG production in the Middleton Shelf creates almost as many vessel trips as peak oil production. After 1992, annual LNG ship movements exceed those of oil tankers. On the other hand, LNG ship movements for the Yakutat Shelf exceed those of oil tankers only from 1988 to 1991. The peak year for LNG shipping from the Yakutat area is 1994 when an estimated 237 round-trips will occur.

Table 4-16 shows LNG and oil tanker traffic for four segments from Valdez to south of Yakutat. The first segment -- Valdez to Middleton Shelf -- handles tanker traffic from the TransAlaska Pipeline (TAPS). The high, mean, and low scenarios include different production levels from the Beaufort Sea and a constant production from Prudhoe Bay. The figures for the other three segments are cumulative figures for vessels/week above the figures provided for the first segment. Peak additional outbound vessel traffic for oil tankers and LNG ships together is 3.8 in 1992 for the second segment, Middleton Shelf to Yakataga Shelf; 4.5 in 1992-1994 for the third segment, Yakataga Shelf to Yakutat Shelf; and 16.4 for the fourth segment, south of Yakutat Shelf. Additional traffic in the second and third segments in any year does not exceed the mean value for the first segment. However, the additional traffic south of Yakutat Shelf exceeds segment one traffic beginning in 1991. Additionally, the peak value of 16.4 vessels/week exceeds the peak value for segment one, which is 13.3 vessels/week for all cases.

*

<u>4.5.2.2 Summary of Impacts</u>

<u>Terminals.</u> Table 4-43 contains induced and OCS tonnages converted to base year growth factors. The threshold values for low and high capacities are provided at the bottom of Table 4-42. By the end of the study period, low capacity threshold values are exceeded for both dry bulk and petroleum at Anchorage.

The dry bulk threshold is first exceeded in 1995, the same year as *in* the MBM case. Only small delays are anticipated because the large carriers operate on strict schedules. Yakutat, which has the highest growth rate factors, also has the highest threshold values. No congestion is expected due to population-related petroleum or freight shipments. The figures in Table 4-43 clearly show that congestion will develop at Yakutat and Seward if additional supply base berths and construction docks are not built in a timely manner. As long as they are built as scheduled in the high scenario and are sized to handle peak loads, the impacts on existing facilities can be expected to be minimal. At Yakutat the construction of a structurally-sound public dock is considered necessary in the base case and, thus, is assumed to be present in the high scenario.

Impacts of an expanded supply base at Seward will depend in part on where it is constructed. Likely sites are in the vicinity of the existing Alaska Railroad clock and Fourth of July Creek on the other side of Resurrection Bay. At Yakutat, peak requirements are for eight berths, six more than exists at ARCO'S present facility in Monti Bay. Eight berths would minimally require 488 m(1,600ft.) of dock space. The decision might be made to construct a new facility at a different location.

Three berths are required for oil tankers at Yakutat and an additional two for LNG ships. No existing facilities for deep-draft vessels exist in the area. The mean scenario calls for two oil tanker berths and two LNG ship berths. The largest tankers projected to use Yakutat will have a length of approximately 290 m (950 ft.) (ECO, 1978). For Hinchinbrook, a single berth will be adequate for both scenarios but an increase in LNG ship berths from one two probably will be required.

Carriers and Routes. Marine carriers of general freight will be able to handle forecast traffic with incremental increases in existing services. Capacity of existing services historically has never been a limitation to carriers serving Alaska. As demand increases, existing carriers have responded with larger vessels, more extensive routes, and greater frequency. Greater frequency of service can be expected to Seward, Cordova, and Yakutat, particularly the latter, which *relies on* air shipments of consumable items at the present time.

During the peak of production, LNG and oil tanker traffic south of Yakutat from Northern Gulf of Alaska operations alone will be greater than that for Trans Alaska Pipeline. The route to West Coast refineries will not even remotely approach capacity but the increased level of traffic does increase the likelihood of pollution incidents and conflicts with fish vessels. Adjustments in the existing approach routes to Prince William Sound for TAPS tankers likely will have to be changed once development activities begin. The existing route does not take into account the potential of OCS activites.

Issues. Issues at ports concern the timing, location, and size of docks to service drilling, construction, and production activities. This issue is particularly important at Yakutat, where the scope of activities is largest but also at Seward, where the existing dock facilities serve a variety of users. Route issues focus on vessel traffic serving the Middleton Shelf, since the potential for conflicts with fishing vessels and oil tankers to and from Valdez is the greatest in issues exist for carriers that do not exist for the MBM case.

4.5.3 AIR MODE

4.5.3.1 Description of Activities

Employee Movements

o Helicopters. The highs scenario requires a high level of support from both Cordova and Yakutat to transport employees working at offshore and remote sites. The forecast number of peak weekly employee round-trips and resulting helicopter round-trips are shown on Table 4-45. Peak helicopter usage occurs out of Yakutat in 1991 with a forecast number of 121 trips per week or approximately 18 per day, and out of Cordova in 1988 with 70 trips per week, or 10 per day. The Yakutat figure is twice the peak for the mean scenario and the Cordova figure almost four times the mean scenario peak. In each instance, the mean scenario peak is exceeded five consecutive years in the high scenario.

- Interstate and Intrastate Carriers. Table 4-46 shows the weekly trips produced by non-local employees traveling to their place of residence during the summer. Peak figures occur at the height of development activities (1988-1989) except for the Seward-Anchorage link that peaks in 1984. The link having the highest level of direct OCS traffic is Cordova-Anchorage. For seven consecutive years beginning in 1985, employee round-trips exceed 400 per week and reach a peak of 1,152 in 1998. The peak for Yakutat-Southeast is 998 trips per week followed by Southeast-Seattle with 932, Yakutat-Cordova with 587, and finally Seward-Anchorage with 115 trips per week.

The increases over the mean scenario are not uniform for all links. On the Cordova-Anchorage link, the peak for the high scenario is 153% higher than that for the mean scenario while for the Seward-Anchorage the other extreme exists. The peak figures for the two scenarios on this link are virtually the same. A increase of 93% in peak values occurs on the Yakutat-Southeast link and is 112% on the Anchorage-Seattle link.

Population Movements and Total Passengers. The population-induced air traffic above existing levels is shown in Tables 4-47 and 4-20

(Anchorage-Seattle). Also shown are the OCS traffic and total weekly one-way trips. On the Anchorage-Seattle route, increases due to population greatly exceed those due to Northern Gulf of Alaska OCS activities or for mean base case activities. The total increase due to population increases never falls below 70.6% of the total population. For the other six links, for at least several years OCS traffic exceeds population-related increases but the latter dominate by the mid-1990's. Peak total travel occurs between 1988 and 1991 for all links except Anchorage-Seattle where peak travel occurs at the end of the study period. The largest total increase, of course, occurs on the Anchorage-Seattle link. Otherwise, Yakutat-Southeastern has the largest with an increase of 1,888 weekly trips in 1991 and is followed by Cordova with 1,497. Seward-Anchorage has a peak of only 200 trips but the other links have peaks in excess of 1,000 trips per week.

4.5.3.2 Summary of Impacts

Increases in flights, passenger movements at passenger terminals, and the number of based aircraft potentially impact airport facilities. During peak development activities, helicopter operations are greater than the increase in fixed-wing operations. Because of the relatively small air taxi and general aviation operations at the Yakutat airport, the additional operations brought about by OCS activities will not create runway capacity problems.

The large increase in the number of persons passing through passenger terminals at all airports creates the potential need for major improvements. At Anchorage International Airport, a construction program adequate for the mean base case will also be adequate for the HBM case because most of the growth is population-related. At Yakutat, passenger terminal movements -- either a deplaning or an enplanement -- will reach a peak of 6,620 per week in 1991, which is more than 12 times the base year value and 2-1/4 times the peak for the MBM case. The figure for the end of the study period is only two-thirds of the 1991 peak, which lessens the incentive to provide for the peak demand. The peak year for usage of the Cordova passenger terminal also is in 1991 but the number of movements is somewhat less (6,354). The figure for the end of the study period is 4,938, which is slightly more than that for Yakutat. The potential for overbuilding exists at Cordova but is less than at Yakutat. Extensive facilities for storing and maintaining helicopters will be required at Yakutat. Helicopter requirements in the year 2000 are only one-eighth of the peak in 1991, but oil companies require dependable logistics during the development phase and most likely will underwrite facilities to meat peak demands.

Carriers and Routes. Table 4-47 shows the threshold values for a given number of daily flights on each link. Once a threshold value is reached, the given number of flights is inadequate. Passenger traffic for the Seward-Anchorage (Table 4-47) and Anchorage-Seattle (Table 4-20) links is remarkably similar to that for the MBM case. The HBM case will not bring increased impacts to these routes, although carriers serving them also serve other cities potentially impacted by Northern Gulf of Alaska activities. On the Alaska Airlines route serving Cordova and Yakutat, Cordova-Anchorage is the critical link on northbound flights and Yakutat-Southeast on southbound flights. Based on the passenger forecasts and the estimated threshold values, the threshold values for one and two flights per day, respectively, are reached in 1984 and 1988 for both northbound and southbound flights. A fourth flight is required in 1989 due to the 1,689 passenger trips/week on the Yakutat-Southeastern link and is needed through 1991. Otherwise, three flights are adequate throughout the 1990's in both directions. All threshold values are reached after airline deregulation is expected to be complete. If air taxis and commuter airlines are able to attract a significant percentage of traffic which is forecast for the Cordova-Anchorage link, some flights between Anchorage and Yakutat might bypass Cordova. Also, Yakutat logically could become a northern terminus for one or more flights a day. To place in perspective traffic demands at Yakutat, Juneau received three flights per day in each direction from Alaska Airlines in 1979 before Wien and Western were given approval by the CAB to enter the Southeastern market.

Issues. Providing adequate passenger terminal facilities remains the most important issue for the air mode. The high level of helicopter operations at Yakutat might generate the need for additional FAA flight service personnel. The additional traffic between Cordova and Anchorage likely will be split between commuter and trunk airlines. The nature of trunk airline service to Southeast Alaska when airline deregulation becomes complete in 1984 likely will determine whether or not any carrier besides Alaska Airlines decides to serve Cordova and/or Yakutat.

4.5.4 LAND MODES

Roads. The HBM case produces only incremental increases for Anchorage and Seward, which of the cities studied are the most dependent on the State's highway system. Also, Seward does not serve as a major transfer point for offshore employees rotating to and from work sites. Traffic levels on the Seward Highway leading to the Kenai Peninsula will occur one year earlier than in the MBM case. Local truck traffic in Yakutat will increase between the three major generators of OCS traffic -- the airport, the support base, and the oil and gas processing facilities. The impact of this traffic relates greatly to ideal uses of the roadway, and such an assessment falls beyond the scope of this study.

Railroads. No significant changes compared to the MBM or even the BM case in freight carried by the Alaska Railroad are forecast. Incremental populati increases in the primary service area for the railroad are minor, and most OCS industrial supplies will be delivered directly to support bases and work sites. Should crowded conditions exist at Seward, freight can be routed there through Whittier.

4.5.5 SUMMARY COMPARISON OF HIGH OCS-MEAN BASE CASE (HBM) AND MEAN OCS-MEAN BASE CASE (MBM)

The HBM case does not introduce any new landside areas that are potentially impacted by OCS development, either directly or indirectly, since the location of LNG and oil processing facilities and support bases are the same as in the MBM case. The Yakataga Shelf has economic oil reserves in the HBM case for the first time, but the largest increase in oil and gas reserves occurs in the Yakutat Shelf. Increased transportation demands at Yakutat occur for industrial freight, passenger movements, and transportation of oil and gas. Intense activity at the height of development produces the need for

Table 4-32

Regional Population Projections: High OCS - Mean Base Case (HBM)[1]
Factors to Produce Incremental Changes from Mean Base Case (BM)

Year	Statewide	Anchorage	Southcentral	Fairbanks
1977	0	0	0	
1978	0	0	0	
1979	0	0	0	
1980	0	0	0	
1981	0.002	0.001	0.014	-0.001
1982	0.004	0.002	0.025	-0.001
1983	0.006	0.004	0.032	-0.001
1984	0.019	0.018	0.066	0.014
1985	0.048	0.048	0.136	0.046
1986	0.068	0.073	0.141	0.076
1987	0.084	0.091	0.160	0.092
1988	0.095	0.101	0.195	0.096
1989	0.094	0.100	0.199	0.084
1990	0.092	0.095	0.222	0.065
1991	0.094	0.100	0.228	0.064
1992	0.088	0.096	0.197	0.060
1993	0.083	0.091	0.186	0.052
1994	0.080	0.088	0.184	0.050
1995	0.079	0.086	0.178	0.051
1996	0.079	0.086	0.180	0.051
1997	0.081	0.088	0.186	0.053
1998	0.083	0.090	0.188	0.055
1999	0.084	0.092	0.188	0.057
2000	0.085	0.094	0.185	0.060

Note: (1) F_I = Incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: ISER, 1979,

Table 4-33

Yakutat Field - 5% Resource Level Scenario

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed (1)	Dev. Rigs Jan.	Dev. Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	Oil Production Wells (2) Offshore Loading	Oil Production Wells (2) Onshore Loading	Gas Production Wells (2) (Non-Assoc./Assoc.)	Onshore Facility Construction (3)
1981	1	3				6								
1982	2	5				12								
1983	3	6				14								
198'2	4	7				16								YCSB (1/1)
1985	5	6				14								YLNG(1/3)
1986	6	5	1s			12								YLNG(2/3)
1987	7	4	1s		1	9		2	20.5	29.6				YOIL(1/3), YLNG(3/3)
1988	8	4	3s	1	3	9	8	4					4	YOIL(2/3)
1909	9	2	2s, 1C	3	8	7	34	6	14.0	84.6	14		12	YOIL (3/3)
1990	10	1	3s, 1C	10	13	2	74	10		43.4	9	66	24/24	
1991	11		2s, 1C	19	18		102	14			32	135	40/66	
1992	12			20	20		114	16			91	217	56/133	
1993	13			18	16		94	14			98	25B	64/174	
1994	14			11	7		50	3			120	2s0	64/196	
1995	15			4			8				120	280	64/196	
1996	16										120	280	64/196	
1997	17										120	280	64/196	
1998	18										120	280	64/196	
1999	19										120	280	64/196	
2000	20										120	280	64/196	

Notes: (1) S = Steel; C = Concrete.
(2) Based on estimated wells drilled by July of each year.
(3) YSCB = Yakutat Construction Support Base; YLNG = Yakutat LNG Terminal; YOIL = Yakutat Oil Terminal.

Source: Dames & Moore, 1978.

Table 4-34

Yakataga Field - 5% Resource Level Scenario
Transportation-Related Activities

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed(1)	Dev. Rigs Jan.	Dev. Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	Oil Production Wells(2) Offshore Loading	Oil Production Wells(2) Onshore Loading	Gas Production Wells(2) (Non-Assoc./Assoc.)	Onshore Facility Construction
1981	1													
1982	2	1				2								
1983	3	1				2								
1984	4	1				3								
1985	5	1				2								
1986	6	1				1								
1987	7													
1988	8		1C				2							
1989	9			2	2		16				9			
1990	10			2	2		16				23			
1991	11			2	2		10				40			
1992	12										40			
1993	13										40			
1994	14										40			
1995	15										40			
1996	16										40			
1997	17										40			
1998	18										40			
1999	19										40			
2000	20										40			

Notes: (1) S = Steel; C = Concrete.
(2) Based on estimated wells drilled by July of each year.

Source: Dames & Moore, 1978.

Table 4-35

Middleton Field - 5% Resource Level Scenario

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed[1]	Dev. Rigs Jan.	Dev. Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	Oil Production Wells[2] Offshore Loading	Oil Production Wells[2] Onshore Loading	Gas Production Wells[2] (Non-Assoc./Assoc.)	Onshore Facility Construction[3]
1981	1	1				2								
1902	2	1				2								
1983	3	2				4								
1984	4	3				7								
1985	5	3				7								SCSB (1/1)
1986	6	1				2								
1987	7	1	2s			3			9.4					HOIL(0.5/2.5)
1988	8	1	2s		4	1	16			92.2				HOIL(1.5/2.5), HLNG(0.5/2.5)
1969	9			4	7		40	2			28			HOIL(2.5/2.5), HLNG(1.5/2.5)
1990	10		1s	7	7		41	4			44	29,	4/32	HLNG(2.5/2.5)
1991	11			5	4		20	6			59	40	8/40	
1992	12			2	2		4	8			70	40	20/40	
1993	13			2	2			6			70	40	24/40	
1994	14										70	40	24/40	
1995	15										70	40	24/40	
1996	16										70	40	24/40	
1997	17										70	40	24/40	
1998	18										70	40	24/40	
1999	19										70	40	24/40	
2000	20										70	40	24/40	

Notes: (1) S = Steel.
(2) Based on estimated wells drilled by July of each year.
(3) SCSB (1/1) = Facility (Years Under Construct. ion/Years to Construct),
SCSB = Seward Construction Support Base; NOIL = Hinchinbrook Oil Terminal;
NLNG = Hinchinbrook LNG Terminal.

Source: Dames & Moore,' 1978,

Table 4-36

Logistics Requirements for Yakutat-Based Drilling - 5% Scenario

Calendar Year	Years After Lease Sale	Yakutat Shelf Tonnage (Short Tons): Drill Pipe	Dry Bulk	Fuel	Drill Water	Inbound: Dry Goods Barges (1)	Fuel Tankers (2)	Outbound: Supply Boats (3)	Base Year Factors (4): Dry Freight	Fuel
1981	1	2,749	7,812	13,884	21,696	2	3	62	7.2	1.6
1982	2	5,498	15,624	27,768	43,392	4	6	123	14.3	3.2
1983	3	6,415	18,228	32,396	50,624	5	7	144	16.7	3.7
1984	4	7,331	20,832	37,024	57,856	5	8	164	19.1	4.3
1985	5	6,415	18,228	32,396	50,624	5	7	144	16.7	3.7
1986	6	5,498	15,624	27,768	43,392	4	6	123	14.3	3.2
1987	7	5,130	13,570	24,118	38,972	4	5	107	12.7	2.8
1988	8	8,897	20,054	35,642	61,472	5	8	158	19.7	4.1
1989	9	17,957	34,356	61,060	112,902	9	13	271	35.4	7.1
1990	10	31,478	54,710	97,234	188,038	15	20	431	58.4	11.2
1991	11	42,236	72,022	128,002	249,914	20	26	567	77.4	14.8
1992	12	47,381	80,822	143,642	280,450	22	29	636	86.8	16.6
1993	13	39,475	67,390	119,770	233,842	18	24	531	72.4	13.8
1994	14	18,760	31,728	56,389	110,092	9	12	250	34.2	6.5
1995	15	2,760	4,632	8,232	16,072	2	2	37	5.0	1.0
1996	16									
1997	17									
1998	18									
1999	19									
2000	20									

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-37

Logistics Requirements for Seward-Based Drilling - 5% Scenario .

