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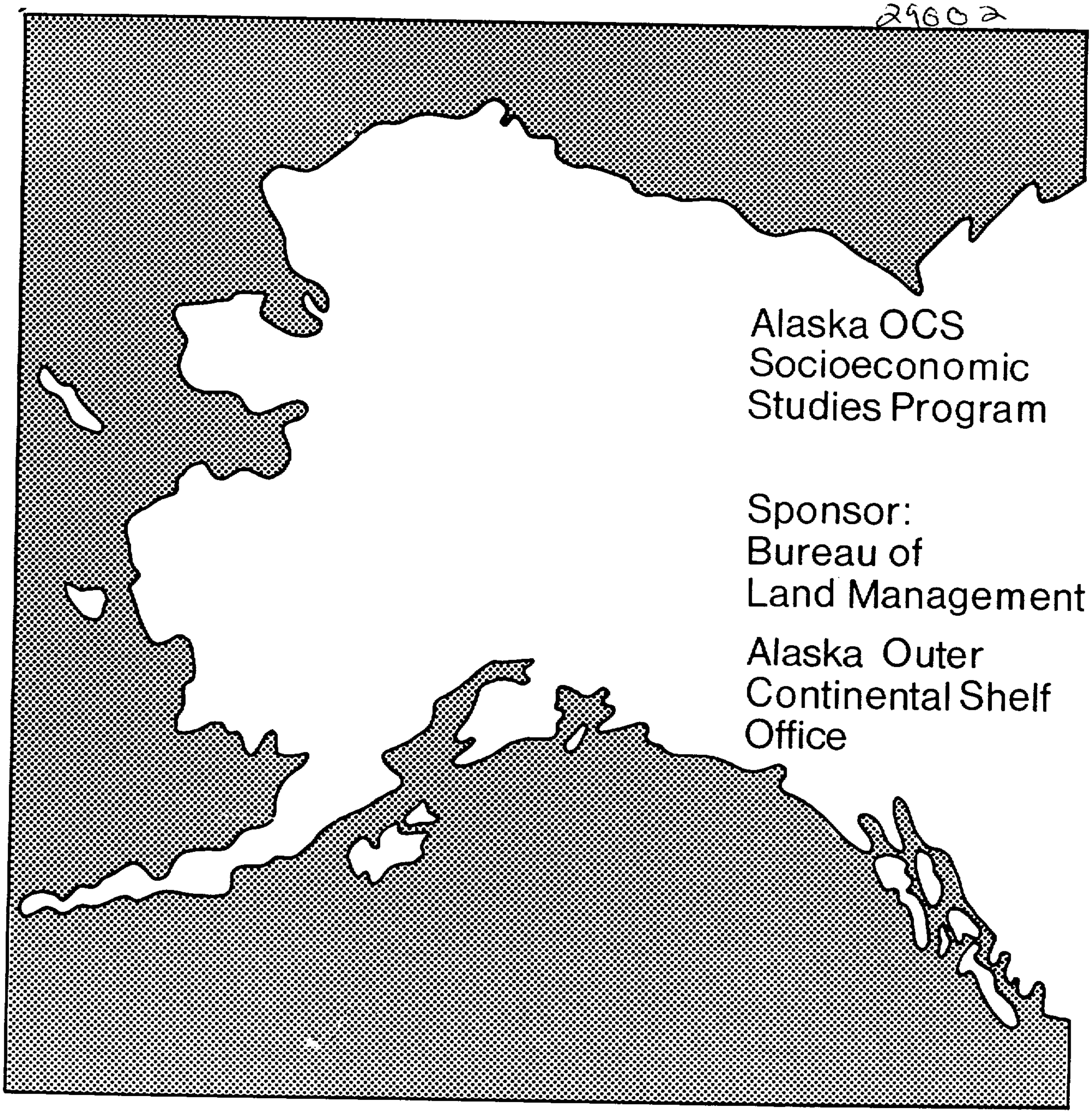

Alaska OCS
Socioeconomic
Studies Program

Sponsor:
Bureau of
Land Management
Alaska Outer
Continental Shelf
Office

Western 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.

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Alaska OCS Socioeconomic Studies Program

WESTERN GULF OF ALASKA
PETROLEUM DEVELOPMENT SCENARIOS
TRANSPORTATION SYSTEMS ANALYSIS

Prepared for

Bureau of Land Management

Alaska Outer Continental Shelf Office

Prepared by

Peter Eakland

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Peter Eakland and Associates

January 1980

Document is available to the public through the
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NOTICE

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

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

January 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. 46 which is proposed for Western Gulf of Alaska southeast of Kodiak Island. 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 includes the low, medium, and high scenarios of the Beaufort Sea and Northern Gulf of Alaska (No. 55) lease sales. 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