Calendar Year	Yakataga Shelf Tonnage (Short Tons)				Middleton Shelf Tonnage (Short Tons)				Inbound		Outbound	Base Year Factors (4)	
	Drill Pipe	Dry Bulk	Fuel	Drill Water	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges (1)	Fuel Tankers (2)	Supply Boats (3)	Dry Freight	Fuel
1981					916	2,604	4,628	7,232	1	1	21	0.1	0.2
1982	916	2,604	4,628	7,232	916	2,604	4,628	7,232	2	2	42	0.1	0.4
1983	916	2,604	4,628	7,232	1,833	5,208	9,256	14,464	2	3	63	0.2	0.6
1984	1,375	3,906	6,942	10,848	3,207	9,114	16,198	25,312	3	5	105	0.3	1.1
1985	916	2,604	4,628	7,232	3,207	9,114	16,198	25,312	3	3	94	0.2	1.0
1986	458	1,302	2,314	3,616	916	2,604	4,628	7,232	1	2	32	0.1	0.3
1987					1,375	3,906	6,942	10,848	1	2	56	0.1	0.3
1988	690	1,158	2,058	4,018	5,978	10,566	18,778	35,760	4	4	94	0.3	1.0
1989	5,520	9,264	16,464	32,144	14,806	25,012	44,452	86,789	10	13	275	0.8	2.8
1990	5,520	9,264	16,464	32,144	16,158	27,443	48,773	93,216	10	14	294	0.9	3.0
1991	3,450	5,790	10,290	20,090	9,919	17,136	30,456	59,464	7	9	184	0.5	1.9
1992					5,406	9,724	17,284	33,748	3	4	78	0.2	0.8
1993					3,019	5,556	9,876	19,284	2	2	45	0.1	0.5
1994													
1995													
1996													
1997													
1998													
1999													
2000													

Notes: (1) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(2) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker).
(3) Supply boats = (Dry bulk tonnage)/190.6 x 1.5, where 190.6 is the average dry bulk tonnage per supply boat trip and 1.5 is a factor to account for less than optimum loading.
(4) Base year factors are the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-38

Seward Tonnage Related to Pipe-Coating Plant - 5% Scenario

Year	Field	Inbound Pipe (Tons)[1]	Outbound Pipe (Tons)	[2] Cement (Tons)[3]	Throughput Tonnage (Tons)	Base Year Factor[4]
1986	Yakutat	14,847		3,750	18,597	0.28
1987	Yakutat		44,696	3,822	76,168	1.14
	Middleton	27,650				
1988	Yakutat	32,330		6,163	96,557	1,44
	Middleton		58,064			
1989	Yakutat	10,790	81,376	1,042	93,208	1.39
1990	Yakutat		19,083		19,083	0.29

Notes: (1) Offshore uncoated pipeline for Middleton and Yakutat shelves. Inbound tonnage one year before laying operation scheduled.
(2) Cement for coating of offshore pipeline pipe. Arrives one year before laying operations.
(3) Coated pipe weight computed on weight required to offset buoyant forces for a given diameter pipe.
(4) For Seward, base year (1977) dry bulk tonnage was 60,726 metric tons (66,939 short tons).

Source: Peter Eakland and Associates, 1979.

Table 4-39

Estimated Barges and Tonnage for Construction Activities – 5% Scenario

Location	Facility	1984	1985	1986	1987	1988	1989	1990
Yakutat	Construction Camp	10						
	Support Base	4						
	LNG Plant - 2 BCFD	16	32	32				
	Oil Terminal - 700,000 bbls/day				5	10	5	
	Onshore Pipeline			2		1		
	Construction Equipment	10	10					
	Total Barges	40	42	34	5	11	5	
	Est. Tonnage at 6,000 Short Tons/Barge	240,000	252,000	204,000	30,000	66,000	30,000	
Seward	Construction Camp	1	1					
	Support Base	5	5					
	Inbound Uncoated Pipe			2	5	5	2	
	Outbound Coated Pipe				7	10	14	3
	Total Barges	6	6	2	12	15	16	3
	Est. Tonnage at 6,000 Short Tons/Barge	36,000	36,000	12,000	72,000	90,000	96,000	18,000
Hinchinbrook	Construction Camp			4				
	LNG Plant - 750 MMCFD			6	12	12		
	Oil Terminal - 100,000 bbls/day			3	4			
	Onshore Pipeline			0.3				
	Construction Equipment			4				
	Total Barges			17	16	12		
	Est. Tonnage at 6,000 Short Tons/Barge			102,000	96,000	72,000		

Source: Peter Eakland and Associates, 1979.

Table 4-40

Average Monthly Consumable Demands - 5% Scenario

Calendar Year	Years After Lease Sale	Tons (1) Yakutat	Tons (1) Cordova	Tons (1) Seward	Containers (2) Yakutat	Containers (2) Cordova	Containers (2) Seward
1981	1	32.4	7.5	5.7	3	1	1
1982	2	38.3	11.6	8.1	3	1	1
1983	3	65.3	19.2	13.5	5	2	1
1984	4	65.3	22.8	15.3	5	2	2
1985	5	65.3	27.4	83.1	5	2	6
1986	6	144.6	86.9	23.9	10	6	2
1987	7	256.2	93.6	10.1	18	7	1
1988	8	323.4	19.6	13.5	22	2	1
1989	9	260.4	109.3	21.9	18	8	2
1990	10	218.5	131.1	10.1	15	9	1
1991	11	153.6	6.8	4.1	11	1	1
1992	12	76.5	6.8	2.0	6	1	1
1993	13	48.6	10.5	2.0	4	1	1
1994	14	34.2	10.5	2.0	3	1	1
1995	15	37.9	10.5	2.0	3	1	1
1996	16	49.2	14.3	2.0	4	2	1
1997	17	52.9	14.3	2.0	4	2	1
1998	18	56.7	14.3	2.0	4	2	1
1999	19	56.7	14.3	2.0	4	2	1
2000	20	56.7	14.3	2.0	4	2	1

Notes: (1) Tons = (Offshore onsite + Onshore onsite non-local) x (300 lbs./person) ÷ (2,000 lbs./ton).
(2) Containers = Tons/(15 tons/container) .

Source: Peter Eakland and Associates, 1979.

Table 4-41

Monthly Suppl y Boat Round-Tr i ps by Service Base - 5% Resource Level Scenario

Calendar Year	Years After Lease sale	Middleton Shelf Exploration	Middleton Shelf Development	Middleton Shelf Production	Yakataga shelf Exploration	Yakataga shelf Development	Yakataga shelf Production	Total Seward-Based Trips	Maximum Berth Requirements (1)	Total Cordova-Based Trips	Berth Requirements (1)	Yakutat Shelf Exploration	Yakutat Shelf Development	Yakutat Shelf Production	Total Yakutat-Based Trips	Berth Requirements (1)
1981	1	12						12	1			36			36	1
1982	2	12			12			24	1			60			60	2
1983	3	24			12			36	1			72			12	2
1984	4	36			12			48	2			84			84	3
1985	5	36			12			48	2			72			72	2
1986	6	12			12			24	1			60	24		84	3
1987	7	12	48					60	2			4a	87		335	3
1988	a	12	214 (2)			24		2513	5			4a	132	4	184	4
1989	9		140	a		40	4	192	4	6	1	24	318	a	350	6
19%	10		140	16		40	4	200	4	10	1	12	399	24	435	a
1991	11		80	20		40	4	144	3	12	1		432	36	46a	a
1992	12		40	20			4	64	2	12	1		400	52	452	8
1993	13		40	20			4	64	2	12	1		320	60	380	7
1994	14			20			4	12	1	12	1		140	60	200	4
1995	15			20			4	12	1	12	1			60	612	2
1996	16			20			4	12	1	12	3			60	60	2
1991	17			20			4	12	1	12	1			60	60	2
1998	10			20			4	12	1	12	3			60	60	2
1999	19			20			4	12	1	12	1			60	60	2
2000	20			20			4	12	1	12	1			60	60	2

Notes: (1) 30% berth occupancy all-day assumed for A-2 berths. For 3 berths or more, 50% berth occup.uc% assumed all-day.
(2) Assumes two pipelaying and pipeburying barges.

Source: Peter Eakland and Associates, 1979.

Table 4-42

Base-Year Growth Factors for OCS-Induced Freight Tonnage - High-Base Mean (HBM) Case (1)

Calendar Year	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petroleum	Seward Dry	Seward Petroleum	Whittier Dry Bulk	Whittier Petroleum	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry-Bulk	Yakutat Pet KO10U1U	Valdez Dry Bulk	Valdez Pet role um
1981	1				1.05					1.25	1.25	8.29	1.11
1982	2				1.07			1.12	1.12	).42	1.42	a.40	1.15
2983	3			1.86	1.10	1.82		1.13	1.13	1.50	1.s0	6.04	1.12
1984	4	1.31	1.30	1.86	1.18	1.81		1.16	1.16	1.80	1.80	6.03	1.18
1985	5	1.37	1.36	1.38	1.22	1.36		1.18	1.18	2.19	2.19	1.32	1.22
1986	6	1.43	1.42	1.45	1.22	1.42		1.19	1.19	2.27	2.27	1.37	1 . 2 4
1987	7	1.50	1.49	1.59	1.30	1.49		1.24	1.24	2.2a	2.20	1.43	1.27
19MM	a	1.57	1.55	1.71	1.44	1.55		1.30	1.30	3.41	3.41	1.50	1.34
1989	9	1.63	1.61	1.75	1.53	1.61		1.46	1.46	4.74	4.74	1.54	1.36
1990	10	1.62	1.65	1.78	1.58	1.64		1.75	1.75	6.04	6.04	1.58	1.41
1991	11	1.13	1.71	1.76	1.59	1.70		1.77	1.77	6.35	6.35	1.62	1.41
1992	12	1.78	1.76	1.80	1.49	1.75		1.78	1.78	6.18	6.18	1.64	1.40
1993	13	1.83	1.81	1.81	1.49	1.79		1.81	1.81	6.31	6.31	1.6a	1.41
1994	14	1.90	1.87	1.87	1.47	1.85		1.85	1.85	6.33	6.33	1.72	1.42
1995	15	1.96*	1.93	1.93	1.54	1.91		1.89	1.339	6.21	6.21	1.76	1.44
1996	16	2.03*	2.00	2.00	1.54	1.98		1.92	1.92	6.25	6.25	1.82	1.47
1997	17	2.11*	2.07	2.06	1.58	2.05		1.95	1.95	6.36	6.36	1.87	1.50
1998	18	2.18*	2.15	2.12	1.63	2.12		2.00	2.00	6.47	6.47	1.93	1.52
1999	19	2.28*	2.23	2.20	1.68	2.20		2.02	2.02	6.47	6.47	1.99	1.54
2000	20	2.36*	2.31*	2.29	1.73	2.29		2.06	2.06	6.48	6.48	2.05	1.57
Threshold value for low cap.		1.92	2.24	3.78	3.26	2.74	No	3 . 2 3	2.15	9.09	11.20	19.90	3.09
Threshold value for high cap.		2.70	3.54	5.42	4.64	3.90	increase	3.45	4.55	20.013	23.44	41.40	6.25
Low value (year)		1.15 (1981)	1.15 (1981)	1.14 (1981)	1.05 (1981)	1.14 (1901)	expected	1.09 (1981)	1.09 (1981)	1.25 (1981)	1.25 (1981)	1.10 (1981)	3.05 (1981)
High value (par)		2.16 (2000)	2.31 (2000)	2.29 (2000)	1.70 (2000)	2.29 (2000)		2.06 (2000)	2.06 (2000)	6.4a (20001	6.4a (2000)	2.05 (2000)	1.57 (2000)

Value exceeding low capacity *
high capacity **

Note: (1) Values not shown are unchanged from the mean case. Factors shown are cumulative and include base case.

Source: Peter Eakland and Associates, 1979.

Table 4-43

Base Year Factors for Freight Categories by Service Base -[1,3]
High-Base High (HBH) and High-Base Mean (HBM) Cases

Yakutat

Calendar Year	Fuel: Induced (Throughput)	Fuel: Drilling[2] (Throughput)	Dry Freight: Induced (Throughput)	Dry Freight: Consumables (Inbound)	Dry Freight: Drilling[2] (Throughput)	Dry Freight: Construction (Inbound)
1981	1.3	3.2	1.3	0.3	14.4	
1982	1.4	6.4	1.4	0,3	28.6	
1983	1.5	7.4	1.5	0.5	33.4	
1984	1.8	0.6	1.8	0.5	38.2	162.5
1905	2.2	7.4	2,2	0.5	33.4	170.6
1986	2.3	6.4	2.3	1.2	20.6	138.1
1907	2.2	5.6	2,2	2.1	25.4	20.3
1988	3.4	S.2	3.4	2.6	39.4	44.7
1989	4.7	14.2	4.8	2.1	70.8	20.3
1990	6.o	22.4	6,0	1.8	116. B	
1991	6.4	29.6	6.4	1.2	154.0	
1992	6.2	33.2	6.2	0.6	173.6	
1993	6.3	27.6	6.3	0.4	144. B	
199'4	6.3	13.0	6.3	0.3	68.4	
1995	6.2	2.0	6,2	0.3	30.0	
1996	6.3		6.3	0.4		
1997	6.4		6.4	0.4		
1998	6.5		6.5	0.5		
1999	6.5		6.5	0.5		
2000	6.5		6.5	0.5		

Fuel: Base Value (1.0) = 7,858 metric tons [8.662 tons)

Dry Freight: Base Value (1.0) - 1,340 metric tons (1,477 tons)

Seward and **Cordova**

Calendar Year	Seward Fuel: Induced (Throughput)	Seward Fuel: Drilling[2] (Throughput)	Seward Dry Freight: Induced & Base Dev. (Throughput) HBM Case	Seward Dry Freight: Induced & Base Dev. (Throughput) HBH Case	Seward Dry Freight: Consumables (Inbound)	Seward Dry Freight: Drilling[2] (Throughput)	Seward Dry Freight: Construction[4] (Throughput)	Cordova Dry Freight: Induced (Throughput)	Cordova Dry Freight: Consumables (Inbound)
1981	1.1	0.4	2.4	2.4	0	0.2		1.0	0
1982	1.1	0.8	2.5	2.5	0	0.2		1.1	0
1983	1.1	1.2	1.9	1.9	0	0.4		1.1	0
1984	1.2	2.2	1.9	1.9	0	0.6	0.5	3.2	0
1905	3.2	2.0	1.4	1.4	0	0.4	0.5	1.2	0
1986	1.2	0.6	1.5	1.5	0	0.2	0.2	1.2	0.1
1907	1.3	0.6	1.6	1.6	0	0.2	1.1	1.2	0.1
1988	1.4	2.0	3.7	1.7	0	0.6	1.3	1.3	0
1989	3.5	4.6	1.8	1.7	0	1.6	1.4	1.5	0.1
1990	1.6	6.0	1.8	1.s	0	1.8	0.3	1.8	0.1·
1991	3.6	2.8	1.8	1.8	o	1.0		1.8	o
1992	1.5	1.6	1.0	1.8	o	0.4		1.s	o
1993	1.5	1.0	1.8	1.8	o	0.2		1.8	0
199'4	1.5		3.9	1.9	0			1.9	0
1995	1.5		1.9	2.0	0			3.9	0
1996	1.5		2.0	2.0	0			1.9	0
1997	1.6		2.1	2.1	0			2.0	0
1998	1.6		2.1	2.2	0			2.0	0
1999	1.7		2.2	2.2	0			2.0	0.
2000	1.7		2.3	2.3	0			2.1	0

Seward Fuel: Base Value (1.0) = 19,760 metric tons {21,782 tons)

Seward Dry Freight: Base Value (1.0) = 60.726 metric tons (66,939 tons)

Cordova: Base Value (1 .0) - 14,861 ❑et. ic tons (16, 302 tons)

Notes: (1) Factors are related to base year tonnages for the individual community. A comparison of factors for different communities is not meaningful. Care should be observed in combining the figures. Some are throughput tonnages, and others are inbound only where they are considered more meaningful. No common type of vessels or landside facilities are implied.

12) Fuel and dry freight tonnage required for drilling has been doubled to provide throughput figures.

(3) The use of the same facilities for all dry freight is not implied.

(4) For Seward, construction tonnage consists primarily of uncoated and coated offshore pipeline, and throughput tonnage used.

Source: Peter Eakland and Associates, 1979.

Table 4-44

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Oil and Gas Production													
Yakutat Shelf													
Oil Terminal (MMBBL)	0	0	54.3	115.6	185.7	241.8	266.0	262.4	245.3	213.4	177.7	178.6	124.6
Offshore Loading (MMBBL)	0	14.0	0	14.0	40.3	84.8	114.2	128.9	128.5	117.5	100.6	83.2	69.6
Total (MMBBL)	0	14.0	54.3	129.6	226.0	326.6	380.2	391.3	373.8	330.9	276.3	261.8	194.2
LNG Terminal (BCF)	140.2	140.2	294.3	474.1	604.2	645.2	662.3	660.9	641.7	614.0	592.0	574.1	559.7
Yakataga Shelf													
Offshore Loading (MMBBL)	0	14.0	26.3	35.0	35.0	35.0	35.0	32.6	28.2	24.3	21.0	18.2	15.7
Middleton Shelf													
Oil Terminal (MMBBL)	14.0	26.3	35.0	35.0	35.0	33.2	27.3	23.1	19.6	16.6	14.0	11.9	10.0
Offshore Loading (MMBBL)	0	14.0	40.3	52.6	58.0	49.6	41.8	28.8	22.1	16.1	11.8	8.5	3.9
Total (MMBBL)	14.0	40.3	75.3	87.6	93.0	82.8	69.1	51.9	41.7	32.7	25.8	20.4	13.9
LNG Terminal (BCF)	0	0	166.2	189.0	275.3	275.3	275.3	272.0	261.0	253.2	246.6	218.4	177.9
Oil Tanker and LNG Ship Traffic (1)													
Yakutat Shelf													
Oil Terminal (Oil Tankers/Year)	0	0	58	124	200	260	286	283	264	230	191	192	134
Offshore Loading (Oil Tankers/Year)	0	15	0	15	43	91	123	139	138	127	108	90	75
Total (Oil Tankers/Year)	0	15	58	139	243	351	409	422	402	357	299	282	209
LNG Terminal (LNG Ships/Year)	50	50	105	169	216	230	237	236	229	219	211	205	200
Yakataga Shelf													
Offshore Loading (Oil Tankers/Year)	0	15	28	38	38	38	38	35	30	26	23	20	17
Middleton Shelf													
Oil Terminal (Oil Tankers/Year)	15	28	38	38	38	36	29	25	21	18	13	9	4
Offshore Loading (Oil Tankers/Year)	0	15	43	57	62	53	45	31	24	17	13	9	4
Total (Oil Tankers/Year)	15	43	81	95	100	89	74	56	45	35	26	18	8
LNG Terminal (LNG Ships/Year)	0	0	59	68	98	98	98	97	93	90	88	78	64

Notes: (1) Oil Tanker Trips/Day = (Total Production/Year)/(7.74) (120,000). Assumes average tanker fleet size of 120,000 DWT. 7.74 bbls = 1 long ton.
LNG Ship Trips/Day = (Total Production/Year)/(2.8 BCF), where 2.8 BCF of natural gae is equivalent to 130,000 m^3, the capacity of LNG vessels designed for the Cook Inlet.

Source: Bill Wade, petroleum economist, Dames & Moore, 1978,

Table 4-45

Weekly Helicopter Round Trips from Service Bases in Northern Gulf of Alaska - 5% Scenario

	Yakutat			Cordova		
Calendar Year	Total Offshore Average Monthly Employment (1)	Peak Weekly Round Trips (2)	Helicopter Trips per Week (3)	Total Offshore Average Monthly Employment (1)	Peak Weekly Round Trips (2)	Helicopter Trips per Week (3)
1981	298	100	8	150	50	4
1982	588	196	14	196	66	5
1983	706	236	17	302	101	8
1984	758	253	19	474	158	12
1985	682	228	17	438	146	11
1986	1,218	405	29	156	52	4
1987	1,876	626	45	1,074	358	26
1988	3,350	1,117	80	2,934	979	70
1989	4,744	1,582	113	2,028	677	49
1990	4,696	1,566	112	1,310	437	32
1991	5,052	1,685	121	1,024	342	25
1992	3,065	1,022	73	96	32	3
1993	1,710	570	41	96	32	3
1994	1,164	388	28	171	57	5
1995	599	200	15	221	74	6
1996	506	169	13	246	82	6
1997	606	202	15	246	82	6
1998	656	219	16	246	82	6
1999	656	219	16	246	82	6
2000	656	219	16	246	82	6

Notes: (1) Total employment equals offsite plus onsite employments. All offshore tasks have been included except supply/anchor/tug boats and include surveys, rigs, platforms, platform installation, and offshore pipeline construction.
(2) Peak weekly trips = (0.717 round trips/month) x (2.0 peak factor) ÷ 4.3 weeks/month.
(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979.