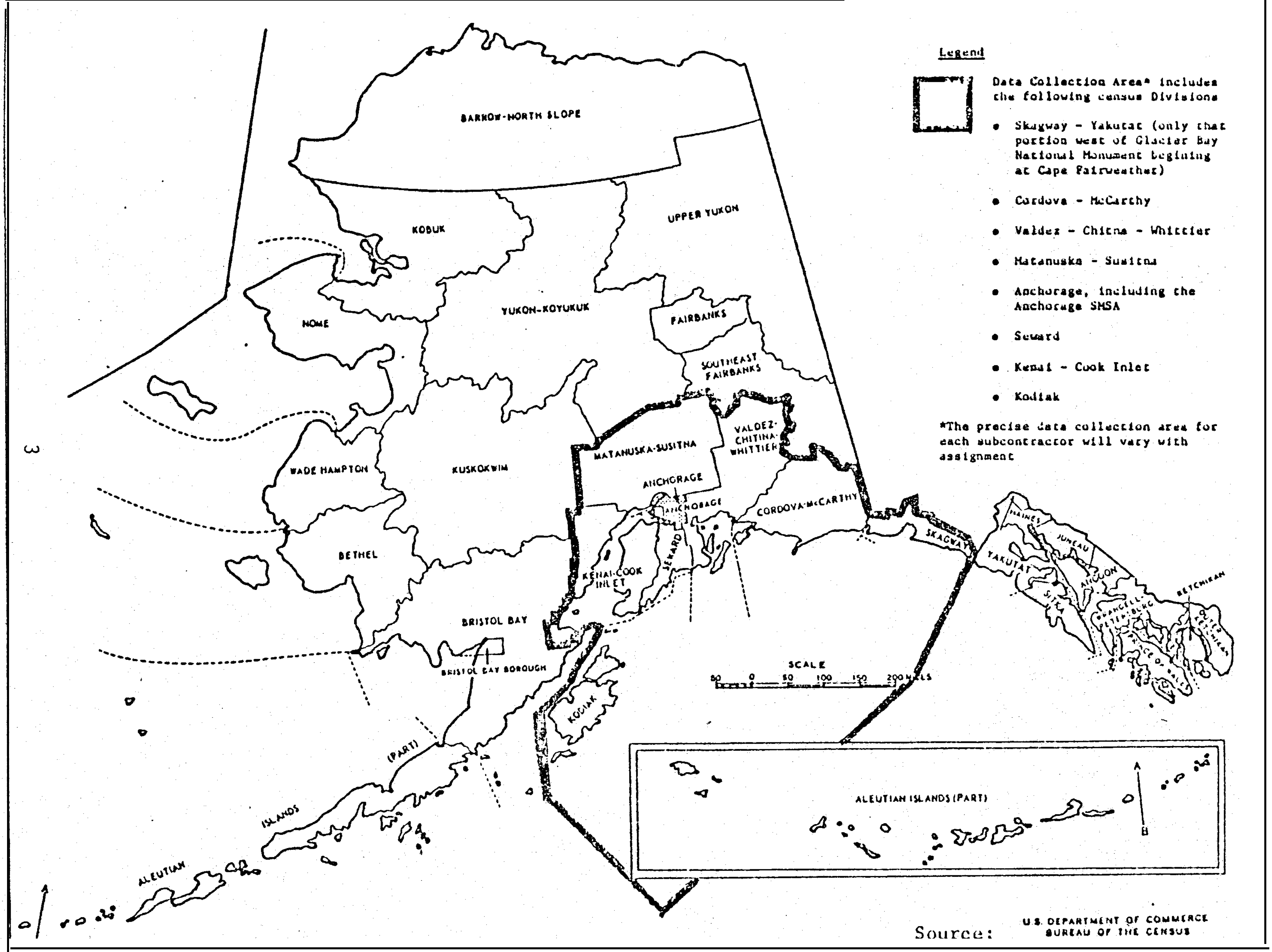
The study of transportation impacts resulting from OCS development activities includes analysis at the local, regional, and statewide levels. Consequently, the study area varies depending upon the topic under consideration. The oil and gas scenarios establish the location and size of oil and gas discoveries 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 two basins, the Middle Albatross Basin east of Kodiak Island and the Tigidak Basin which is east of the Trinity Islands. In the medium and high scenarios, the principal supply bases are expected to be located at Seward and Kodiak. The analysis of local and regional terminals and facilities is limited to Seward, Kodiak, 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

Figure 1-1.

Northern and Western Gulf of Alaska Lease Sales



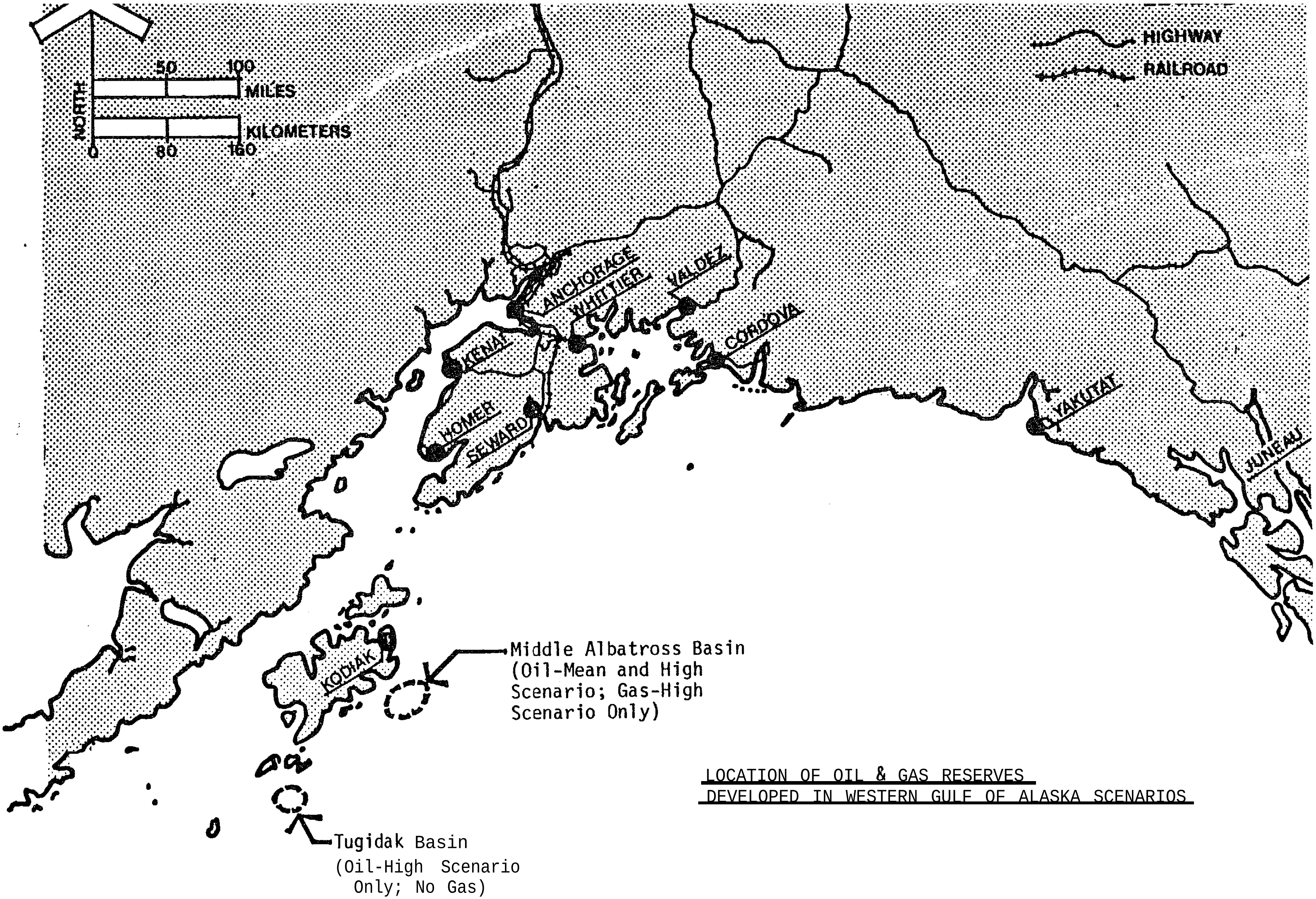
Legend

Data Collection Area* includes the following census Divisions

- Skagway - Yakutat (only that portion west of Glacier Bay National Monument begining at Cape Fairweather)
- Cordova - McCarthy
- Valdez - Chitna - Whittier
- Matanuska - Susitna
- Anchorage, including the Anchorage SMSA
- Seward
- Kenai - Cook Inlet
- Kodiak

*The precise data collection area for each subcontractor will vary with assignment

Source: U.S. DEPARTMENT OF COMMERCE BUREAU OF THE CENSUS



Middle Albatross Basin
(Oil-Mean and High
Scenario; Gas-High
Scenario Only)

Tugidak Basin
(Oil-High Scenario
Only; No Gas)

LOCATION OF OIL & GAS RESERVES
DEVELOPED IN WESTERN GULF OF ALASKA SCENARIOS

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.

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, except in the case of Kodiak where they relate to movement of OCS-related materials. 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 from 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 exist 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 movement of 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 containeror 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 vessles 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 use of 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 at one 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 accomodate 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 when 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 Western Gulf of Alaska and Lower Cook Inlet 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 limit for paved roads as appropriate to minimize damage to paved surface. 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 extentof damage that occurred. Unfortunately, the load limits come to 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 Western 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 studies 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

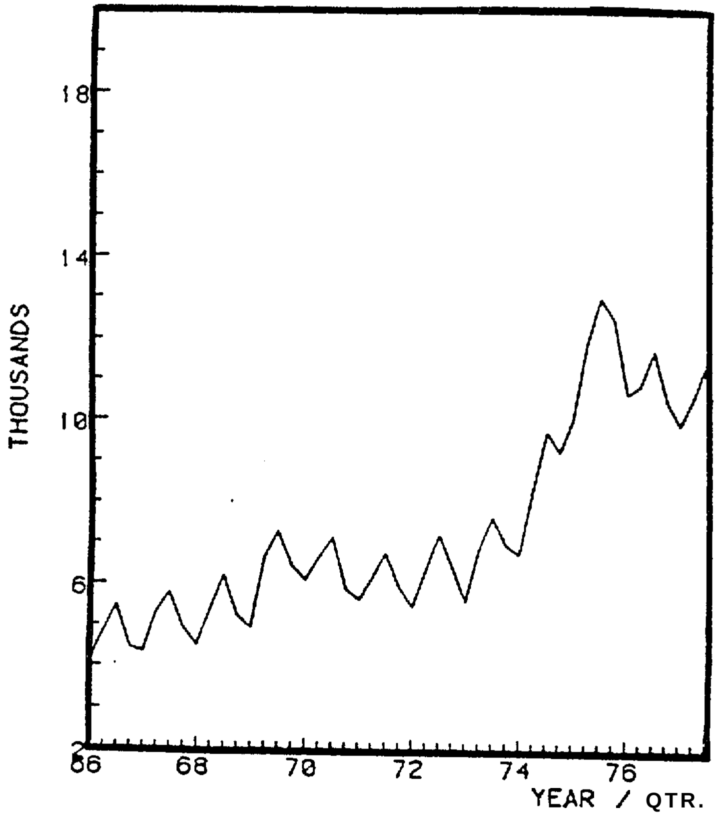
Demand for transportation services is not distributed evenly over time, particularly in Alaska. At the regional level, seasonal and annual differences are of interest. Hourly distribution of traffic is of interest only at the local level. Figure 1-3 shows the peaking of transportation employment on a 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 constants or the influence 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 Western 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,

Figure 1-3.

TRANSPORTATION EMPLOYMENT



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

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). Use of 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.