Table 4-46

OCS Employment-Related Weekly Air Trips by Trip Segment - 5% Scenario

Northbound Links

Calendar Year	Years After Lease Sale	Yakutat-Cordova: CDV Inter (R)(1) .25	Yakutat-Cordova: YAK Intra .75	Yakutat-Cordova: YAK Inter .25	Total Weekly One-Way Trips	Jet Plane Equiv.(2)	Cordova-Anchorage: CDV Intra 1.0	Cordova-Anchorage: CDV Inter .75	Cordova-Anchorage: YAK Intra .75	Cordova-Anchorage: YAK Inter .25	Total Weekly Trips	Plane Equivalent: Jet(2)	Plane Equivalent: Commuter(3,4)	Seward-Anchorage: SWD Intra 1.0	Seward-Anchorage: SWD Inter 1.0	Total Weekly Trips	Plane Equivalent: Jet(2)	Plane Equivalent: Commuter(3)
1981	1	8	22	20	50	.5	9	24	22	20	75	.7	1.7	5	10	15	.1	.8
1982	2	11	42	39	92	.8	12	32	42	39	125	1.1	2.3	9	17	26	.2	1.4
1983	3	17	50	47	114	1.0	19	49	50	47	165	1.5	3.6	13	25	38	.3	2.0
1984	4	38	115	70	223	2.0	29	128	115	70	342	3.1	9.6	49	66	115	1.0	6.1
1985	5	23	260	107	390	3.5	28	69	260	107	464	4.2	5.1	29	41	70	.6	3.7
1986	6	9	275	138	422	3.8	34	25	275	138	472	4.3	3.1	18	18	36	.3	1.9
1987	7	76	161	135	372	3.4	101	220	161	135	625	5.7	17.3	24	15	39	.4	2.1
1988	8	174	198	211	583	5.3	191	552	198	211	1,152	10.5	39.1	52	24	36	.3	1.9
1989	9	119	197	271	587	5.3	83	355	197	271	906	8.2	23.1	44	16	60	.5	3.2
1990	10	69	208	243	520	4.7	58	205	208	243	714	6.5	13.8	55	9	64	.6	3.4
1991	11	46	224	253	523	4.0	14	138	224	253	689	6.3	11.2	50	2	52	.5	2.7
1992	12	0	159	146	306	2.8	32	1	159	146	338	3.1	1.7	28	1	29	.3	1.5
1993	13	0	163	62	226	2.1	32	1	163	62	258	2.3	1.7	13	1	14	.1	.7
1994	14	0	147	35	183	1.7	47	1	147	35	230	2.1	2.5	13	1	14	.1	.7
1995	15	0	124	8	133	1.2	57	1	124	8	190	1.7	3.1	13	1	14	.1	.7
1996	16	0	127	2	123	1.2	62	1	127	1	191	1.7	3.3	13	1	14	.1	.7
1997	17	0	142	2	144	1.3	62	1	142	1	206	1.9	3.3	13	1	14	.1	.7
1998	18	0	149	2	151	1.4	62	1	149	1	213	1.9	3.3	13	1	14	.1	.7
1999	19	0	149	2	151	1.4	62	1	149	1	213	1.9	3.3	13	1	14	.1	.7
2000	20	0	149	2	151	1.4	48	1	149	1	199	1.8	2.6	12	1	13	.1	.7

Notes: (1) (R) represents return on inbound trips. Yakutat-Cordova is the only link on which both inbound and outbound trips occur.

(2) Jet aircraft assumed to have capacity of 110 passengers.

(3) Commuter aircraft assumed to have capacity of 19 passengers. Feasible on Seward-Anchorage and Cordova-Anchorage links.

(4) commuter plane equivalents based only on Cordova-originating trips.

Source: Peter Eakland and Associates, 1979.

Table 4-46 (cont.)

OCS Employment-Related Weekly Air Trips by Trip Segment - 5% Scenario

Southbound Links

Calendar Year	Yakutat-S.E. YAK Intra .25	Yakutat-S.E. YAK Inter .75	Yakutat-S.E. CDV Inter .25	Total Weekly Trips	Jet Plane Equiv.(2)	S.E.-Seattle CDV Inter .25	S.E.-Seattle YAK Inter .75	Total Weekly Trips	Jet Plane Equiv.(2)	Anchorage-Seattle YAK Inter .25	Anchorage-Seattle CDV Inter .75	Anchorage-Seattle SWD Inter 1.0	Total Weekly Trips	Jet Plane Equiv.(2)
1981	8	58	8	74	.7	8	58	63	.6	20	24	10	54	.5
1982	14	117	11	142	1.3	11	117	128	1.2	39	32	17	88	.8
1983	17	140	17	174	1.6	17	140	157	1.4	47	49	25	121	1.1
1984	38	210	43	291	2.6	43	210	253	2.3	70	128	66	264	2.4
1985	87	321	23	431	3.9	23	321	344	3.1	107	69	41	217	2.0
1986	92	414	9	515	4.7	9	414	423	3.8	138	25	18	181	1.6
1987	54	404	76	524	4.9	76	404	480	4.4	135	228	15	378	3.4
1988	66	631	184	881	8.0	184	631	815	7.4	211	552	24	707	7.2
1989	66	813	119	998	9.1	119	813	932	8.5	271	355	16	642	5.8
1990	69	728	69	866	7.9	69	728	797	7.2	243	205	9	457	4.2
1991	75	759	46	880	8.0	46	759	805	7.3	253	138	2	393	3.6
1992	53	438	1	492	4.5	1	438	439	4.0	146	1	1	148	1.3
1993	54	185	1	240	2.2	1	185	186	1.7	62	1	1	64	.6
1994	49	104	1	154	1.4	1	104	105	1.0	35	1	1	37	.3
1995	41	24	1	66	.6	1	24	25	.2	8	1	1	10	.3
1996	42	3	1	46	.4	1	3	4	0	1	1	1	1	0
1997	47	3	1	49	.4	1	3	4	0	1	1	1	3	0
1998	50	3	1	54	.5	1	3	4	0	1	1	1	3	0
1999	50	3	1	54	.5	1	3	4	0	1	1	1	3	0
2000	50	3	1	54	.5	1	3	4	0	1	1	1	3	0

Source: Peter Eakland and Associates, 1979.

Table 4-47

Induced and OCS-Related Weekly Air Travel - High-Base High (HBH) and High-Base Mean (HBM) Cases [1]

Northbound Links

Calendar Year	Years After Lease Sale	Cordova-Anchorage Induced YAK	Cordova-Anchorage Induced CDV	Cordova-Anchorage High OCS	Cordova-Anchorage Total Weekly Trips	Yakutat-Cordova Induced YAK	Yakutat-Cordova Induced CDV	Yakutat-Cordova High Ocs	Yakutat-Cordova Total Weekly !!X@Z.-	Seward-Anchorage Induced	Seward-Anchorage BH	Seward-Anchorage Total Weekly lQll$Z-
1981	1	27	27	75	129	26	9	50	85	12	15	27
1982	2	45	34	125	204	44	11	92	147	17	26	43
1983	3	54	40	165	259	53	13	114	180	24	38	62
1984	4	85	47	342	474	84	15	223	322	43	115	157
1985	5	126	52	464	642	124	16	390	530	52	70	122
1986	6	135	57	472	664	132	18	422	572	53	36	89
1987	7	128	71	625	824	125	22	372	519	69	39	108
1988	8	257	88	1,152	1,497	252	28	583	863	105	36	141
1989	9	397	134	906	1,437	389	42	587	1,018	125	60	185
1990	10	534	218	714	1,466	524	68	520	1,112	“136	64	200
1991	11	568	225	689	1,482	557	70	523	1,150	139	52	191
1992	12	549	227	338	1,114	539	71	306	916	114	29	143
1993	13	564	235	258	1,057	553	73	226	852	114	14	128
1994	14	566	248	230	1,044	555	77	183	815	110	14	124
1995	15	552	259	190	1,001	542	81	133	756	126	14	140
1996	16	556	269	191	1,016	546	84	129	759	126	14	140
1997	17	569	278	206	1,053	558	87	144	789	137	14	151
1998	18	579	288	213	1,089	568	90	151	809	148	14	162
1999	19	579	297	213	1,089	568	92	151	811	160	14	174
2000	20	581	306	199	1,086	570	95	151	816	171	14	185
Lowest % Induced (year)					24.2% (1987)				26.2% (1986)			26.8% (1984)
1 Fit/Day Threshold (jet)					296				349			
2 Flt/Day Threshold (jet)					929				994			
3 Fit/Day Threshold (jet/commuter)					1,609				1,680			66
4 Fit/Day Threshold (commuter)												370

Note: (1) A single base forecast exists at the local level.

Source: Peter Eakland and Associates, 1979.

Table 4-47 (cont.)

Induced and OCS-Related Weekly Air Travel - High"-Base High (HBH) and High-Base Mean (HBM) Cases [1]

Southbound Links

Calendar Year	Years After Lease Sale	Cordova-Yakutat Induced YAK	Cordova-Yakutat Induced CDV	Cordova-Yakutat High Ocs	Cordova-Yakutat Total Weekly Trips	Yakutat-Southeastern Induced YAK	Yakutat-Southeastern Induced CDV	Yakutat-Southeastern High Ocs	Yakutat-Southeastern Total Weekly Trips	Southeastern-Seattle Induced YAK	Southeastern-Seattle Induced CDV	Southeastern-Seattle High Ocs	Southeastern-Seattle Total Weekly Trips
1981	1	27	16	50	93	407	16	74	497	26	11	63	100
1982	2	46	20	92	158	69	20	142	231	44	14	128	186
1983	3	55	24	114	193	83	23	174	280	52	16	157	225
1984	4	87	28	223	338	132	27	291	450	83	19	253	355
1985	5	128	31	390	549	195	30	431	656	123	21	344	488
1986	6	137	34	422	593	208	33	515	756	131	23	423	577
1987	7	130	42	372	544	197	41	534	772	124	29	480	633
1988	8	232	52	583	867	397	51	881	1,329	249	35	815	1,099
1989	9	404	79	587	1,070	614	77	998	1,689	386	54	932	1,372
1990	10	544	129	520	1,193	826	126	866	1,818	519	87	797	1,403
1991	11	578	133	523	1,234	878	130	880	1,888	552	90	805	1,447
1992	12	559	134	306	999	849	131	492	1,472	534	91	439	1,064
1993	13	574	138	226	938	872	135	240	1,247	548	94	186	828
1994	14	577	146	183	916	875	143	154	1,172	550	99	105	754
1995	15	563	153	133	849	854	149	66	1,069	537	104	25	666
1996	16	567	159	129	855	861	155	46	1,062	541	108	4	653
1997	17	580	164	144	888	880	160	49	1,089	553	112	4	669
1998	18	590	170	151	911	896	166	54	1,116	563	115	4	682
1999	19	590	1’75	151	916	896	171	54	1,121	563	119	4	686
2000	20	591	180	151	922	898	176	54	1,128	564	123	4	691
Lowest % Induced (year)					28.8% (1986)				30.8% (1987)				24.2% (1987)
1 Fit/Day Threshold					349				287				223.
2 Fit/Day Threshold					994				918				837
3 Flt/Day Threshold					1,609				1,597				1,510

Note: (1) A single base forecast exists at the local level.

Source: Peter Eakland and Associates, 1979.

eight supply boat berths at Yakutat, three more than in the MBM case. Higher employment creates twice as many helicopter operations out of Yakutat and makes a fourth daily flight serving Yakutat necessary. The number of tanker round-trips serving the Yakutat Shelf fields reaches 422, which is more than twice the MBM figure of 163. The increase in LNG ship movements is less but still substantial -- 115 greater than the MBM figure of 122 annual round-trips.

The differences in transportation demands and potential impacts between the HBM and MBM cases are less for Seward and Cordova and the areas they serve than for Yakutat. At Seward, the largest increase in tonnage is related to handling of offshore pipeline materials. Although the increases in vessel traffic for development and production activities in the Middleton and Yakataga Shelves are less than those for the Yakutat Shelf, its potential for impacts may be greater since it is in proximity to the designated route for TAPS tankers approaching Prince William Sound.

4.6 Low OCS-Low Base Case (LBL)

4.6.1 REVIEW OF LOW BASE CASE

The low base case differs from the mean base case in only one respect. Transportation demands and an assessment of their impacts are developed for the low rather than the mean scenario of previous OCS lease sales in Lower Cook Inlet and the Beaufort Sea. Only a single set of baseline forecasts for population or employment were developed for the communities of Seward, Cordova, and Yakutat. These forecasts were discussed as part of the mean base case. The low base case, thus, consists of demands generated by regional populations or by low scenarios of previous lease sales.

Regional populations show steady growth in the low base case except for one annual decrease for Anchorage and Fairbanks and two for the Southcentral region. Freight from low development activities is forecast to occur at Seward until 1992 and at Whittier until 1991. These tonnages do not present capacity problems.

Dry freight tonnage into Anchorage is expected to reach the estimated low capacity threshold by 1996. Otherwise, no capacity problems are expected at any of the ports studied. Air passenger traffic on the Anchorage-Seattle link will be twice the base (1977) level by 1998. Frequent vehicle congestion on the Seward Highway between Girdwood and the junction with the Sterling Highway is expected in approximately 1989.

4.6.2 FACTORS CAUSING GROWTH

The analysis of the LBL case will consider only those aspects that are different from the LBM case. These differences are limited to transportation demands due to regional population changes and to communities which provide logistics support for previous lease sale activities, namely Whittier and Seward. Exploration drilling in the Yakutat, Middleton, and Yakataga Shelves takes place from 1981 to 1984. Seward provides support for the latter two areas. Population increases over the BL case are shown in Table 4-48 by region. The largest incremental factors occur for the Southcentral region, but they do not exceed 1.3% of the base year population and fall to zero after 1985. In the Anchorage region, the factor is only 0.002 during exploration, falls to 0.001 in 1986, and then to zero in 1998.

4.6.3 WATER MODE

4.6.3.1 Description of Activities

Induced and industrial freight inbound to Seward in the low base case peaks in 1982, which also is the peak year for exploration of the Northern Gulf of Alaska lease sale (Table 4-28). The throughput tonnage for drilling supplies increases by approximately 50% the total tonnage for 1982. A single dedicated berth should be adequate to provide for OCS logistics out of Seward (Table 4-26). Table 4-49 shows the base-year growth factors that differ from the base case. Except for Valdez, they are the same as the values for the LBM case. Regional population changes are insufficient to change the factors by even 0.01 for Anchorage, Seward, or Whittier.

4.6.3.2 Summary of Impacts

No population-related impacts can be expected in the LBL case that did not occur in the BL case due to the small changes in regional population forecasts and the limited duration of the increases. Even if development projects in the BL case should coincide with the peak year of exploration, 1982, Seward's port has adequate capacity to handle the freight. Marine carriers will experience little or not change in tonnage due to the addition of the low scenario to the low base case. Specialized carriers will handle the direct OCS tonnage.

4.6.3.3 Issues

The LBL case does not create any new issues that did not exist in the low base case.

4.6.4 AIR MODE

4.6.4.1 Description of Activities

The only air link having traffic in the LBL case different from the LBM case is Anchorage-Seattle, whose forecasts are shown in Table 4-50. The only column different from the LBM case is the induced traffic, but even it differs little from the BL figures because of the small population growth experienced in the Anchorage region.

4.6.4.2 Summary of Impacts

No impacts exist which did not occur in the BL case.

4.6.4.3 Issues

No new issues or changes in issues previously describe for the BL case exist.

4.6.5 LAND MODES

No discernible differences can be expected between the BL and LBL cases for highway traffic or the Alaska Railroad.

4.6.6 SUMMARY COMPARISON OF LOW OCS-LOW BASE CASE (LBL) AND LOW BASE CASE (BL)

The LBL case is virtually the same as the BL case because of the short duration of increased demands on transportation facilities and services.

Table 4-48

Regional Population Projections: Low Ocs - Low Base Case (LBL)
Factors to Produce Incremental Changes from Low Base Case (BL) (1)

Year	Statewide	Anchorage	Southcentral
1977	0	0	0
1978	0	0	0
1979	0	0	0
1980	0	0	0
1981	0.002	0.001	0.013
1982	0.003	0.002	0.013
1983	0.003	0.002	0.010
1984	0.002	0.002	0.003
1985	0.001	0.002	0.001
1986	0.001	0.001	0
1987	0.001	0.001	0
1988	0.001	0.001	0
1989	0.001	0.001	0
1990	0.001	0.001	0
1991	0.001	0.001	0
1992	0.001	0.001	0
1993	0.001	0.001	0
1994	0.001	0.001	0
1995	0.001	0.001	0
‘1996	0	0.001	0
1997	0	0.001	0
1998	0	0	0
1999	0	0	0
2000	0	0	0

Note: (1) F_1 = Incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: ISER, 1979,

Table 4-49

Base-Year Growth Factors for
OCS-Induced Freight Tonnage - Low-Base Low (LBL) Case (1)

Calendar Year	Years After Lease Sale	Anchorage Dry Bulk	Anchorage Petroleum	Seward Dry Bulk	Seward Petroleum	Whittier Dry Bulk	Whittier Petroleum	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry Bulk	Yakutat Petroleum	Valdez Dry Bulk	Valdez Petroleum
1981	1				1.06					1.25	1.25	8.51	1.38
1982	2				1.08			1.12	1.12	1.22	1.22	8.38	1.11
1983	3				1.09			1.13	1.13	1.18	1.18	6.02	1.08
1984	4				1.12					1.13	1.13		
1985	5												
1986	6												
1987	7												
1988	8												
1989	9												
1990	10												
1991	11												
1992	12												
1993	13												
1994	14												
1995	15												
1996	16												
1997	17												
1998	18												
1999	19												
2000	20												

Note : (1) Values not shown are unchanged from the low base (BL) case. Factors shown are cumulative and include base case.

Source: Peter Eakland and Associates, 1979.

Table 4-50

Additional Anchorage-Seattle Weekly "Air Travel - Low-Base Low (LBL) Case

Calendar Year	Years After Lease Sale	Induced LBL	Low OCS Inter	Low Development Inter	Total
1981	1	1,827	62	448	2,337
1982	2	2,934	66	682	3,682
1983	3	3,590	59	1,161	4,810
1984	4	3,526	17	1,044	4,587
1985	5	3,822		173	3,995
1986	6	4,336		161	4,497
1987	7	4,928		243	5,171
1988	8	5,597		388	5,985
1989	9	6,292		528	6,820
1990	10	6,948		501	7,449
1991	11	7,643		558	8,201
1992	12	8,312		485	8,797
1993	13	9,071		464	9,535
1994	14	9,843		39	9,882
1995	15	10,640		18	10,658
1996	16	11,490		5	11,495
1997	17	12,403			12,403
1998	18	13,355			13,355
1999	19	14,423			14,423
2000	20	15,465			15,465

Lowest % Induced (year)	74.6% (1983)
Existing Passengers	12,866
Year Service Will Double	1998

Source: Peter Eakland and Associates, 1979.