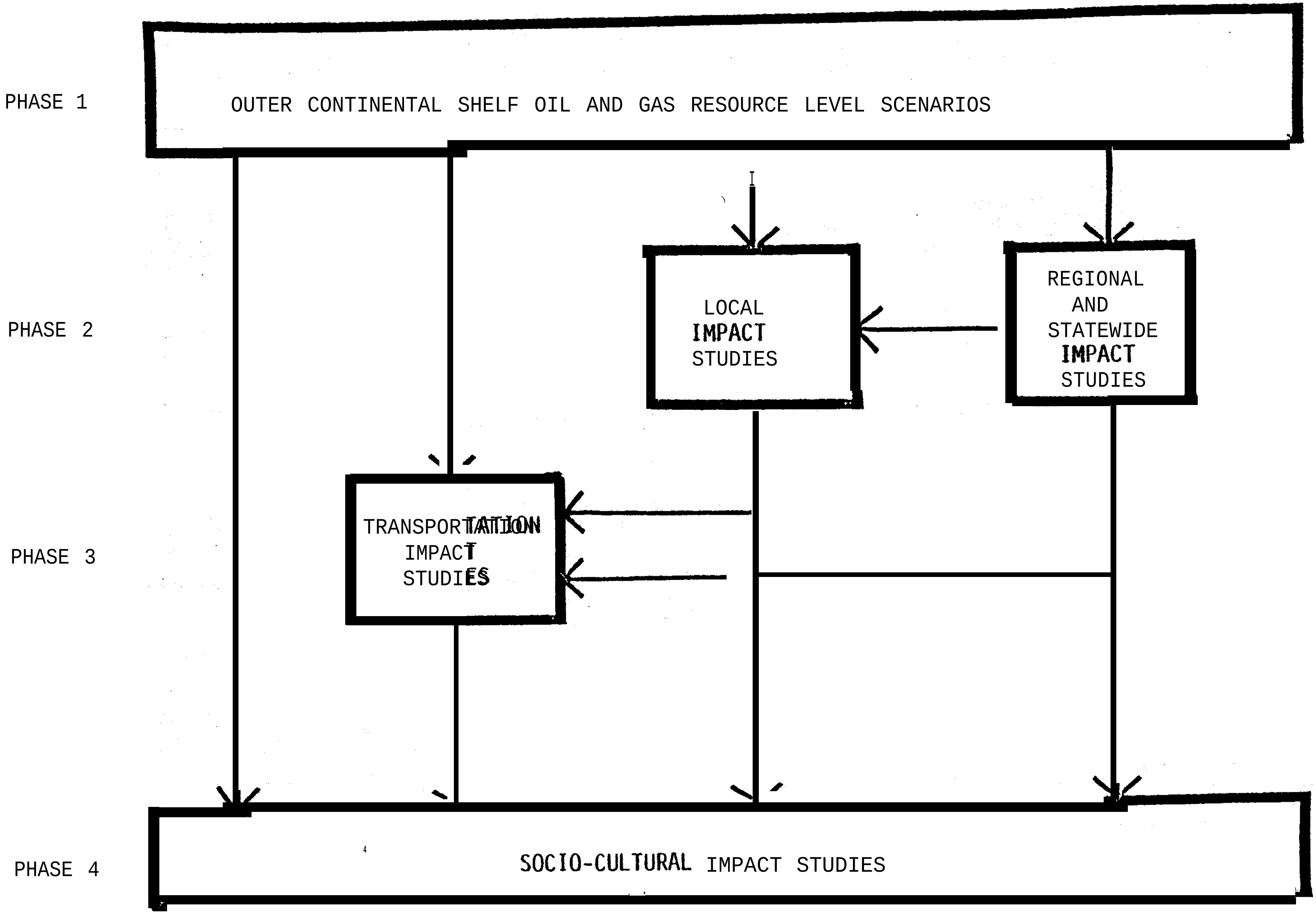
1.8 Relationship to Other Studies

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 level s-- 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 and the Northern Gulfof Alaska (No. 55) 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. The second phase is the development of impacts resulting from population and' employment forecasts at the local and regional levels. 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.

FIGURE 1-4

RELATIONSHIP OF TRANSPORTATION IMPACT STUDIES TO OTHER STUIDES IN SOCIOECONOMIC STUDIES PROGRAM

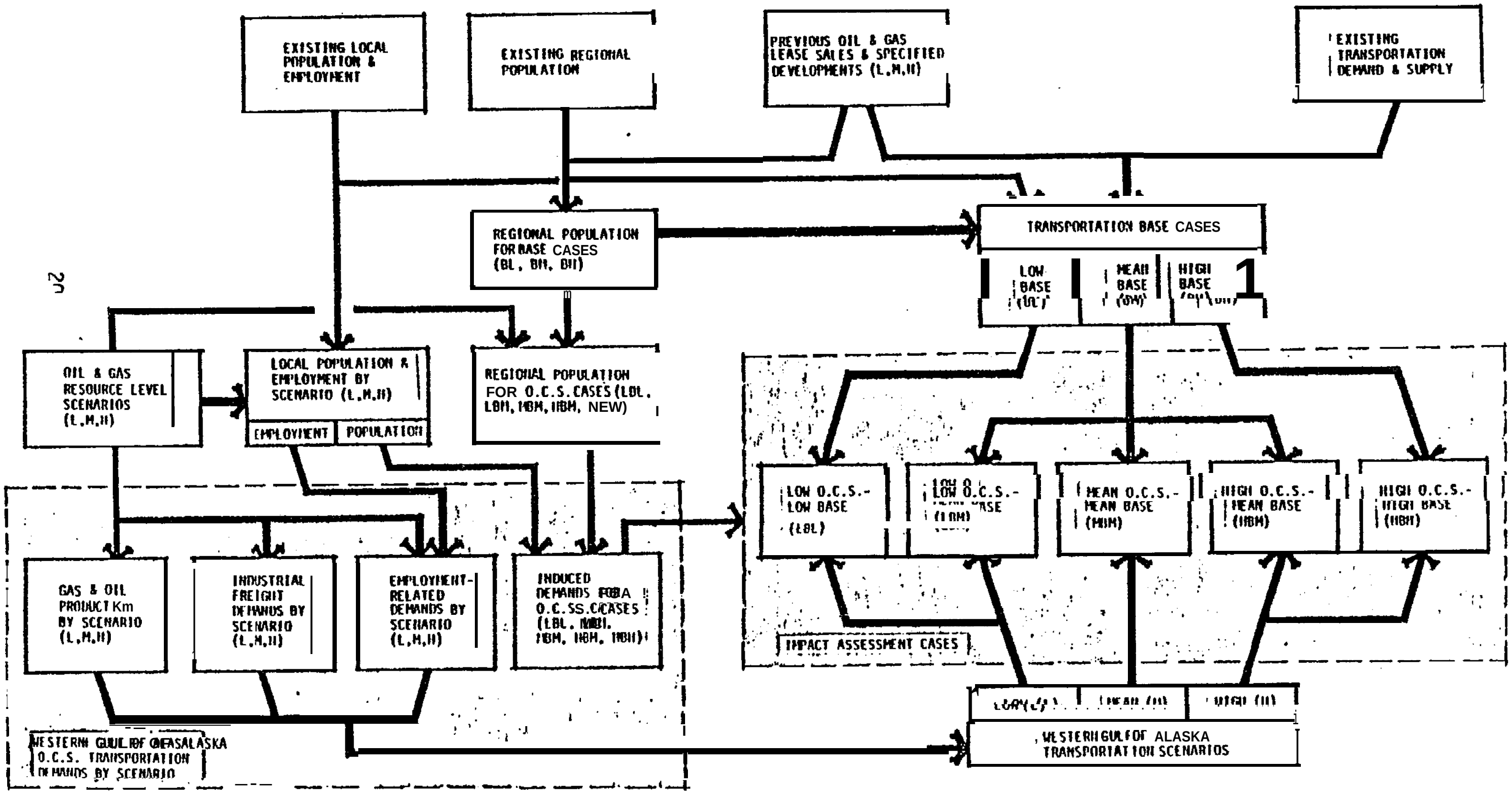


Source: Peter Eakland and Associates, 1979.