4.7 High OCS-High Base Case (HBM)

4.7.1 REVIEW OF HIGH BASE CASE

The high base case includes the effects of high levels of economic discoveries in the Lower Cook Inlet (CI) and Beaufort Sea OCS lease sales and of base developments such as the gas pipeline, which are included in all base cases. The BH case emphasizes differences from the mean base case. These are principally transportation demands and impacts derived from regional influences since only a single base case was constructed for the communities of Seward, Yakutat, and Cordova. Tanker traffic also has separate demands for the high base case, since Beaufort Sea oil is assumed to be transported to Valdez by pipeline.

The Anchorage region shows steady growth throughout the study period. The base year population is exceeded by 50% by 1989 and is doubled by 1997 (Table 3-10). The southcentral region only grows 43% above the base year population by the end of the study period and experiences three years of population decreases during the middle of the study period.

The low capacity thresholds for petroleum and dry bulk are both reached at Anchorage by the end of the study period. Whittier and Seward are expected to handle tonnage for high scenario developments until the mid-1990's (Table 3-11). The highest development tonnage at these ports occurs during the early 1980's when exploration drilling in previous OCS lease sales coincides with other development projects.

Air traffic on the Anchorage-Seattle link is expected to be twice the base year value of 12,866. Population growth in the Anchorage region will lead to more tonnage on the Alaska Railroad and more traffic on roads leading to the Kenai Peninsula. The Alaska Railroad will be able to handle the traffic, but the Seward Highway can be expected to experience congested conditions more frequently. Tanker traffic out of Valdez is the same for all base cases until 1989 when Beaufort Sea production begins to offset the decline of Prudhoe Bay production. The number of tanker sailings (Table 4-16) thereafter does not again approach the peak production value in 1985.

4.7.2 WATER MODE

4.7.2.1 Description of Activities

The modest growth in regional populations ·n the HBH case will cause increased tonnage at Anchorage, Whittier, and Seward Table 4-52 contains the base year factors for induced tonnage. Dry freight and petroleum factors for Cordova and Yakutat and the petroleum factor for Seward are identical to those for the HBM case. Seward, alone of all the regional entry ports, will handle OCS drilling supplies for the Northern Gulf of Alaska lease sale. Table 4-43 shows the fuel and dry freight throughput tonnages for drilling converted to base year factors. By 1984, 48 monthly supply boat round-trips are forecast for Seward. The peak period occurs in 1988 when 250 monthly trips are expected.

Table 4-16 shows outbound oil tanker sailings per week from Valdez and from the three oil-producing shelves in the Northern Gulf of Alaska. In the HBH case, the total sailings attributable to Lease Sale No. 55 are shown in column 4 (South of Yakutat Shelf). They first exceed the traffic from Valdez in 1993 and reach their peak of 10.0 sailings per week in 1994. Total traffic that year, which includes that from Valdez, is 18.1 sailings per week which, is 36% higher than the peak value of 13.3 for the Valdez segment.

4.7.2.2 Summary of Impacts

Terminals. The growth factors for dry freight and petroleum both reach the low estimated low capacity threshold value at Anchorage during the study period. The dry freight low threshold is reached in 1994, two years earlier than in the high base case. The low threshold for fuel is reached in 1999, one year earlier than in the high base case. Impacts are expected to be small as long as carriers operate on strict schedules as TOTE and Sea-Land do presently. Ample port capacity exists at Whittier for rail barges, and no impacts there are expected. Existing port facilities at Seward will serve both induced and direct OCS users during exploration. An expanded support base facility is scheduled for construction in 1984 and will be operational by the end of the year. The combination of induced and direct OCS fuel and dry freight handled by the port facilities causes the low capacity threshold to be approached by 1984. Small delays are possible until the support base project is completed, particularly if the flow of tonnage has high seasonal variations. However, alternative routings are available for freight to be transshipped to interior destinations.

Carriers. The HBH case represents the highest level of induced marine demand, but still the forecasts are only for modest incremental changes that can be handled by existing carriers or possibly by new competing carriers. No new routes are anticipated, although demands at Seward probably will be sufficient again to make possible PAL northbound trips to Seward which were abandoned in early 1979.

Issues. The timing of construction and the location of the support base at Seward is a principal issue for this case. Induced demands do not present the potential for impacts that direct OCS demands do, as they grow in an incremental fashion. Capacity problems could develop at Anchorage if a significant amount of direct OCS demands are routed via existing carriers. The Port of Anchorage by the end of the study period will be limited in attracting cargo beyond that related to population growth unless new facilities are provided. As induced demands grow, the potential for new or expanded port facilities becomes greater throughout the study area. Such facilities have the greatest feasibility in this case and, if built,could create significant changes in the market areas of existing ports. Development of tanker routings is an issue in this case as it was in the HBM case.

4.7.3 AIR MODE

4.7.3.1 Description of Activities

The Anchorage-Seattle link is the only one affected by regional population growth. The combination of travel by out-of-state OCS employees and growth in the Anchorage region produces by 1988 an additional 8,826 weekly trips above the present level of traffic. This figure is 2,151 more than the figure for the same year in the high base case. After 1990, the difference between the two cases for induced travel remains about the same, but the interstate movement of employees drops sharply (Table 4-53). Traffic doubles (12,866 additional passengers) by 1996, which is one year earlier than in the high base case.

4.7.3.2 Summary of Impacts.

Anchorage International Airport will see a significant increase in passenger movements in the late 1980's when the height of the development phase occurs for both the Beaufort Sea the Northern Gulf of Alaska lease sales. Construction of the satellite terminal for international arrivals in 1980 will provide more space for interstate flights. Moving ahead some of the improvements scheduled for later years might be necessary.

4.7.3.3 Issues.

The need for adherence to the Master Plan for the International Airport is a major issue as is the impact of deregulation of air carriers on service between Anchorage and Seattle.

4.7.4 LAND MODES

Roads. Increased population in the HBH case compared to the BH case will cause similar traffic conditions to occur approximately one year earlier. No significant changes are forecast in the demand for freight moved by trucks, since most of the growth in the Southcentral region will occur at Cordova and Yakutat in the HBH case.

Railroads. The Alaska Railroad can expect additional tonnage in the HBH case and will be able to easily handle it. Capacity problems for the railroad, should they exist, most likely would occur on the marine segment to Whittier.

4.7.5 SUMMARY COMPARISON OF THE HIGH OCS-HIGH BASE CASE (HBH) AND THE HIGH BASE CASE (BH)

The increase in regional growth for the HBH case compared to the BH case moves ahead one to three years the transportation demands for air, marine, and land modes that serve Anchorage. Besides Anchorage, Seward and Whittier are also affected by the HBH case since they serve as regional ports of entry, and an HBH case also exists for tanker sailings between Valdez and south of Yakutat. The largest differences in demand occur in the air mode since there induced and direct OCS demands are additive for the Anchorage-Seattle link. In all cases, the direct OCS demands for this link are small enough that the peak demands occur at the end of the study period rather than at the height of the development phase.

Similar conditions at the Port of Anchorage and on the Seward Highway are moved ahead one to two years because of the effect of the Northern Gulf of Alaska's high scenario on the high base case.

At Seward, differences in induced tonnage for the two cases are minor, but the additional traffic when combined with the large amount of OCS tonnage possibly could create conflicts among users of the Alaska Railroad's port facility.

Peak tanker traffic due to the high scenario of the Northern Gulf of Alaska lease sale will come in 1995, 10 years after peak production is forecast for North Slope oil fields. Total traffic south of Yakutat will be greater than the peak for the BH case for seven years late in the study period.

Table 4-51

Regional Population Projections: High OCS - High Base Case (HBH) Factors to Produce Incremental Changes from High Base Case (BH)[1]

Year	Statewide	Anchorage	Southcentral
1977	0	0	0
1978	0	0	0
1979	0	0	0
1980	0	0	0
1981	0.002	0.001	0.014
1982	0.004	0.002	0.025
1983	0.006	0.004	0.032
1984	0.020	0.018	0.068
1985	0.051	0.052	0.138
1986	0.072	0.077	0.142
1987	0.087	0.095	0.162
1988	0.098	0.106	0.197
1989	0.098	0.105	0.200
1990	0.095	0.100	0.223
1991	0.098	0.104	0.230
1992	0.092	0.100	0.199
1993	0.087	0.095	0.188
1994	0.084	0.092	0.186
1995	0.083	0.091	0.180
1996	0.083	0.091	0.182
1997	0.085	0.092	0.188
1998	0.087	0.095	0.191
1999	0.088	0.098	0.191
2000	0.090	0.100	0.188

Note: (1) F_I = Incremental factor = $\frac{\text{Incremental population change}}{\text{Population 1977}}$

$F_T = F_B + F_I$ = Factor for base case + Incremental factor.

Source: ISER, 1979,

Table 4-52

Base-Year Growth Factors for OCS - Induced Freight Tonnage - High-Base High (HBH) Case[1]

Calendar Year	Years After Lease Sale	Anchorage Dry	Anchorage PetroBulk	Seward Dry Bulk	Seward Petroleum	Whittier Dry Bulk	Whittier Petroleum	Cordova Dry Bulk	Cordova Petroleum	Yakutat Dry Bulk	Yakutat Petroleum	Valdez Dry Bulk	Valdez Petroleum
1981	1				1.05					1.25	1.25	8.28	1.15
1982	2				1.07			1.12	1.12	1.42	1.42	0.40	1.29
1983	3			1.86	1.10	1.82		1.13	1.13	1.50	1.50	6.07	1.31
1984	4	.33	1.33	1.88	1.18	1.82		1.16	1.16	1.80	1.80	6.09	1.37
1985	5	.39	1.38	1.39	1.22	1.3s		1.18	1.18	2.19	2.19	1.36	1.41
19B6	6	,46	1.45	1.46	1.22	1.44		1.19	1.19	2.27	2.27	1.40	1.43
1987	7	.52	1.52	1.56	1.30	1.56		1.24	1.24	2.20	2.20	1.46	1.49
1 98a	8	1.59	3.58	1.66	1.44	1.58		1.30	1.30	3.41	3.41	1.53	1.58
1989	9	1.65	1.64	1.71	1.53	1.64		1.46	1.46	4.14	4.74	1.56	1.62
1990	10	1.69	1.68	1.7'3	1.58	1.69		1.75	1.75	6.04	6.04	1.61	1.69
1991	11	1.76	1.73	1.79	1.59	1.74		1.77	1.77	6.35	6.35	1.65	1.73
1992	12	1.131	1.79	1.79	1.49	1.77		1.78	1.78	6.10	6.10	1.67	1.74
1993	13	1.87	1.85	1.84	1.49	1.83		1.81	1.81	6.31	6.31	1.71	1.70
1994	14	1.93*	1.90	1.88	1.47	1.88		1.85	1.05	6.33	6.33	1.76	1.83
1995	15	3 .99*	1.97	1.95	1.54	1.95		1.89	1.89	6.21	6.21	1.81	1.0?
1996	16	2.06*	2.01	2.01	1.54	2.01		1.92	1.92	6.25	6.25	1.05	1.91
1997	1'2	2.13*	2.10	2.0a	1.50	2.08		1.95	1.95	6.36	6.36	1.91	1.98
1990	18	2.22*	2.19	2.16	1.63	2.16		2.00	2.00	6.41	6.47	1.96	2.03
1999	19	2.31*	2.27*	2.24	1.68	2.2A		2.02	2.02	6.47	6.47	2.02	2.09
2000	20	2.40*	2.36*	2.32	1.73	2.32		2.06	2.06	6.40	6.40	2.09	2.16
Threshold value for low cap.		1.92	2.24	3.7a	3.26	2.74	No	3.23	2.15	9.09	11.20	19.90	3.09
Threshold value for high cap		2.?0	3.54	5.42	4.64	3.90	increase	3.45	4.55	20.00	23.44	41.40	6.25
Low value (year)		1.14 (1981)	1.14 (1981)	1.13 (1981)	1.05 (1981)	1.13 (1981)	expected	1.09 (1981)	1.09 (1981)	1.25 (1981)	1.25 (1981)	1.09 (1981)	1.09 (1981)
High value (year)		2.40 (2000)	2.36 (2000)	2.32 (2000)	1.73 (2000)	2.32 (2000)		2.06 (2000)	2.06 (2000)	6.40 (2000)	6.40 (2000)	2.09 (2000)	2.16 (2000)

Value exceeding low capacity ^
high capacity •*

Note: (1) Values not shown are unchanged from the high base (BH) case. Factors shown are cumulative and include base case

Source, Peter Eakland and Associates, 1979.

Table 4-53

Additional Anchorage-Seattle Weekly Air Travel - High-Base High (HBH)

Calendar Year	Years After Lease Sale	Induced HBH	High Ocs	High Base Development	Total
1981	1	1,866	54	710	2,630
1982	2	2,973	88	1,206	4,267
1983	3	3,835	121	2,106	6,062
1984	4	4,156	264	2,317	6,737
1985	5	4,915	217	1,244	6,376
1986	6	5,726	181	1,070	6,977
1987	7	6,575	378	366	7,319
1988	8	7,437	787	602	8,826
1989	9	8,170	642	899	9,711
1990	10	8,737	457	903	10,097
1991	11	9,496	393	969	10,858
1992	12	10,126	148	922	11,196
1993	13	10,846	64	879	11,807
1994	14	11,606	37	75	11,718
1995	15	12,429	10	37	12,476
1996	16	13,278	3	11	13,292
1997	17	14,217	3		14,220
1998	18	15,234	3		15,237
1999	19	16,353	3		16,356
2000	20	17,447	3		17,450

Lowest % Induced (year)	61.7% (1984)
Existing Passengers	12,866
Year Service Will Double	1996

Source: Peter Eakland and Associates, 1979.

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APPENDIX: METHODOLOGY

I.1 Introduction

The task of assessing the impact on regional and statewide transportation systems of oil and gas development in Northern Gulf of Alaska requires an integrated methodology that can forecast transportation demands and then can assess the impact of these demands. The multidisciplinary aspect of the Socioeconomic Studies Program is enhanced to the extent that the forecasts are based on population and employment figures generated by concurrent studies in the Socioeconomic Studies Program. The value of the impact assessments relates to the ability to pinpoint the cause of the impacts. The desirability of establishing causal relationships between demand and impacts prompted two requirements which were incorporated into the methodology, as follows: (1) that base conditions be established to which incremental growth and development activities could be added, and (2) that transportation demands be disaggregate as much as possible.

The material which follows explains the methodologies for forecasting transportation demands and assessing impacts as well as the assumptions on which they are based.

1.2 Size of Existing Communities and Existing Transportation Infrastructure

Where possible, the oil industry will locate supply bases to take advantage of existing infrastructure, which includes, but is not limited to, transportation services and facilities. Yakutat, Seward, and Cordova, the most likely supply base sites for oil and gas activities in Northern Gulf of Alaska, have certain transportation facilities in excess of what would be expected for communities of their population, which ranges from 500 in Yakutat to 2,500 in Cordova. This is particularly true for the air mode, since World War II construction provided Yakutat and Cordova with runways that have the length and bearing capacity to accommodate jet passenger and Hercules C-130 freight aircraft. Unlike the air mode, port and dock facilities in the communities are not greatly in excess of existing requirements, although Seward, whose port was reconstructed by the Corps of Engineers for the Alaska Railroad after the 1964 earthquake, has port and dock facilities greatly in excess of existing requirements.

1.3 Nature of the Oil Industry

The manner in which oil companies undertake the exploration and development of offshore petroleum resources will influence the extent and nature of transportation impacts. Four items, as follow, deserve special consideration.

1.3.1 CAPITAL INTENSIVE NATURE OF THE INDUSTRY

Extremely large expenditures are required before production can begin after a discovery has been made. Once the decision to develop is reached, a field is put into production as soon as practicable and the oil recovered in as short a period as possible to maximize productivity of costly capital intensive activities. Costs per clay of operating an offshore pipeline bury barge have been estimated at $?50,000 per day (ADH, 1976). Consequently, oil companies to an extent will sacrifice costs to assure that established schedules are met.

1.3.2 USE OF SPECIALIZED COMPANIES AND EQUIPMENT IN OFFSHORE EXPLORATION, DEVELOPMENT, AND PRODUCTION OF OIL AND GAS

Offshore oil and gas activities, first in the Gulf of Mexico and later in the North Sea and other parts of the world, have produced specialized technologies and companies utilizing them. Oil and gas companies contract with these companies when the need arises rather than develop such capabilities in-house. Carriers now serving Alaska, it is assumed, would not compete for business where specialized vessels or expertise are required for such activities as moving goods from supply bases to offshore work sites and laying underwater pipelines.

1.3.3 REQUIREMENT FOR DEDICATED FACILITIES

Commercial discoveries, as indicated, will be developed and produced as fast as prudently possible. To accomplish this requires that onshore facilities be available whenever required by OCS-related traffic. This requirement does not present any difficulties for air facilities, as capacity limits for runways realistically will never be constraints at any airport within the study area except for Merrill Field and Anchorage International Airport. Consequently, the joint use of runways by OCS-related and other traffic is expected. For the marine mode, peak activity for both OCS and fishing activities will occur during the summer months. Port and harbor requirements for OCS activities potentially conflict with those of fishing and marine freight carriers. Priority berthing arrangements for OCS-related vessel traffic is not only desirable but in most cases a necessity in order to maintain the productivity of exploration and development activities. Shari ng of dock berths by OCS vessels with other users is possible where the estimated level of OCS activity is significantly less than the threshold value for one berth, 40 monthly supply boat round-trips. This situation can exist in the exploration phase or for forward supply bases which provide only fuel and water. Otherwise, dedicated berths are considered necessary. OCS requirements for dedicated berths can be met with existing facilities where a significant excess in capacity exists, such as Seward. Where the scenario calls for supply base construction, it is assumed that the resulting facility will be used exclusively for OCS activities, which implies consolidation of all supply base functions and a facility size based only on peak OCS demands.

1.3.4 UNIT AGREEMENTS TO OPERATE SUPPLY BASES

Oil companies working adjacent leases normally agree to jointly operate supply bases, and this practice will be assumed. Unit agreements are also assumed in the development of oil terminals and LNG plants.

1.4 Climate

Climatic conditions place certain constraints on transportation activities within the study area. Their potential impact on oil and gas activities in the Northern Gulf of Alaska depends upon the location and the mode involved. The more important climatic impacts are discussed below:

- Ice Conditions. None of the Northern Gulf of Alaska ports experience ice problems. Cook Inlet, however, can be ice covered as far south as Kenai, which limits the use of the Port of Anchorage by tug and barge operators during the winter. Freight ships operated by TOTE and Sea-Land have reinforced hulls, and the thin ice does not present difficulties for them. Icebergs in Prince William Sound and Yakutat Bay are not considered serious impediments to safe navigation.

- Snow Conditions. Snow conditions can affect the efficiency of supply base operations and close an airport for several days at a time. Yakutat receives a mean snowfall of 5.64 meters (222 inches), which is almost twice the figure for Cordova and three times that for Seward. Despite the inconvenience caused by snow, the short duration of its impacts on transportation movements make it of secondary importance in assessing impacts.

- Visibility. Fog conditions can curtail airport operations during parts of the day and reduce operating speeds of marine vessels. In the vicinity of Seward, visibility during August is less than 3.2 km (two miles), an average of 11.8% and 12.5%, respectively. Winter percentages of restricted visibility are less than during the summer. CAB certificated carriers flying into Anchorage operated at 93.2% reliability, and Valdez operations trailed at 79.3% (CAB, 1978). Fog will create inconveniences for both air and marine operators; but transportation demands are forecast for annual , monthly, or weekly time periods, depending upon the tyPe of activity. Effects of fog on transportation systems rarely extend for such lengths of time.