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 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 high (H) and the medium (M) resource level scenarios each involve development and production activities in the Albatross and Tugidak Fields. Three base cases have been developed for analysis. They are based, respectively, on the cumulative transportation demands existing in the low OCS casses of previous lease sales. Five OCS cases are developed. Three of them represent demands of the low, medium, and high oil and gas Lower Cook Inlet (Sale No. 60) scenarios 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 base cases, whereas induced

Figure 1-5

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



SOURCE : PETER EAKLAND & ASSOCIATES, 1979 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 CASE

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 Western 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 local and regional analyses are used to forecast the induced demands for eachof 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 areas of Kodiak, Seward, and Anchorage. The two former areas are the probable location of principal supply bases, and the latter is a collection point for transportation services to and from the Kenai Peninsula and to a lesser extent to and from Kodiak. 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, Kodiak, and 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 but 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 Alaskafs major port until World War 11 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 trans-shipment 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 and Kodiak fall 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). The Port of Kodiak prospers because of its central location for seafood processing and for distributing freight to Cordova and the Aleutian Islands.

Seward and Whittier represent ports that experience large fluctuations in traffic. Both ports 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 conditions. The Port of Seward served well the function of a safety-valve, but if rail shipment had been planned initially much of the freight would have been routed through Whittier.

Other communities in the study area, such as Homer or Kenai, 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 trans-shipment 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' Southcentral 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 Frederick 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) wharf, 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.

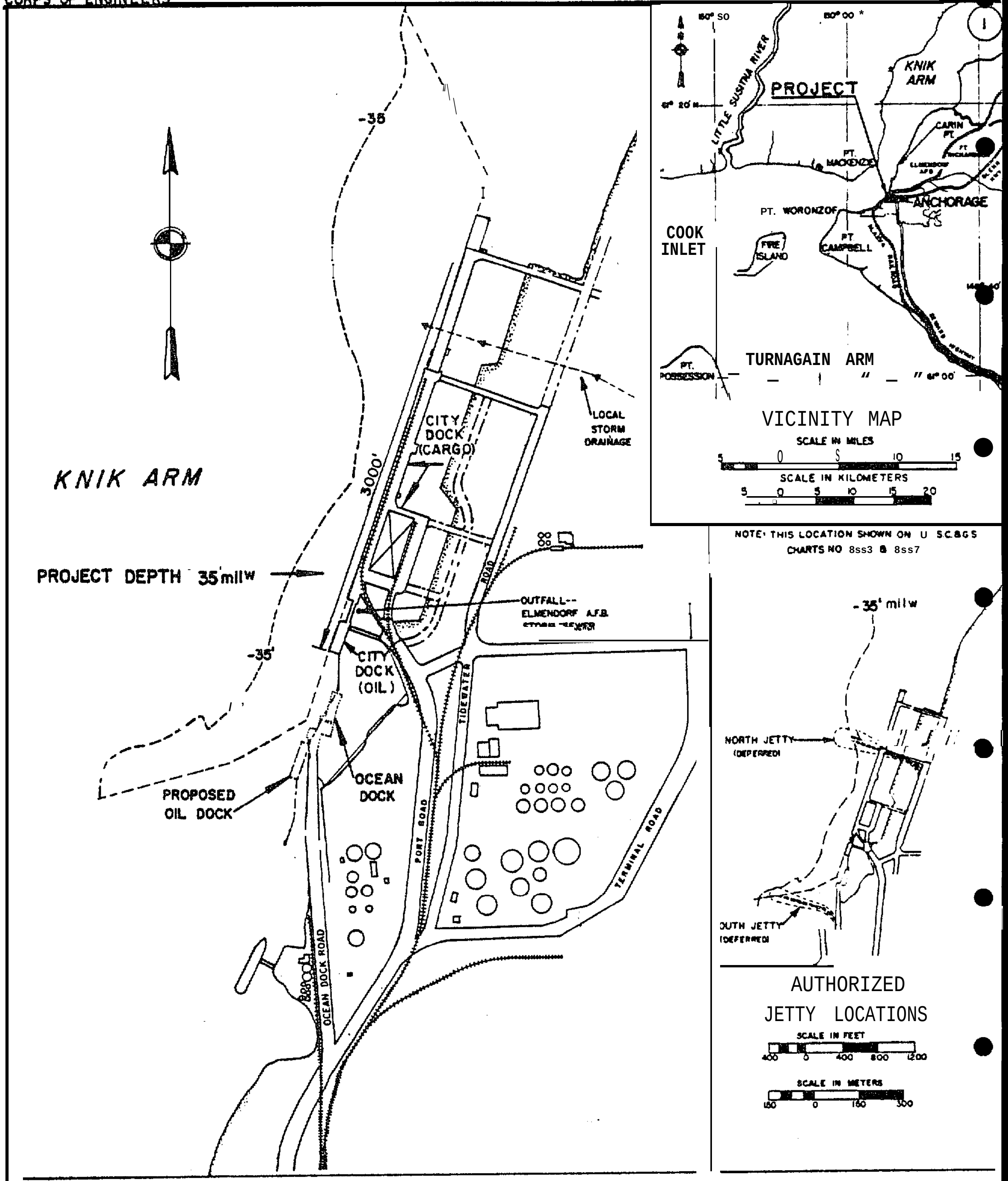
- Terminal No. 2: 186m (610 foot) wharf, 21 m (69 feet) wide., ame capabilities as Terminal No. 1.

- Terminal No. 3: 273.7 m (898 foot) wharf, including a recent 55 m (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.

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.

CORPS OF ENGINEERS U. S. AR



NOTES

NORTH & SOUTH JETTY CONSTRUCTION L? INDEFINITLY DEFERRED.
JETTIES HAVE SEEN OMITTED FROM MAIN PLAN FOR CLARITY,
SOUNDINGS AND ELEVATIONS ARE IN FEET AND REFER TO MEAN 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 1200

SCALE IN METERS
150 0 150 300

Figure 2-1

Table 2-1 shows the capacities of the Port of 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.

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 Portof 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 have a draft of 6.1 m (21 feet) or less.