- Wind and Swells. Winds and accompanying swells adversely affect the efficiency and safety of ship-related offshore activities, particularly offloading of materials at platforms and laying of pipeline. Technological improvements have increased offloading capabilities of supply boats, particularly for bulk cargo, such as water, fuel, drilling mud, and cement, which can be transferred using flexible hoses in seas up to 6.1 meters (20 feet).

Offloading of tubular pipe-requires calmer seas, and 3.35 to 4.57 meter (11 to 15 foot) seas have been suggested as a maximum limit for safe and complete offloading. The storage capacity of exploratory drilling rigs exceeds 30 days for all materials needed, and bad weather conditions will not be this long. supply boats will be able to reestablish depleted reserves once weather permits.

Lower productivity is expected during winter months, not only for ship activities, such as pipe laying, but also on platforms because of long periods of darkness, cold temperatures, wind, and heavy seas, Lower productivity stretches out somewhat the minimum allowable time between deliveries for supply boats. The adverse impacts on productivity have been recognized by Dames & Moore in establishing annual manpower figures, yearly drilling schedules, and average productivity levels for the three scenarios (Dames & Moore, 1978).

1.5 Technology

Efforts by transportation companies to increase productivity have resulted in the introduction of larger vessels and aircraft and more efficient equipment for loading and unloading cargo. Two airlines now operate DC-10'S on a daily basis between Seattle and Anchorage, and containerized freight is rapidly replacing breakbulk cargo which requires manual manipulation, These trends are expected to continue as demand for transportation services in Alaska increases. Because of this trend toward larger vessels and aircraft and more efficient freight handling, aircraft and vessel movements will grow more slowly than freight volumes.

1.6 Transportation Demand Methodology

Transportation demands resulting from OCS activities can be broken down into two basic types--direct demands that can be derived from the schedule and nature of activities and indirect, or induced, demands that re-suit from overall increases in population of disposable income. Figures A-la to A-lc show six categories of transportation demands, four of which are direct and two indirect. The detailed methodologies for each are described below.

1.6.1 CATEGORIES 1 &2: INDUCED TRANSPORTATION DEMANDS

Induced transportation demands are forecast for dry freight and liquid bulk arriving by the marine mode and for air passengers on scheduled airlines. Forecasts covering the years 1981-2000 are made for the three base cases and for each of the five OCS cases. The relationship that exists between population and demand in the base year is assumed to remain constant in future years at each location. The forecasting process first involves establishment of base year demands, then computing ratios of population in future years to base year population, and finally multiplying the resulting ratios by the base year demands. The forecast demands, as appropriate, are compared against capacities or threshold

FIGURE 1a. FLOW CHARTS FOR DEVELOPMENT OF TRANSPORTATION DEMAND CATEGORIES 1,2, AND 3

Category 1&2:
3·BASE CASE TRAFFIC
4·OCS-INDUCED TRAFFIC
A. PASSENGERS B. DRY FREIGHT
C. FUEL-ALASKA CONSUM TOI

Category 3:
OCS INDUSTRIAL FREIGHT

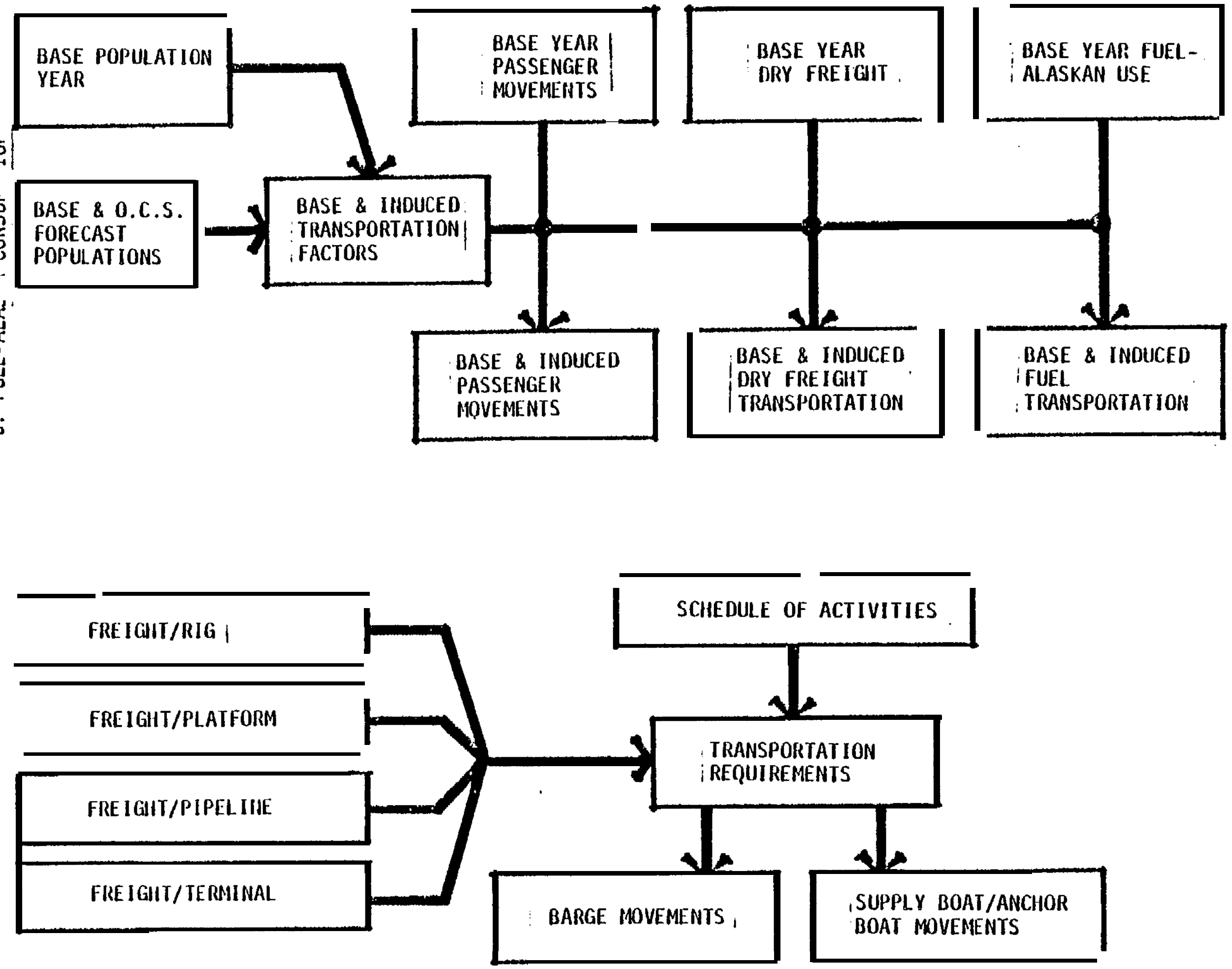


FIGURE 1b. FLOW CHARTS FOR DEVELOPMENT OF TRANSPORTATION DEMAND CATEGORIES 4 AND 5.

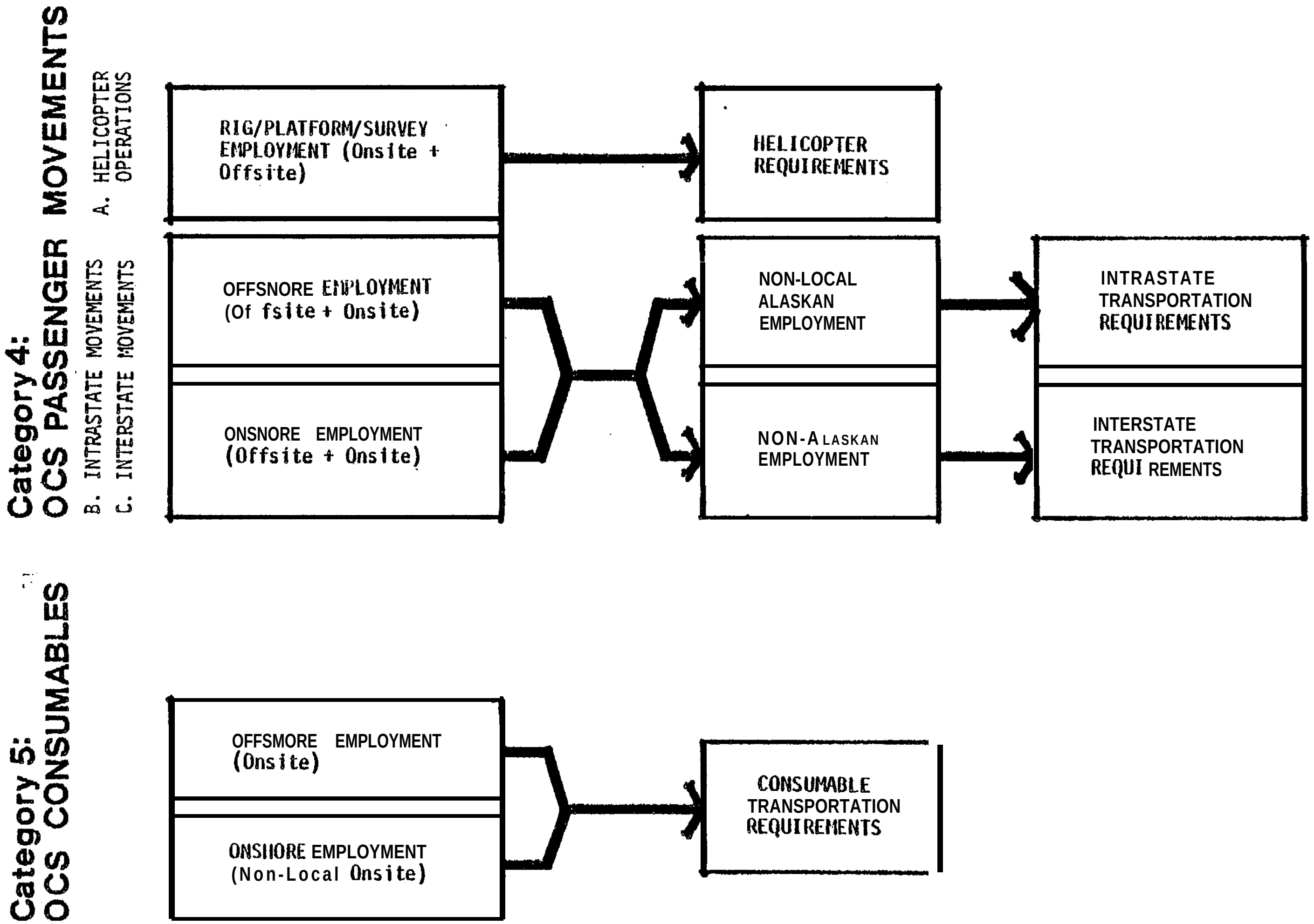
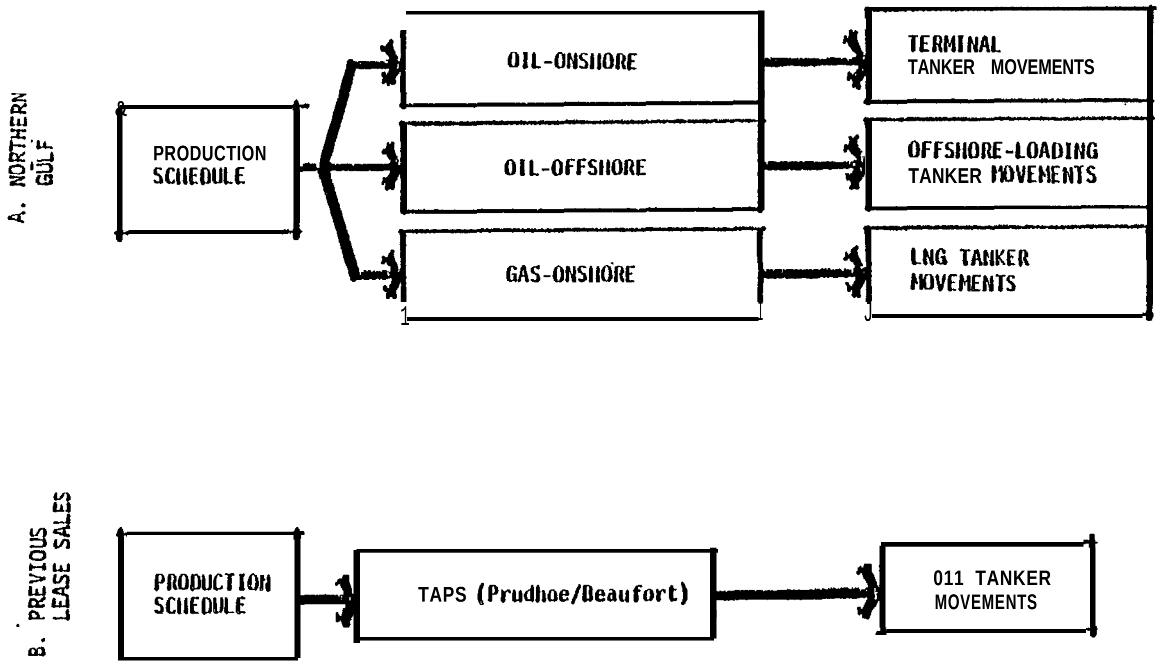


FIGURE 1c. FLON CHARTS FOR DEVELOPMENT OF TRANSPORTATION DEMAND CATEGORY 6

Category 6:
OIL & GAS PRODUCT ON



values. A detailed description of the process, first for the marine mode and next for the air mode, is described below.

I.6.1.1 Induced Marine Freight Demand

The forecasting process for induced marine freight and fuel consists of three steps, which are described below:

(1) Base Year Throughput Tonnage. Because of substantial fluctuations that occurred for all transportation facilities and services within the study area between 1970 and 1975 because of construction of the trans-Alaska pipeline, the use of regression analysis as a basis for forecasting was discarded. Instead, 1977 was chosen as a base year, and data was compiled for the major ports in the study, area for two tyPes of traffic throughput tonnage for dry freight and throughput tonnage for liquid bulk. Fortunately, data for this year was readily available as a result of the first phase of the Corps of Engineers' Southcentral Deep-water Port Study.

Data for the water mode is shown in Table A-1. All values were taken directly from Corps of Engineers' 1977 figures except that for Anchorage an average of the 1975 and 1976 figures for liquid bulk was used in order to eliminate the effect of the Nikiski oil pipeline.

Table A-1

Distribution of Final Destination of Tonnage Handled by Ports

Facility	Commodity	Local	Regions		
			Anchorage	Fairbanks	Southcentral
Port of Anchorage	Dry Bulk		0.8	0.2	
	Petroleum Bulk		1.0		
Port of Seward	Dry Bulk		0.7	0.2	0.1
	Petroleum Bulk	1.0			
Port of Whittier	Dry Bulk		0.7	0.2	0.1
	Petroleum Bulk	Military Use			
Port of Cordova	Dry Bulk	1.0			
	Petroleum Bulk	1.0			
Port of Yakutat	Dry Bulk	1.0			
	Petroleum Bulk	1.0			
Port of Valdez	Dry Bulk			0.5	0.5
	Petroleum Bulk (except TAPS output)				1.0

Source: Peter Eakland and Associates, 1979.

(2) Development of Freight Distribution Factors. Population data was available for three regions--Anchorage, Fairbanks, and Southcentral. The Anchorage and Southcentral regions together include the primary data collection area for lease sales in both the Gulf of Alaska and Lower Cook Inlet. On the basis of interviews and available data, the percentage of throughput tonnage related to local or regional influences was estimated. Table A-1 shows the distribution of dry bulk and petroleum for ports affected by Sale No. 55. Present trends are assumed to continue in the future. Only facilities for which funding has been obtained are assumed to exist. The service area for bulk petroleum facilities in Seward, Cordova, and Yakutat is assumed to be local in nature. The Port of Anchorage has a market area beyond the Anchorage region, but approximately 80% of tonnage has a local destination.

(3) Development of Base Year Factors for Each Year for Each Case for Each Port. Regional and local population forecasts are converted into base year factors by dividing each forecast by the base year populations. The base year depends upon the available data set. In some cases, 1977 is used, primarily for marine tonnage and regional forecasts. In the remaining cases, including local population forecasts, 1978 is used. The impact on forecasting of the one-year difference in data sets is assumed to be minimal. For the base cases, base year factors are developed only for total population, whereas for the OCS

cases-values are developed for incremental changes. Where the distribution factor is 1.0, no further computations are required. For ports that serve transshipment roles, regional values are weighted by the appropriate distribution factors. Once base year factors have been developed, threshold values are computed against which they can be compared. Because the relationship between tonnage and population in the base year is assumed to remain constant, threshold figures are simply the ratio of base year throughput tonnage to capacity figures.

1.6.1.2 Induced Air Passenger Movements

The process of forecasting induced passenger movements on scheduled airlines as with the marine mode uses the base year growth factors. However, the forecasting occurs for links rather than terminal points. The process is as follows:

(1) Development of Links to Be Analyzed. Air links on scheduled airlines will be studied that involve routes from Yakutat, Cordova, and Seward to Anchorage and Seattle. Two trunk airline routes and one commuter route are involved. Seward-Anchorage is the commuter route. Use of medium-body jet aircraft on this route is considered infeasible because of the short distance involved and the marginal runway length and ground facilities at Seward. Anchorage to Seattle non-stop service is one of the trunk routes. The other route consists of four

links connecting Anchorage to Seattle--Anchorage-Cordova, Cordova-Yakutat, Yakutat-Southeast, Southeast-Seattle. Since the emphasis is on travel from Yakutat and Cordova, five total links have been selected for analysis. They include the two northbound links beginning at Yakutat and the three southbound links beginning at Cordova. Note that the link between Yakutat and Cordova is included in each direction.

(2) Development of Base Year, Peak Week Traffic Values by City Pairs. Data was collected for scheduled passenger service by carrier and route from the Civil Aeronautics Board or Alaska Transportation Commission as appropriate. Data from 1978 was used for the Anchorage-Seattle link and data from 1979 for Alaska Airlines service to Yakutat and Cordova. The load factor for Seward-Anchorage was estimated to be 0.60. The base period was July or August in order to reflect peak demand. For the Seward-Anchorage and Anchorage-Seattle links, monthly figures were divided by 4.3 to obtain weekly figures. For links on the Southeast route, average passenger/day figures from Tables 2-22 and 2-24, respectively, for Yakutat and Cordova originating traffic were multiplied by seven. Base level traffic figures are shown in Table A-2.

(3) Development of Incremental Base Year Growth Factors for Each Air Link. In this step, a determination is made how the population forecasts will be used to generate corresponding passen-

Table A-2

Base Period Passengers/Meek by Trip Link

Link	Direction	From(To) Yakutat	From(To) Cordova	From Seward	From Anchorage
Cordova-Anchorage	NB	106	290	-	
Cordova-Yakutat	SB	(1 08)	171	-	
Yakutat-Cordova	NB	108	(90)	-	-
Yakutat-Juneau	SB	164	167	-	
Juneau-Seattle	SB	103	116	-	
Seward-Anchorage	NB			240	-
Anchorage-Seattle	SB				12,866

Source: Peter Eakland and Associates, 1979; CAB, 1978.

ger forecasts. Two basic assumptions are made. First, growth in air passenger service is assumed to be wholly related to population growth of the smaller community in each 1 ink. Second, the ratio between population and traffic between city pairs is expected to remain constant in the future. The reliance on population *as a* predictor of passenger traffic has weaknesses; but population figures are a primary output of both the regional and local socioeconomic studies, and their use creates a desirable consistency between the studies.