The extreme tidal range of 12.7 m (40.7 feet) creates high mid-stream velocities and eddy currents along shore, but these conditions have little effect on deep-draft vessels. Shoaling occurs west of Point

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	Berth Occupancy High (2) V/C	Berth Occupancy Low (1.4) Capacity	Berth Occupancy Low V/C
Containerizable	897	101	998	1,530	37%	1,070	52%
RO/RO				1,200		839 (3)	
Breakbulk				-			
Neobulk				1,760		1,3:0	
Special	96	0.5	97	4,280	2%	3,360	3%
Dry Bulk				-		-	
Bulk Cement	111	1	112	1,490	8%	870	13%
Liquid Bulk	1,024	36	1,060	4,530	23%	2,180	49%
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 for containers.
(4) Each capacity for a handling category assumes only that category will be handled during the available berth period. Thus, the total port capac 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 (2,936,159)
1971	1,616,653 (1,782,064)	1976	2,660,276 (2,932,463

Source: Corps of Engineers, 1977.

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 3m (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 of792 vessels, of which 34%, or 271, had drafts greater than 6.1 (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 Port of Anchorage is the State's major port of entry for containerized freight. The large ships that carry containers 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 percentof 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.

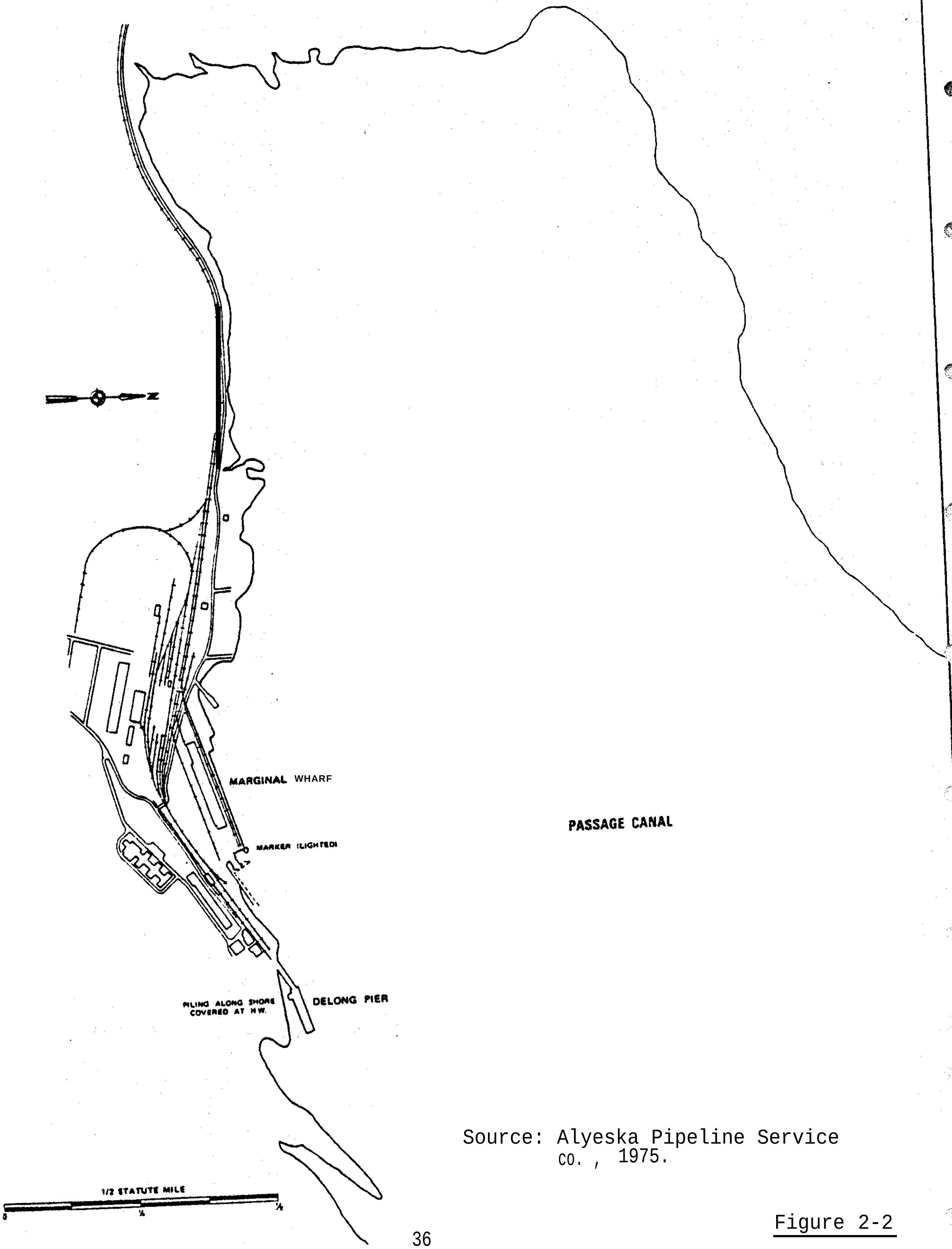
2.2.1.2 Port of Whittier

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 304.8m (1,000 feet) 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 feet) 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 capacities. 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).

<u>Water Depth and Navigational Characteristics</u>. The railcar-barge slips and the Marginal Wharf have depths alongside of 10.7 m (35 feet). North and south faces of the Delong Pier have depths respectively of 13 m (45 feet) and 9.1 m (30 feet). The port is ice-free but weather

Map of Whittier area showing dock and railroad yard.



Source: Alyeska Pipeline Service Co., 1975.

Figure 2-2

Table 2-3

Whittier Railcar Traffic

Year	Revenue Railcars	Revenue Tonnage	Tons 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 (100%)

(1)

High Capacity (2)			Low Capacity	
Carloads	Tons	v/c	Carloads	Tons
23,680	592,000	57%	16,640	416,000

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

Source: Frederic R. Harris, 1978.

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 shipments; but at Whittier they become a single handling category, which leads to capacity figures in terms of rail cars. Principal commodities carried are those that are more suited to boxcar or flatcar delivery than 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 in high demand during periods of economic expansion and 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 foot) by 61 m (200 foot) 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 183 m (600 feet), 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. A 2,230m^2 (24,000 square foot) heated warehouse is located on the dock and serves one spur and three truck loading areas. The

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.

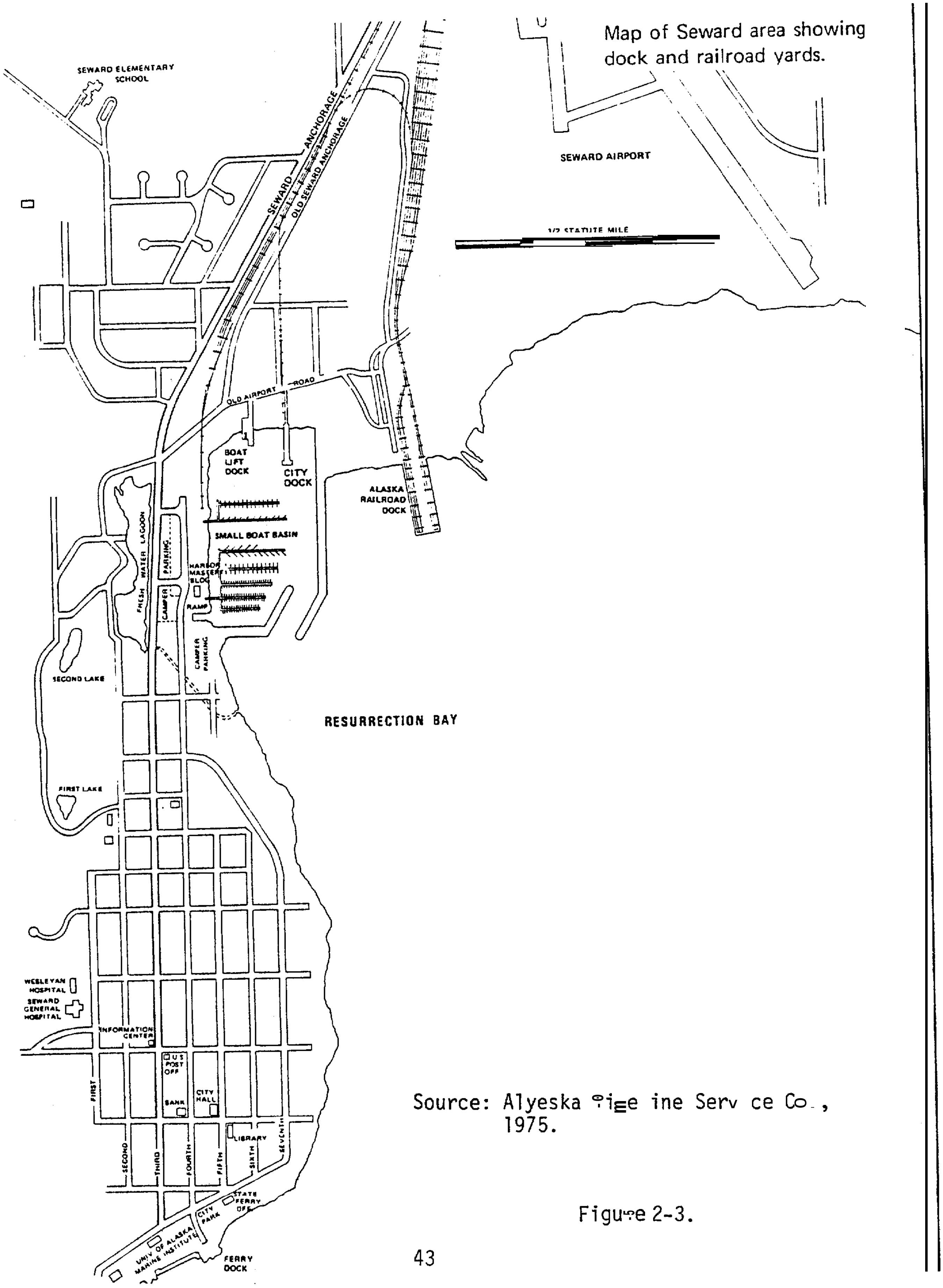
dock area is lighted. Adequate storage area is available on land. Despite its modern facilities, the dock does not have equipment to efficiently handle containers and cannot accommodate railcar barge or roll-on/roll-off traffic.

The dock serving the Marine Highway System is located at the south end of town and has a 58 m (190 foot) 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 feet) 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.

ALASKA RAILROAD DOCK AT SEWARD



Map of Seward area showing dock and railroad yards.

Source: Alyeska Pipeline Service Co., 1975.

Figure 2-3.

Table 2-6

Seward Port - 1977 Tonnage and Capacities
(Short Tons)

Freight 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)
ontainerizable	21,953	2,684	24,637	15,700	3%	499,500	5%
reakbulk				190,800		133,560	
eobulk				381,600		266,400	
pecial	14,255	28,047	42,302	795,000	5%	555,000	8%
ry Bulk				474,000		333,000	6%
iquid Bulk	21,782	-	21,782	505,000	4%	355,000	6%
eneral Cargo				30,000		14,400	
Total	56,990 (64%)	30,731 (36%)	88,721 (100%)				

---

otes: (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.

ource: 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 (1 1,809 tons), a figure which should increase if a bottom fishing 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.