Regional and local forecasts as appropriate are first used to produce base year factors by dividing each forecast by the base year population, which is 1978 for the local communities and 1977 for the regions. These factors are the same as those used in forecasting induced marine tonnage. Local, areawide populations are used for Seward, Yakutat and Cordova and regional population for Anchorage. For OCS scenarios, onshore construction workers are not considered as part of the population. Their movements are forecast separately as a direct transportation demand.

The analysis of air passenger service during the study period emphasizes increases in traffic over that for the base period. The incremental *base* year growth factors are produced by subtracting ?.0 each of the base year growth factors. For example, a base year population of 5,000 and a forecast population of 6,000 leads to a growth factor of 1.2, which in turn leads to an incremental base year growth factor of 0.20. The same procedure is used for OCS cases. The incremental factor is the difference between the factor for the OCS case in a given year and that for the base case in the same year.

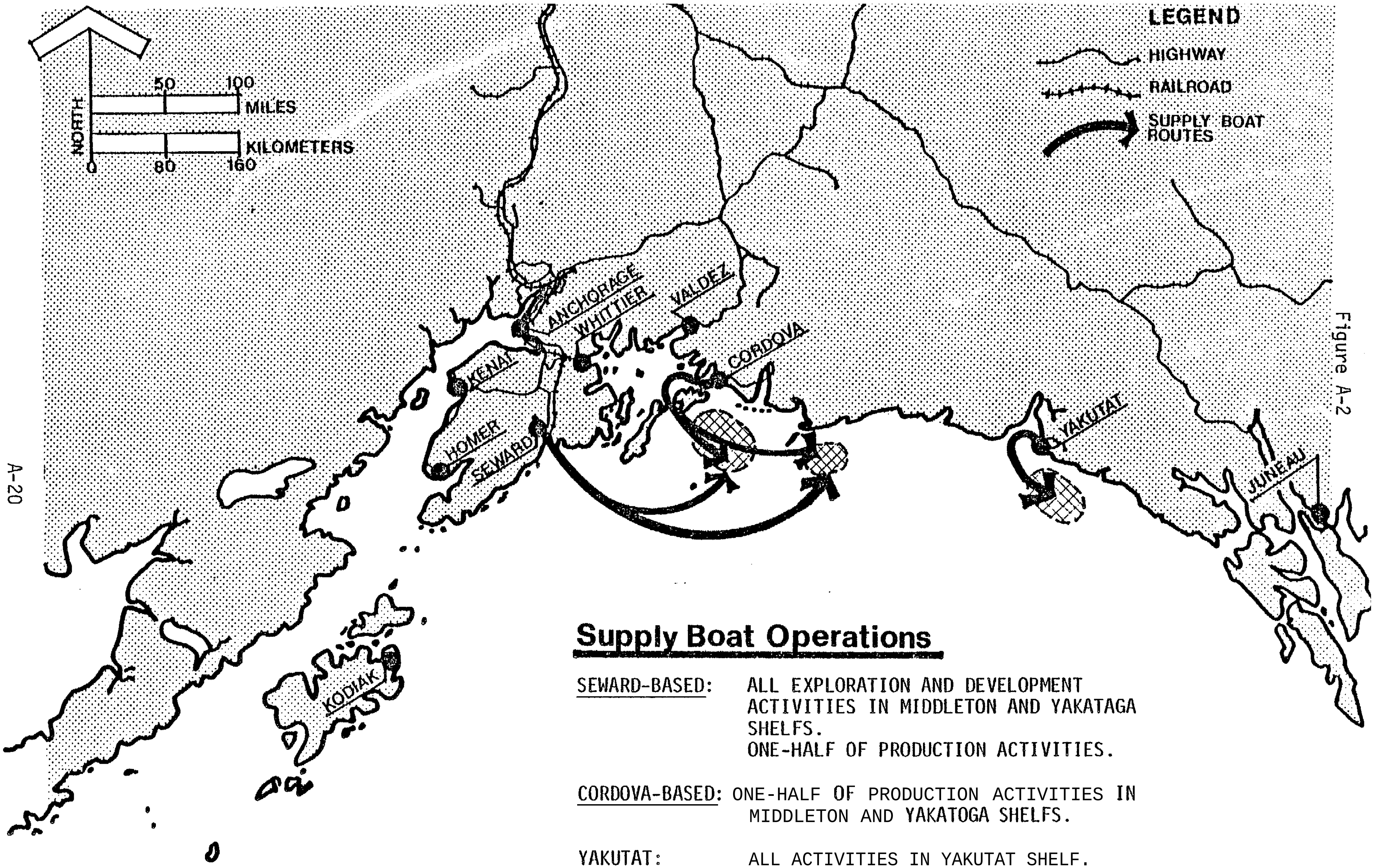
(4) Twenty-year Incremental Weekly Passenger Forecasts by Link. Forecasts by link for increases in weekly passenger traffic above the base level during the peak travel period are simply the product of the incremental base year growth factors and the base level weekly traffic for the peak month.

1.6.1.3 Miscellaneous Induced Transportation Demands.

Several additional areas of transportation demand are examined which are based primarily on population growth. Growth in the use of passenger terminal facilities will be based on air carrier forecasts. Only passenger movements on the links discussed in the previous section will be considered. Terminal usage is twice the number of passengers forecast to arrive or depart at any facility because trips in both directions must be considered.

For intercity roads on the Kenai Peninsula, peak travel occurs during the summer months. Since much of this traffic is based on the Anchorage area, population growth factors for the Anchorage region were used to forecast traffic increases. No attempts were made to forecast local traffic increases, because such increases will depend upon the location of new residences and businesses and the ability of traffic to use alternative routings. Examination of both questions is beyond the scope of this study.

Figure A-2



Supply Boat Operations

SEWARD-BASED: ALL EXPLORATION AND DEVELOPMENT ACTIVITIES IN MIDDLETON AND YAKATAGA SHELFS.
ONE-HALF OF PRODUCTION ACTIVITIES.

CORDOVA-BASED: ONE-HALF OF PRODUCTION ACTIVITIES IN MIDDLETON AND YAKATOGA SHELFS.

YAKUTAT: ALL ACTIVITIES IN YAKUTAT SHELF.

Source: Peter Eakland and Associates. 1979.

1.6.2 CATEGORY 3: INDUSTRIAL FREIGHT

Industrial freight for OCS oil and gas activities supports two general activities--drilling and construction. Quantities for the two activities are not considered to be additive, since different facilities would be used except in rare circumstances.

1.6.2.1 Role of Supply Bases

The transportation impacts of OCS oil and gas activities on marine facilities depends upon the location chosen for supply bases and the roles that they will assume during each phase of activity--exploration, development, and production. Roles can vary significantly from one phase to another. The factors that are considered in the selection of supply bases are as follows:

- Proximity to offshore work areas. Figure A-2 shows the location of areas selected for development in the scenarios in relationship to adjacent communities and selected supply base sites.

- Port facilities and water conditions. Water depths must be adequate to accommodate supply boats with 4.9m (16 ft.) draft. Safe anchorage should be available for boats not tied up at docks. Efficient means of transferring freight and fuel from the shore to supply boats should be available as well as adequate landside storage.

- Airport facilities. An airfield at least 1,524 m (5,000 ft.) in length should be available to handle jet or Hercules C-130 freight shipments.

- Existing industrial infrastructure to serve the oil and gas 'industry.

- Suitable location for onshore production facilities, including oil terminals and LNG plants. Savings can result if supply bases are constructed adjacent to other facilities rather than in separate locations.

The distribution of activity by supply based is indicated in Table A-3 (Alaska Consul tants, 1978).

1.6.2.1.1 Exploration

During the exploration phase, an emphasis is placed on using existing facilities. A great variation in logistics philosophies among oil companies can occur in this phase depending upon previous investments in the area, the estimated likelihood of making economic discoveries, and overall company policies. Generally, oil companies are willing in the exploration phase to have supply boats travel relatively long distances instead of investing in major new facilities close to the drilling activities. Savings i n operating costs for the closer facility woul d be

Table A-3

Distribution of Supply Boat Functions to Supply Bases

Supply Base	Exploration: Well Drilling	Development: Well Drilling	Development: Platform Installation	Development: Offshore Pipeline Construction	Production: Resupply
Yakataga and Middleton Shelves					
Seward	1	1			1/2
* Cordova	0	0			1/2
Yakutat Shelf					
Yakutat	1	1			1

Source: Alaska Consultants, 1978.

inadequate to amortize construction costs over the length Of the exploration phase.

Two types of supply base facilities exist usually during the exploration and development phases, except in areas already having experienced oil and gas development where one base may be able to serve both purposes. The primary facilities referred to as rear supply bases are those that handle bulk commodities and major industrial freight. They require dock equipment to efficiently transfer cargo, adequate storage space, and dedicated berth areas. .

Forward supply bases are those used principally for obtaining fuel, water, and miscellaneous industrial supplies that have arrived by air or the land modes. These facilities are located closer to the drilling areas and do not require extensive infrastructure or landside storage. Drilling activities during the exploration phase in the Middleton and Yakataga shelves are forecast to be supplied exclusively from Seward and activities in the Yakutat shelf exclusively from Yakutat.

1.6.2.1.2 Development

Of all phases, the development phase has the largest logistics requirements. It lasts from three to ten years depending upon the size of fields and facilities required. During the mid-years of this phase, the three principal activities--platform installation, drilling, and pipeline laying--can occur concurrently.

Supply base roles that existed during exploration activities will remain unchanged. Expansion of supply boat facilities in both Seward and Yakutat will occur in both the mean and high scenarios.

Location of a pipe-coating plant in Seward will require offshore pipeline for all areas to first go to Seward for concrete coating. After being coated, the pipe will be distributed to pipe-laying barges working in the Middleton and Yakutat Shelves for both the mean and high scenarios.

1.6.2.1.3 Production

The low level of support requirements during this phase favors use of a single facility, except for a high level of production activities. Shipments for several platforms can be combined into a single trip, which keeps vessel requirements to a minimum. A platform's fuel requirements can be satisfied by gas in the material being produced, and distillation facilities can provide the crews water requirements.

Yakutat is assumed to handle all resupply logistics for the Yakutat Shelf. Cordova and Seward will share equally resupply responsibilities for the other two shelves during production.

1.6.2.2 Inbound Drilling Supplies (Barges and Tankers)

Table A-4 summarizes the estimated material requirements for individual exploration and development wells at depths outlined in the Western Gulf of Alaska scenarios. Development wells are assumed to require 80% of the materials/foot needed for exploration wells, except for water which will remain the same. At the exploratory stage, it is uncertain what drilling conditions will be encountered, and wells must be designed for a wide range of conditions. At the development stage, conditions are better known, and an optimum design can be made except for dri 11 pipe. Tonnages for a 4,267 m (14,000 ft.) well developed for the Alaska Depart-ment of Community and Regional Affairs (Alaska Consul tants, 1976} are scaled down for the average well depths for each type of well. Drill pipe tonnages are based on data prepared for the Beaufort Sea Environ-mental Impact Statement (Bureau of Land Management, 1979).

All materials are assumed to go to supply bases by barge or, in the case of fuel, by small tanker. Supply boats move all goods from the bases to the drill rigs and platforms. Table A-4 shows the approximate number of barges and supply boats required to move sufficient tonnage of a given commodity for one well. The barge requirements are cumulative, because each commodity would arrive on a separate barge. Assuming an average barge load of 5,443 metric tons {6,000 tons), each exploratory well will require 0.40 barge 1 oads of fuel and each development wel 1 0.23. Dri 11 i ng wi 11 oc-cur year-round which will require a steady flow of barge traffic. Greater

Table A-4

Materials Requirements for Gulf of Alaska Drilling Activities

Material	Oil and Gas Exploration[2] Depth: 13,500 Feet				Oil Development[2,3] Depth: 7,500 Paint				Gas Development[2,3] Depth: 12,000 Feet			
	Quantity	Tons	Barge Loads[4,6]	M.W. Supply Boat Trips[5,7]	Quantity	Tons	Barge Loads[4,6]	Supply Boat Trips[5,7]	Quantity	Tons	Barge Loads[4,6]	Supply Boat Trips[5,7]
Drill Pipe:[1]												
16 in.	100 ft.	7.7			80 ft.	6.2			80 ft.	6.2		
20 in.	1,000 ft.	66.5			800 ft.	53.2			800 ft.	53.2		
13-3/8 in.	3,500 ft.	119.0			2,000 ft.	95. Z			2,800 ft.	95.2		
9-5/0 in.	10,000 ft.	26S.0			4,700 ft.	124.6			9,200 ft.	243.8		
5" tubing					7,500 ct.	65 5			12,000 ft.	104 8		
		4513. a	0.08	0.92		345.0	0.06	0.69		503.2	0.013	1.01
Dry Bulk:												
Bentonite		615		4.56		300		2.03		400		3.24
Cement		289		1.26		129		0.56		206		0.90
Barite		338		1.01		150		0.45		240		0.11
		1,302	0..32	6.(43		579	0.10	3.04		926	0.15	4.96
Fuels		2,314	0.39	5.)4		1,029	0.17	2.29		1,646	0.27	3.66
Drill Water:		3,616	N/A	6.03		2,009	u/A	3.35		3,214	N/A	5.36

Writes: (See following page).

Source: Peter Eakland and Associates, 1979, except as noted.

Table A-4 (Continued)

Notes:

(1) Dril 1 pipe sizes, quantities, and unit weights obtained from Bureau of Land Management Beaufort Sea OCS Draft EIS , 1979.

(2) Quantities for bulk materials, fuel, and water are scaled down from material requirements for 14,000-foot well as shown on page 81 of "Marine Service Bases for Offshore Development," Alaska consultants, 1976.

(3) Development wells are assumed to require 80% of materials/ foot as needed for exploration wells except of water. See page 57 of reference cited in Note (2) above.

(4) Barge loads are cumulative by type of commodity.

(5) Supply boat loads are not cumulative as commodity spaces are not interchangeable. The largest number dominates.

(6) Barge 1 oads are based on average barge capacities of 6,000 short tons.

(7) Minimum suppl y boat tri ps are based on commodi ty capaci - ties contained on page 82 of reference cited i n Note (2) above.

productivity during the summer months will result in corresponding increases in logistics requirements during this period.

Supply boats are designed to carry a variety of commodities. They have enclosed areas for carrying fuel, drill water, and dry bulk, and-deck storage areas that are used for carrying pipe. The estimate of required supply boat trips for each type of commodity is based on capacities for
9 a typical 61.0 m (200 ft.) supply boat (Alaska Consultants, 1976). Unlike for barges, the resulting figures are not additive. The largest figure pinpoints the controlling commodity, which in exploratory wells is dry bulk followed closely by drill water in exploratory wells. Drill water, fuel, and dry bulk all are in the same range, while drill pipe has a much smaller value. On a tonnage basis, drill water is the critical commodity. For each exploration well, it represents 47% of the required tonnage.

Data in Table A-3 can be used to forecast the minimum number of barges and supply boats necessary to meet the logistics requirement for well drilling. The estimate for supply boats will significantly underestimate the actual number of round trips carried out, however. Optimum deliveries will not occur for a variety of reasons, including weather, the need to reduce turnaround time because of competition for berthing spaces, the location of drilling operations, and the use of several service bases. Also, supply boats are called upon during development to serve functions other than making deliveries to platforms. Supply boat movements will be forecast separately.

The potential for conflicts between normal shipping operations to a community and logistics for OCS drilling varies from community to community, and individual circumstances must be recognized. Separate facilities to handle supply boats have been developed at Yakutat and Nikiski. At Seward, circumstances are different. No separate OCS facilities exist, although the port has been used to support exploration activities in the Gulf of Alaska. The Alaska Rail road dock in Seward, with two 183 m (600 ft.) faces, conceivably could handle as many as six supply boats at one time. However, this dock also serves as the receiving dock for petroleum deliveries, Pacific Alaska Line barges, and miscellaneous shipments. At 1 evels of OCS activity other than exploration, a point will be reached when additional facilities will be required. The timing of their construction will influence what the impact is on regular transportation services. Throughput tonnages for drilling, i.e., twice the inbound tonnage for dry freight and fuel, and the estimated number of supply boat round-trips can be used as guidelines to determine when the critical period is approached.

1.6.2.3 Construction Materials

Construction activities can be separated into offshore pipelaying, platform installation, and onshore facilities, including support bases, LNG plants, oil terminals, and onshore pipelines.

Platform installation, though a large operation requiring six support vessels, does not produce measurable impacts on the transportation systems because the platforms are moved directly to where they will be installed.

Logistics operations for onshore facilities will involve one-time logistics operations as opposed to the recurring logistics requirements for drilling. Careful planning will be required because of the oversized shipments that will be involved and *the* need to move a large amount of tonnage during relatively short periods. For the most part, shipments will be delivered directly to work sites, and construction docks will be developed. If deep water is available close to shore, construction docks may also later serve *as* docks for LNG ships and oil tankers. Existing regional transportation facilities will be called upon to handle miscellaneous shipments connected with the construction.

Transportation impacts related to offshore pipelines will occur only at Seward, which is expected to have a concrete-coating plant. The inbound, uncoated pipe is assumed to arrive by barge the year before laying occurs. Pipe is coated to a sufficient thickness that it will sink if filled with air. Thus, the weight of the coated pipe must be significantly greater than the uncoated pipe, particularly for the larger diameters. The relatively short season for pipelaying barges, May-October, and the heavy weight of the coated pipe produces significant outbound tonnages. The relatively short season for pipelaying barges will create a potential for congestion greater than the tonnages would indicate. Tugs and barges can be expected to deliver coated pipe to offshore work sites. The barge would lay alongside until its supply of pipe was depleted and would then be replaced by another barge. Supply boats would be used to carry some of the pipe but to use them exclusively for this purpose would divert them from other activities which would better use their capabilities. Onshore pipeline supplies will be delivered directly to work sites.

1.6.2.4 Outbound Logistics (Supply Boats)

supply boats serve a variety of functions from anchor handling for pipelaying barges to resupply missions. For some offshore activities, supply boats move offshore employees to and from offshore work sites, but it is assumed that this task will be performed exclusively by helicopters. Typical values of required boat trips per month have been established for each offshore activity (Alaska Consultants, 1976). This information is summarized in Table A-5. The peak summer period is used for computing the number of monthly supply boat round-trips that will use each supply base. Round trips are developed separately for each of the three shelves -- Yakutat, Takataga and Middleton. The strips are then split by supply base according to the breakdown in Table A-3 and finally totaled.

Table A-5

Supply Boat Movements by Activity

Phase	Activity	Trips/Month	Time of Year	Berth Requirements[1]
A. Exploration	1. Well Drilling	12/rig	Year-round	3.33 rigs/berth
B. Development	1. Well Drilling	20/rig[2]	Year-round	2 platforms/berth (1 rig) 1 platform/berth (2 rigs)
	2. Platform Installation	24/platform (6 vessels, 4 resupplies/month)	May-October	1.67 platforms/berth
	3. Offshore Pipeline Construction	43/80.5 km (50 mi.) of pipeline/year	May-October	0.93 pipelines per year maximum of 80.5 km (50 mi.)/berth
	● Pipe-laying	15/barge (all goods except pipe)[3] 16/barge for anchor handling		
	● Pipe-burying	12/barge		
C. Production	1. Resupply	4/platform	Year-round	10 platforms/berth

Notes: (1) Based on one berth accommodating a maximum of 40 trips/month.

(2) Berth requirements for development drilling based on comparison of well depth and number of wells drilled per year for exploration and development wells.

(3) Assumes that all pipe will be delivered directly from barges to pipe-laying barges and will not pass through supply bases. This assumption is invalid for the Northern Gulf of Alaska development scenario a.

Source: Alaska Consultants, 1976.

I.6.3 CATEGORY 4: PASSENGER MOVEMENTS

I.6.3.1 Description of Terms

Generation of OCS employment-related transportation demands, which include passenger movements, requires information from the scenarios and both the regional and local studies. The information is summarized in Table A-6. The rotation factor and job duration are derived directly from the scenarios. Onsite average monthly employment for the proposed lease sale area is provided for each task. Total average monthly employment, which includes those employees that are onsite (on duty) and off-site (off duty) is obtained by multiplying the onsite employment by the rotation factor.

The residency and SEAR (Share of Employment to Alaska Residents) "factors enable the employment figures for the entire lease sale area to be disaggregate by community into local, non-local Alaskan, and non-Alaskan employees. The latter factor breaks down employment into Alaskan and non-Alaskan segments, and the former breaks down employment into local and non-local segments.

Passenger movements can be computed using round-trip per month factors computed for each task. This factor is a ratio of the weeks in a month (4.3) to an employee's rotation cycle (onsite weeks and offsite weeks).

e

Table A-6

Characteristics of OCS Employment Trip-Making by Task

Employment Sectors For Petroleum Operations	Development	Rotation Factor (1)	Duration (2)	Residency (3)	Round-Trips Per Month	Estimated Share of Employment to Alaskan Residents (SEAR) (4) 1979-04	1905-09	1990 +
ONSHORE								
1. Service Base	Exploration	1		L	NA	1.0	1.0	1.0
	Development	1	P	L	NA	1.0	1.0	1.0
	Production	1		L	NA	1.0	1.0	1.0
2. Helicopter Service	Exploration	2		NL	0.717	.5	.525	.578
	Development	1.5	P	NJ.	0.717	.5	.525	.570
	Production	1		L	NA	1.0	1.0	1.0
3. Service Base Const.		1.11	T	NL	0.430	.5	.525	.578
4. Pipe Coating		1.11	T	NL	0.430	.2	.21	.231
5. Onshore Pipeline Const.	Development	1.11	T	NL	0.430	.2	.21	.231
6. Oil Terminal Const.		1.11	T	NL	0.430	.5	.525	.570
7. LNG Plant Const.		1.11	T	NL	0.430	.5	.525	.578
0. Concrete Plat. Const.								
9. Oil Terminal Operations	Production	1	P	L	NA	1.0	1.0	1.0
10. LNG Plant Operations		1	P	L	NA	1.0	1.0	1.0
OFFSHORE								
11. surveys	Exploration	1	T	NL	0.717	.2	.21	.231
12. Rigs		2	T	NL	0.717	.2	.21	.231
13. Platforms	Development	2	P	0.05L/0.95NL	0.717	.1	.3	.33
	Production	1	P	0.10L/0.90NL	0.717	1.0	1.0	1.0
14. Platform Installation	Development	2	T	NL	0.717	.1	.105	.116
15. Off shore Pipeline Const.		2	T	NL	0.717	.1	.105	.116
16. Supply-Anchor-Tugboats	Exploration	1.5	T	NL	0.717	.4	.42	.462
	Development	1.5	T	0.05L/0.95NL	0.717	.8	.00	.968
	Production	1.5	P	0.10L/0.90NL	0.717	.0	.00	.968

Notes: (See following page.)

Table A-6 (continued)

Characteristics of OCS Employment Trip-Making by Task (Cont.)

Notes: (1) Rotation factor is defined as follows:

$$1 + \frac{\text{number of weeks offsite}}{\text{number of weeks onsite}}.$$

Multiplying the onsite employment by the rotation factor produces total employment for a given task.

(2) T = temporary; P = permanent.

(3) L = local; NL = non-local (Alaskan or non-Alaskan).

(4) Computation of round trips per month for each rotation factor was as follows:

$$(4.3 \text{ weeks/month}) \div (\text{weeks onsite} + \text{weeks offsite}).$$

Weeks onsite and offsite for each rotation factor was supplied by Gordon Harrison of Dames & Moore.

Rotation Factor	Weeks Onsite	Weeks Offsite	Round-trips per Month
1.1	9	1	0.430
1.5	4	2	0.717
2.0	3	3	0.717

(5) Concrete platforms to be constructed outside of Alaska.

Sources: Rotation factors - Dames & Moore, 1978;
Sear factors--ISER, 1978;
Residency - Alaska Consultants, 1979;
Otherwise - Peter Eakland and Associates, 1979

1.6.3.2 Helicopter Operations

To obtain peak weekly helicopter operations, total offshore employment. is first obtained for each service base. Employment for supply, anchor, and tug boats is not included since rotation for these tasks occurs when the boats are in port. Employment is then converted to round-trips using a factor of 0.717, which is applicable for employees having rotation factors of either 1.5 or 2.0. The likel i hood that all employees would be allowed offsite time prompted the use of a single factor for offshore employment despite the use of ?.0 rotation factors for survey and platform production work. Final conversion to helicopter trips is based *on* an average load of 14 employees per trip, which is the equivalent of one-half a drilling crew, and a peaking factor of 2.0. Twin-engine helicopters do not usually operate at full capacity. The excess capacity provides allowances for light cargo shipments and trips by transient persons, such as company or government officials. The 2.0 peak factor was decided upon after comparing monthly average employment for each year to the estimated employment in July of the same year.

Helicopter operations for all phases are to be based out of Cordova for activities in the Middleton and Yakataga Shelves and out of Yakutat for the Yakutat Shelf, as assumed for the study of local socioeconomic impacts (Al aska Consultants, 1978).

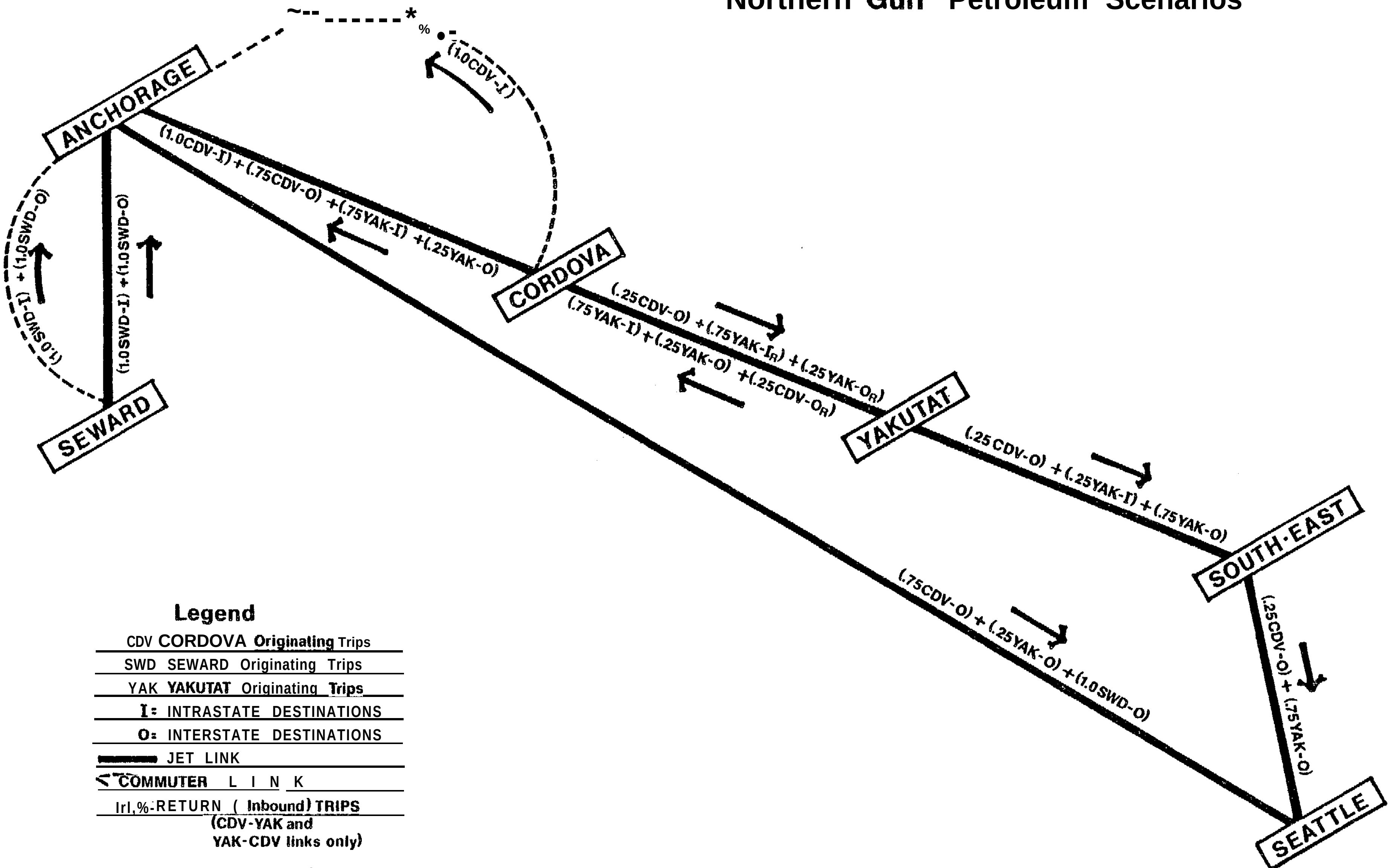
1.6.3.3 Air Carrier Passenger Movements

This category of transportation demand includes trips between service bases and residences. The seven links to be analyzed are those which were described in Section 1.6.1.2 and shown on Figure A-3. The analysis is limited to outbound trips from the service bases, since return trips are the same in number and are assumed to travel over the same links but in reverse. The one exception occurs on OCS-related traffic flights between Yakutat and Cordova, since each direction carries employees leaving from one service base but returning to the other. However, only one of the links needs to be considered because each carries the same volume of direct OCS-related traffic. Intrastate trips accommodate employees that are non-local Alaskans. They live in Alaska but do not reside in the community in which the helicopters are based. The movement of non-Alaskans from the service base to and from points outside of the State constitute interstate trips. Both interstate and intrastate trips will use links within the State. The distinction between the two types of trips is based upon the final destination. Both categories are assumed to use existing scheduled carriers rather than chartered aircraft. Estimated distribution of trips north and south from the service bases is shown on Table A-7 and graphically on Figure A-3. The seven links are those which were described in Section 1.6.1.2. Non-local Alaskans working out of Cordova are expected to live primarily in Anchorage, while those out of Yakutat would live 75% in Anchorage and 25% in Southeast. Seward non-local Alaskans are assumed to travel to Anchorage. For non-Alaskans, Seattle is assumed to be the final destination, although many will continue trips to the south or east. Cordova-based non-Alaskan workers are presumed to prefer routes through Anchorage because of greater frequency of service and comparable prices. Only 25% are assumed to leave on southbound flights from Cordova. For Yakutat workers, the percentages would be reversed. Yakutat's more southerly location places a cost and time penalty on reaching the Lower 48 through Anchorage.

The end result of the analysis for each service base for each scenario is to assign weekly trips to the air travel links shown in Figure A-3. Figure A-4 is a flowchart showing the steps in the development of the link volumes. Numbers 1-10 represent intermediate results leading to 11, which is the peak weekly outbound trip link volumes for each scenario. Numbers 1-9 require nine iterations, based on three scenarios each having three service bases. The reman numerals represent factors and data required for the step-by-step transformations eventually leading to link volumes.

Separate processes are shown for the transformation of onshore and offshore employment data although the processes involve the same steps. Both are provided to emphasize that factor values differ significantly for the two types of employment. Also, several of the onshore and offshore interim products are used in estimating other transportation demands, which would be obscured by showing a single process. Interim product 2A, for example, is the input for computing helicopter operations.

Figure A-3 Assignment to Air Links of Outbound Intrastate and Interstate Travel Northern Gulf Petroleum Scenarios



Distances on Map not to Scale

Source: Peter Eakland & Associates

Table A-7

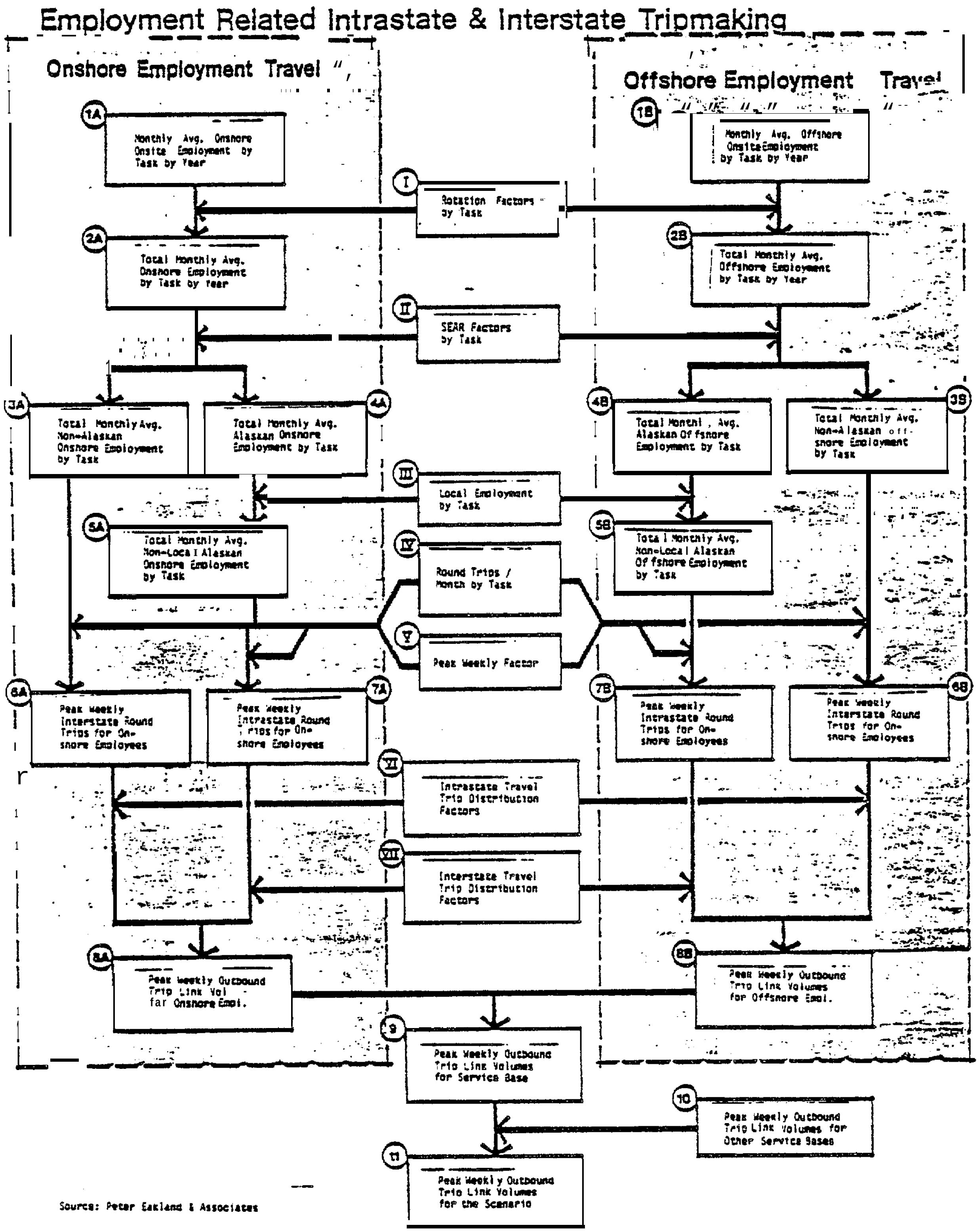
Intrastate and Interstate'Trip Distribution Factors

Airlinks	Cordova Intra	Cordova Inter	Yakutat Intra	Yakutat Inter	Seward Intra	Seward Inter
CDV-ANC	1.00	.75	.75	.25		
CDV-YAK		.25	.75(R)	.25(R)		
YAK-CDV		.25(R)	.75	.25		
ANC-SEA		.75		.25		1.00
SWD-ANC					1.00	1.00
YAK-JNU-KTN		.25	.25	.75		
JNU-KTN-SEA		.25		.75		

(R) = Return trips.

Source: Peter Eakland and Associates, 1979.

Figure A-4


Employment Related Intrastate & Interstate Tripmaking
Onshore Employment Travel
Offshore Employment Travel
1A Monthly Avg. Onshore Onsite Employment by Task by Year
1B Monthly Avg. Offshore Onsite Employment by Task by Year
I Rotation Factors by Task
2A Total Monthly Avg. Onshore Employment by Task by Year
2B Total Monthly Avg. Offshore Employment by Task by Year
II SEAR Factors by Task
3A Total Monthly Avg. Non-Alaskan Onshore Employment by Task
4A Total Monthly Avg. Alaskan Onshore Employment by Task
4B Total Monthly Avg. Alaskan Offshore Employment by Task
3B Total Monthly Avg. Non-Alaskan Offshore Employment by Task
III Local Employment by Task
5A Total Monthly Avg. Non-Local Alaskan Onshore Employment by Task
5B Total Monthly Avg. Non-Local Alaskan Offshore Employment by Task
IV Round Trips / Month by Task
V Peak Weekly Factor
6A Peak Weekly Interstate Round Trips for Onshore Employees
7A Peak Weekly Intrastate Round Trips for Onshore Employees
7B Peak Weekly Intrastate Round Trips for Onshore Employees
6B Peak Weekly Interstate Round Trips for Onshore Employees
VI Intrastate Travel Trip Distribution Factors
VII Interstate Travel Trip Distribution Factors
8A Peak Weekly Outbound Trip Link Vol far Onshore Empl.
8B Peak Weekly Outbound Trip Link Volumes for Offshore Empl.
9 Peak Weekly Outbound Trip Link Volumes for Service Base
10 Peak Weekly Outbound Trip Link Volumes for Other Service Bases
11 Peak Weekly Outbound Trip Link Volumes for the Scenario
Source: Peter Eakland & Associates

The breakdown between onshore and offshore employment is provided in the scenarios, continued in the local studies, and is useful for continuity purposes to carry forward into the assessment of transportation impacts.

The process begins with monthly average onsite employment by task by year for each service base. These figures are derived as part of local studies using scenario information as basic input. Because tasks can have different values for each factor, it is important to maintain employment by task until step 6. Onsite employment is converted to total employment by multiplying it by the appropriate rotation factors. SEAR factors then are used to allocate employment into Alaskan and non-Alaskan categories. Subtracting local employment from the Alaskan employment for each task produces non-local Alaskan employment.

Once average monthly employment has been broken clown into non-Alaskan and non-local Alaskan figures, they are then converted into peak weekly intrastate and interstate trips. The combined factor used is as follows: (round-trips/month by task) (1.5) / (4.3 weeks/month).

The peak factor, 1.5, was determined by comparing average monthly employment with July employment for the same year. A week is used as the time unit for traffic demand to facilitate comparison with existing services which publish weekly schedules.

Distribution factors, which have already been described, are used to assign the trips to specific links. The final step is to combine offshore and onshore link volumes for offshore and onshore employment generated by the three service bases.

I.6.4 CATEGORY 5: CONSUMABLES

This category represents freight, primarily food stuffs, needed to sustain the work force that does not live and work in the same area. Workers in this situation are all offshore workers and non-local, onshore employees, who are primarily involved in construction. The employment figure used to compute consumable requirements is the sum of three products shown in Figure A-5, 2A, 3B, and 5B. It is multiplied by a suggested daily consumption of 4.-54 kg (10 lbs.) per person (ADH, 1976). Consumables most likely will travel by established marine services in containers.

I.6.5 CATEGORY 6: OIL AND GAS PRODUCTION

<u>Category 6: Oil and Gas Production</u>

Oil is currently being produced in Upper Cook Inlet and at Prudhoe Bay on the North Slope. In addition, a previous lease sale has been held in Cook Inlet and a lease sale is scheduled for the Beaufort Sea in 1979. Potential production from Cook Inlet is not considered since tankers do not use routes in Alaska that would be used by tankers transporting oil from Prince William Sound or the Northern Gulf of Alaska lease sale area. Offshore and onshore loadings are computed separately because of the difference in possible impacts. In the mean resource level scenario, both oil and gas production occurs in the Yakutat and Middleton Shelves. The Yakutat fields require an onshore oi" terminal as well as offshore loading. Only an oil terminal is required for the Middleton Shelf. In the high resource level scenario, oil is produced from all three shelves. All require some offshore loading, but only the Middleton and Yakutat Shelves have fields large enough to justify onshore terminals. LNG terminals are forecast to be economical in both the Yakutat and Middleton Shelves.

1.7 Threshold and Impact Methodology

Methods must be developed to assess the impact of the changes in the various categories of transportation demand caused directly and indirectly by OCS activities. For several categories, thresholds can be computed which give service capacity of a given link or terminal. In other cases, accepted standards can be used directly. Finally, in some cases, qualitative analyses will represent the only means of assessing impacts. In the following sections, the various impact methodologies are discussed by mode.

1.7.1 CATEGORIES 1 & 2: INDUCED TRANSPORTATION THRESHOLD

1.7.1.1 WaterM ode

1.7.1.1.1 Induced Marine Freight

For the water mode, high and low port capacities computed by Frederic R. Harris, Inc. (1978) for different commodity handling categories were used as a starting point. High capacities were based on an acceptable ratio of waiting time to berth time of 0.25. The ratio used for computing low capacities was 0.10. The capacity for each handling category--containerizable, neobulk, breakbulk, special, and liquid bulk--assumed that the dock space would be utilized only for that use. The actual capacity of a port depends upon the mix of time used to handle each of the categories. *For* this report, a three-step process was used to estimate total port capacities. First, the capacity figures were 'reviewed against existing conditions and supplementary information for reasonableness. This review produced modified tonnage figures at Whittier and Anchorage. The tonnage capacity at Whittier was adjusted upwards to reflect an actual tonnage per flatcar figure greater than was used by Frederic R. Harris, Inc. Their figure of 22.68 metric tons (25 tons) compares with an actual five-year average of 50.3 tons (55.4 tons). For Anchorage, the capacity of the pipeline from Nikiski was added to the dockside capacity for petroleum fuel. This adjustment is consistent with the use of a base year tonnage figure that occurred previous to the pipeline's Construction.

Second, a mix of handling categories was chosen. The trend towards containerization of cargo prompted the use of capacities for containerized freight, *except* where evidence exists that other categories will continue to be handled. An allocation of capacity on a tonnage basis was made at Seward where a significant amount of uncontainerized cargo exists.

Third, a second distribution of capacities was required at Seward and Cordova, where fuel or dry freight shipments must compete for space with each other or with other users, and where dry freight and liquid bulk vessels share the same dock space. Figures were chosen to provide a reasonable mix. Adjustments could be made if one of the capacities was reached before the other.

Table A-8 shows the resulting capacities for the ports and the base year throughput tonnages. The ratio of volume to capacity for primary commodities at each port is shown, as well as threshold growth factors, which are their reciprocal. The factors represent the amount of growth that can occur before capacity constraints will occur and produce decreased service. For example, the low capacity figure in Anchorage for containerized freight will be reached when throughput tonnage reaches 192% of the present value growth factor of 1.92. In other words, a growth of 92% is possible.

The threshold growth factors will be used as guidelines only. The impact

Table A-8

Development of Threshold Growth Factors for Northern Gulf of Alaska Port Facilities

Facility	Critical Handling Category (1)	Pct. of Capacity Available (2)	Base Value Throughput Tonnage (3) (Metric Tons (Tons))	High Capacity (4) (Metric Tons (Tons))	Low Capacity (4) (Metric Tons (Tons))	Base Year Volume/Capacity (5) High Capacity	Base Year Volume/Capacity (5) Low Capacity	Threshold Growth Factors (6) High Capacity	Threshold Growth Factors (6) Low Capacity
Port of Anchorage	Containerizable	100%	905,366 (986,000)	2,476,600 (2,730,000)	1,731, S00 (1.909,000)	0.37	0.52	2.70	1.92
	Liquid Bulk	100%	1,639,728 (1,807,500) (3)	5,802,756 (6,396,477)	3,670, S83 (4,046,477) (3)	0.28 (3)	0.45	3.54 (3)	2.24 (3)
Port of Seward	Containerizable (0.50)/ Breakbulk (0.50) (7)	80%	60,726 (66,939)	328,943 (362,600)	229,720 (253,224)	0.18	0.26	5.42	3.78
	Liquid Bulk	20%	19,760 (21,782)	91,625 (101,000)	64,410 (71,000)	0.22	0.31	4.64	3.26
Port of Whittier	Railroad Cars	100%	305,052 (336,264)	1,190,104 (1,311,872)	836,289 (921,856)	0.26	0.36	3.90	2.74
	Liquid Bulk (8)	100%	40,939 (45,128)	No capacities computed				No increase expected	
Port of Cordova	Containerizable (0.90)/ Special (0.10) (9)	67%	14,861 (16,382)	51,178 (56,414)	47,652 (52,528)	0.29	0.31	3.45	3.23
	Liquid Bulk	33%	17,022 (18,764)	75,740 (83,490)	36,523 (40,260)	0.22	0.47	4.55	2.15
Port of Yakutat	Containerizable	100%	1,340 (1,477)	24,834 (27.375)	11,907 (13,125)	0.05	0.11	20.00	9.09
	Liquid Bulk	100%	7,858 (8,662)	184,160 (203,000)	87,996 (97,000)	0.04	0.09	23.44	11.20
Port of Valdez	Containerizable (0.50)/ Neobulk (0.25)/ Special (0.25)	100%	15,602 (17,198)	645,510 (711,562)	309,820 (341,515)	0.02	0.05	41.40	19.90
	Liquid Bulk	100%	354,807 (391,110)	2,277,500 (2,510.500)	1,098,000 (1,210,000)	0.16	0.32	6.25	3.09

Notes: (See following page.)

Source: Peter Eakland and Associates, 1979; Frederic Harris, 1978.

Development of Threshold Growth Factors for Northern Gulf of Alaska Port Facilities (Cont.)

Notes:

(1) Critical handling category for dry freight is assumed to be containerizable except where other categories are expected to continue. In these cases, capacities are weighted.

(2) At several ports, liquid bulk and dry freight are handled at the same dock. In these cases, capacity must be allocated. Percentages have been chosen which provide similar threshold growth factors .

(3) 1977 was selected as the base year. In Anchorage, the effect of the Nikiski oil pipeline was considered. For Anchorage, the average of 1975 and 1976 liquid bulk tonnages was used as a base value, but in computing the threshold factors the capacity of the pipeline (36,000 bbls/day) was added to both the computed high and low capacities fordockfacilities.

(4) High and low capacities given are those computed by Frederic Harris . Weighted capacities are given for dry freight at ports of Seward, Cordova, and Valdez. As noted, the Anchorage liquid bulk Facilities include the capacity of the Nikiski pipeline, which is 1,693,231 metric tons (1,366,477 tons) .

(5) Volume/capacity figures are the base values divided by capacities given in the two previous columns.

(6) 'Threshold growth factors are the capacity figures divided by the base values, or the reciprocal ofthevolume/capacity figures.

(7) Seward is expected to remain an entry port for breakbulk cargoandthis handling category has been allocated 50% of capacity.

(8) Liquid bulk facilities primarily serve military needs . No capacity figures were computed, and no growth is anticipated.

of key assumptions used in their development will be considered in assessing impacts. Containerized freight, because it can be handled most efficiently, has the highest capacity of dry freight handling categories. Its *use* as the basis for a port's capacity provides an upper limit, since other handling categories to some extent will always exist. This problem has been addressed by assuming a mix of categories where a significant amount of non-containerized traffic occurs. Nevertheless, an unforeseen arrival of large amounts of breakbulk cargo at a port, particularly during a short period of time, such as occurred at Seward in the summer of 1975, would create congestion problems that the threshold value could not predict. Also, random arrival of vessels has been assumed. Where schedules exist and are adhered to by vessels, waiting can be reduced and capacity increased over what is shown. At present, this situation exists in Anchorage where both Sea-Land and TOTE operate on strict schedules to avoid shoaling areas at low tides.

1.7.1.1.2 OCS Oil and Gas Transportation

For tanker traffic thesholds for increasing numbers of berths have been established (Dooley and Associates, 1978). Table A-9 shows the number of tankers that can be accommodated annually by one to five berths. An average turnaround time of 1.5 days is assumed. The figures will be used to assess the onshore impacts of oil terminals for each resource level scenario.

Table A-9

Oil 'Tanker Movement Thresholds for Berths

Number of Berths	Berth Occupancy Factor	Oil Tankers/Year (1)
1	27%	66
2	51%	249
3	62%	453
4	70%	682
5	74%	900

Note: (1) Assumes 1.5 day turnaround. '

Source: Dennis Dooley and Associates, 1978.

The length of a 239,706 metric ton(140,000 DWT) *tanker, 2$38* m(944 ft.), will be used to assess berthing length requirements. Assumed depth requirements will be 18 m(59 ft.), which is 1.05 the draft of a 139,706 metric ton(140,000 DWT) tanker, estimated as the largest oil tanker that could be accommodated *in* Yakutat Bay(ECO, 1977). LNG ships are assumed *to be* approximately the same length but with a lesser maximum draft 11.6 m(38 ft.)(DCRA, 1978).

1.7.1 .1.3 Routes

Criteria do not exist regarding the level of vessel traffic that is required to justify the establishment of formal *traffic* lanes. Factors to be used in whether to setup such lanes include the following: numbers of vessels by size and cargo, navigational conditions, nature and location of obstructions, and potential interference with fishing operations. A recommended width for traffic lanes in the Gulf of Alaska, should they be established, is 4.0 km (2.5 mi.) (ERCO, 1978). This distance is recommended whether or not separation zones are provided. A common width would enable a two-way safety fairway to be up-graded to a traffic separation system at a later date.

Table A-10 compares navigational conditions in three areas of Alaska and three areas which have implemented safety fairways *or* separation schemes. In Puget Sound, the total width of lanes is 2.0 km (1.25 mi.) and in the Gulf of Mexico 3.2 km (2.0 mi.).

Table A-10

Comparison of Navigation Conditions for Sizing of Vessel Fairways

Basis for Comparison	Gulf of Mexico	Puget Sound	Strait of Juan de Fuca	Prince William Sound	Cook Inlet	Gulf of Alaska
Visibility (fog, rain, snow, etc.)[a]	1[f]	1	1	3	3	3
Current	1	1	2	2	3	2
Severity of Weather[b,c]	1/3	1	2	2/3	2/3	2/3
Ice	1	1	1	2	3	2
Aids to Navigation[d]	1	1	1	1	3	2
Radar Targets[e]	2	1	2	2	2/3	2/3
Totals	7/9	6	9	12/13	16/18	13/15

[a]The visibility in the Northern Gulf of Mexico is poor about 20 percent of the time on average.

[b]The weather in the GOM is generally good. However, during hurricanes, the wind and swells can be very great.

[c]During the winter and/or ice season, the weather conditions in Cook Inlet can become severe from a navigability point of view.

‘During the ice season floating aids to navigation are removed from Cook Inlet and other ice areas.

‘Radar targets in Cook Inlet are not good in the summer season but become worse during the snow and ice season.

[f]Key to rating system for navigation conditions:

1 - Good - minimum exposure to navigational hazard.
2 - Fair - average exposure to navigational hazard.
3 - Poor - maximum exposure to navigational hazard.

Source: ERCO, 1978.

The traffic separation which is one component of the Prince William Sound Vessel Traffic Service, extends from Hinchinbrook Entrance to Rocky Point in Valdez Arm. The total width ranges from approximately 1.5 km (1 mi.) at Hinchinbrook Entrance to 0.9 km (0.57 mi.) at the other end.

An analysis of Alaskan shipping has concluded that even under the most optimistic development scenarios collision losses or enroute delays would have little or no relationship to traffic levels. "The capacity, when compared to expected uses, is practically infinite" (ERCO, 1978).

1.7.1 .1.4 Supply Boats and Service Base Berths

Berth thresholds of 30 arrivals per month have been suggested for supply boats (Al aska Consultants, 1976; DCRA, ? 978]. The figure assumes an eight-hour turnaround and 30% occupancy. The turnaround time will vary depending upon the amount and type of materials being loaded. In this study, it is felt that conservative estimates for berths would be more realistic since periods of peak activity during a year are being used to estimate vessel movements. A turnaround time of six hours has been assumed. Berth occupancy has been assumed to be 30% for one and two berths and 50% for a greater number of berths. The resulting berth capacities per month are 40 and 60, respectively. Table A-n shows the range assumed for each number of berths. The likelihood of a supply boat finding an open berth increases with the number of berths for a

Table A- 11

Relationship Between Supply Boat
Round-trips and Berth Requirements

Round Trips/ Month	Required Berths (1)	Berth Occupancy
0 - 39	1	30%
40 - 79	2	30%
80 - 179	3	50%
180 - 239	4	50%
240 - 299	5	50%
300 - 359	6	50%
360 - 419	7	50%
420 - 479	8	50%

Notes: (1) Based on 6 hr. docking time and berth occupancies as given. Thus, 1 and 2 berths can each handle up to 40 round-trips/month, and each additional berth up to 60 round-trips/month.

Source: Peter Eakland and Associates, 1979, given berth occupancy. Ultimately, an operator must weigh additional construction costs against reducing waiting time of supply ships during exploration and development phases.

Each berth is assumed to be 64 km (21 0 ft.) long and must provide at least 5.5 m (18 ft.) of water alongside at MLLW (DCRA, 1978).

Standards based on offshore activities around the worl d have been established for the number of supply boats required for different activities (Dames & Moore, 1979). Expl oratory dri ll i ng rigs requi re two supply/ anchor boats, one of which is on standby status. Instal lation of a platform requires three such vessels and pipeline laying five. During production, a single boat per platform is required. Exact figures can depend upon distance of offshore facilities from supply bases, proximity of a platform to other platforms, the extent to which logisitcs requirements are shared between companies, the rate of development, and other factors.

I.7.1.2 Air Mode

Thresholds for the air mode are of three types--physical characteristics of runways and terminals, weather minimums, and available passenger and freight space offered by carriers over specified links..

1.7.1 .2.1 Air Passenger Thresholds

The capacity of air carriers serving a specific link depends upon the frequency of service and the size of aircraft they fly. Threshold values relate to the need for and extent of additional service. For routes serving Seward, Yakutat, and Cordova, estimates were made of available empty seats for one, two, and three round-trip flights per day based on summer 1977 load factors. Table A-12 shows the development of threshold values for links on the route serving Yakutat and Cordova. Table A-13 provides the thresholds for additional passengers on all links. Available seats were estimated to be 20% of weekly seating capacity on the Seward-Anchorage link, representing an increase of the load factor from 0.60 to 0.80. Thresholds were estimated for the existing schedule of three flights per day and for a fourth flight.

On the Anchorage-Seattle link, a variety of aircraft is used, and a high level of service is provided--18 flights per day in the 1978 summer season. Impact assessments were based on percentages of existing traffic rather than available empty seats.

Forecasting is independently performed for induced and direct OCS air transportation demands on each of the links, These figures, in the form of peak monthly weeky ridership, are then combined since it is assumed that all intrastate and interstate travel related to movements of OCS employees will be on scheduled carriers. The passenger totals are then compared to the threshold values for additional flights.

Table A-12

Available Seats on Existing and Additional Jet Service from Cordova and Yakutat

Link	August 1977 (1 Flight/Day)			2 Flights/Day		3 Flights/Day	
	Overall Load Factor (1)	Pass./Week (2)	Avail. Seats/Wk. (3)	Pass./Week (4)	Avail. Seats/Wk. (3)	Pass./Week (5)	Avail. Seats/Wk. (3)
CDV-ANCH	0.802	584	144	712	744	777	1,407
CDV-YAK	0.520	379	349	462	994	504	1,680
YAK-CDV	0.526	383	345	467	989	509	1,675
YAK-JNU	0.606	441	287	538	918	587	1,597
JNU-SEA	0.697	507	221	619	837	674	1,510

Notes: (1) Load factors obtained from Table 2-23.

(2) Pass/Week (1 flight/day)=7 days/week x 104 seats/fit. x overall load factor.

(3) Avail seats/week = (7 x 104) - Pass/Week.

(4) Pass/Week (2 flights/day) = Pass/Week (1 flight/day) x 1.22, where 22% is the stimulation factor used by Alaska Airlines in forecasting demand in competitive market.

(5) Pass/Week (3 flights/day) = Pass/Week (1 flight/day) x 1.33, where 33% is the assumed stimulation factor.

Source: Peter Eakland and Associates, 1979; CAB, 1978 (load factors).

Table A-13

Maximum Threshold Values for Incremental Increases in Weekly Carrier Services

Link	Type of Service	Seats per plane	Available Weekly Seats by Flights/Day 1	2	3	4
Cordova-Anchorage	Trunk	104	144	744	1,407	-
Cordova-Yakutat	Trunk	104	349	994	1,680	-
Yakutat-Cordova	Trunk	I 04	345	909	1,675	-
Yakutat-Juneau	Trunk	I 04	287	918	1,597	-
Juneau-Seattle	Trunk	104	619	037	1,510	-
Seward-Anchorage	Commuter	19			80	213
Anchorage-Seattle	Trunk	120		Not applicable(1)		

Note: (1) Additional flight thresholds not used. Rather, percentage increase in service compared to base level of 12,866 passengers/week.

Source: Peter Eakland and Associates.

No thresholds have been established for passenger terminal facilities. Qualitative assessments of impacts will be made based on the forecasts of passenger loadings and unloading.

1.7.1 .2.2 Airport Facilities

For runways, a length of 1,524 m (5,000 ft.) is adequate to serve both jets and Hercules C-130 freight aircraft. Weather minimums are based on local geography, navigational aids present at an airport, type of aircraft, and whether instrument approaches are possible.

The Federal Aviation Administration has established criteria for establishing and discontinuing facilities and services. For an airport to be considered for establishment of an airport traffic control tower, the sum of three ratios must be one or greater. The three ratios are computed as follows: (1) air carrier operations/15,000, (2) air taxi operations/25,000, and (3) general aviation and military operations (local plus itinerant)/200,000 (FAA, 1974).

1.7.1.3 Land Mode

For the Kenai Peninsula primary road network, the critical link at present is the section between Girdwood and the Sterling Highway Junction. Traffic on this route originates from both Anchorage and the Kenai Peninsula. Historical data does not provide a consistent correlation between population and traffic. For purposes of this study, traffic shall be assumed to be a direct function of changes in Anchorage area population. The present volume-to-capacity ration on the segment is 0.73, which provides an allowable growth factor of 1.37. Thus, when traffic reaches 1.37 times the 1977 figure, *or* 1,980 vehicles, level of service B will no longer be possible, and level of service C will be reached. This level still represents stable flow but produces more congestion than desirable. Higher levels of traffic will eventually result in level of service D, which approaches unstable flow.

Thresholds have not been established for the Alaska Railroad. Constraints on the traffic it can handle are assumed to exist at the marine mode. Even during peak periods of freight movement during construction of the Trans-Alaska pipeline, adequate capacity has existed. The Nikiski to Anchorage route is assumed to reach capacity in the near future, but no additional pipelines are assumed to be built.