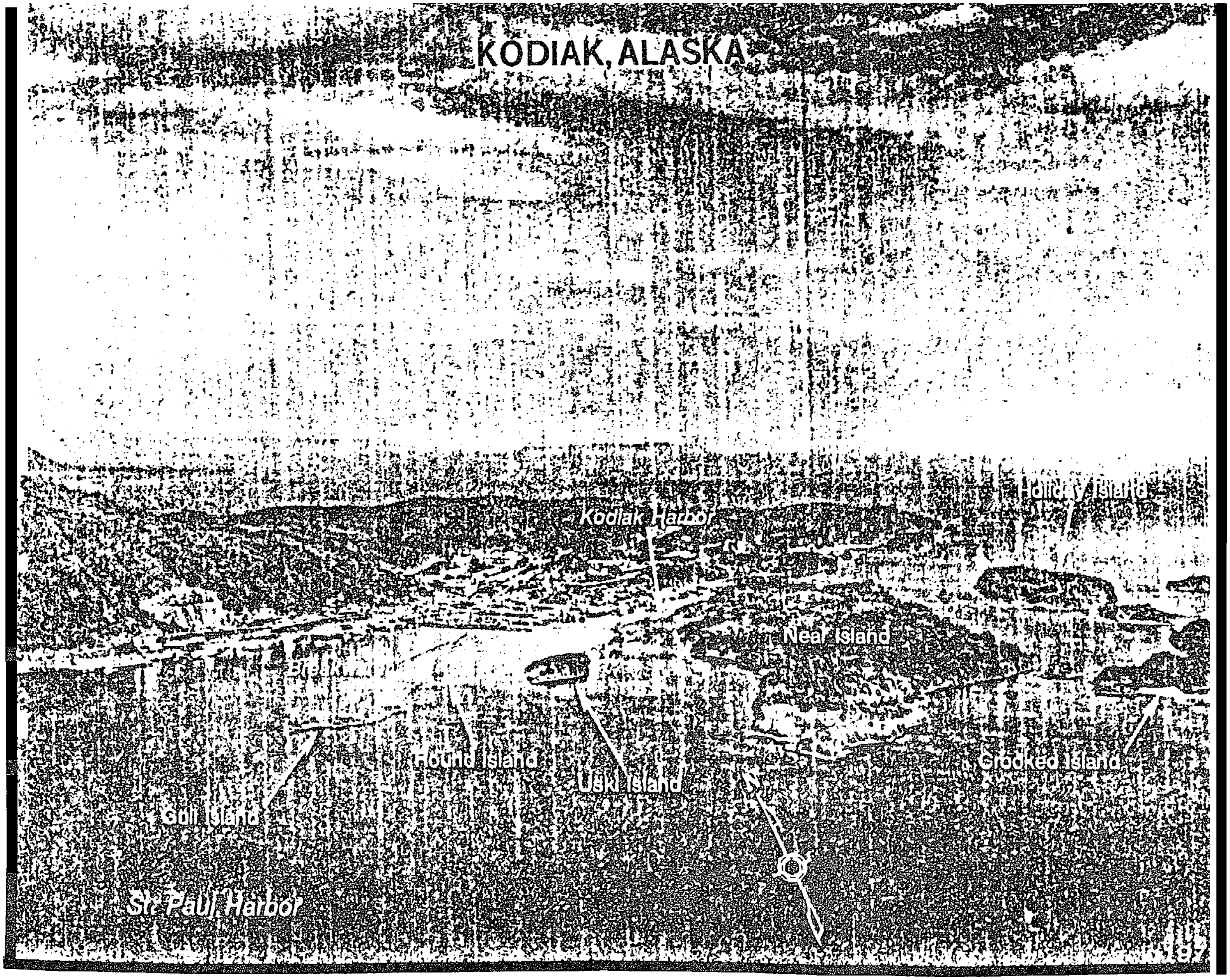
Although cargo traffic currently is low, Seward's advantages of an ice-free bay suitable for navigation by deep-draft ships, road and rail connections to the State's two largest cities, and its proximity to potential oil and gas fields and bottom fish harvesting areas could lead to greater traffic in 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 basedon four separate uses of the port: (1) fish processing; (2) oil refinery; (3) materials handling and (4) a smelter. Road and probable rail access would have to be constructed to the site.

2.2.1.4 Port of Kodiak

Facilities. Dock facilities at Kodiak are located in three general areas--on the east side of downtown Kodiak, southwest of town between downtown and the Coast Guard base, and in Women's Bay. Figure 2-4 shows the location of the first two areas.

- East side of downtown Kodiak: The downtown city dock has a 61 m (200 foot) face. It serves both Standard Oil and the state ferry system.

Figure 2-4



Source: U.S. Department of Commerce and National Oceanic and Atmospheric Administration. 1979. U.S. Coast Pilot. Page 150.

- Road to Coast Guard base: A marginal (parallel to the shore) wharf which serves general cargo shipments has a dock face of 76.2 m (250 feet). It is located 1 km (0.6 mile) southwest of the city and is city-owned. It has storage space for approximately 100 containers. The adjacent Union Oil terminal is a T-pier with face length of 42.7 m (140 feet). A container terminal" is located further southwest along Chiniak Road. It is owned by the City of Kodiak and Sea-Land is the principal user. The use of dolphins allows a usable terminal length of 201 m (660 feet), but the design provides berthing for only one deep-draft ship at a time. Dolphins are isolated, point structures than can be used to support vessels directly (bresting dolphins) or for tying mooring lines (mooring dolphins). The facility has available a 24.9 metric ton (27.5 ton) crane and storage area for 250, 10.7 m (35 foot) containers.

- Women's Bay: Coast Guard waterfront facilities at Women's Bay include three deep-draft wharves. The fuel pier is 152.4 m (500 feet) long, with 8.5 m (28 feet) alongside. The cargo wharf has a 198.1 m (650 foot) face and is used by the four Coast Guard cutters based in Kodiak--two buoy tenders, CGC Citrus and CGC Ironwood; the CGC Confidence, which is a medium-endurance cutter with ice-breaking capabilities. The CGC Ironwood was recently transferred to Kodiak from Adak. The third pier, called the Marginal Wharf, has a 426.7 m (1,400 foot) face but is in poor repair and is submerged at extreme high tides. This facility is used primarily for docking seized foreign fishing vessels. In addition to Coast Guard vessels permanently stationed at Kodiak, Women's Bay facilities are used on a seasonal basis by NOAA vessels and medium and high endurance cutters engaged in fishery patrols. A fourth pier is located across the Bay from Coast Guard facilities near Shannon Point. Formerly a military pier, the facility was excessed by the Coast Guard and has been claimed by Koniag, Inc.

In addition to the facilities described, the area contains eight cannery wharves.

Table 2-8 shows historical data for the Port of Kodiak. Table 2-9 contains the capacities by handling category for Kodiak's two major port facilities, assuming one available berth at each.

Water Depth and Navigational Characteristics. The downtown dock has an 8.2m (27 foot) depth alongside, the general cargo dock 7.9m (26 ft.), the Union Oil pier 9.8m (32 ft.), and the container terminal 12.2 m (40 ft.). Depths of facilities in Women's Bay range from 7.9m (26 ft.) to 10.1 m (33 feet).

Major freight facilities are protected by Woody Island and Near Island. Width of the channel between Near Island and Kodiak Island is 58m (190 feet). Of the 320 outbound vessels from Kodiak in 1976, 53% had drafts of 4-6m (13-20 feet). Six percent had drafts 8m (26 feet) or greater, (Corps of Engineers, 1977).

Table 2-8

Historical Data for the Port of Kodiak

Year	Metric Tons (Tons)	Passengers	Year	Metric Tons (Tons)	Passengers
1967	120,879 (133,247)	3,715	1972	175,052 (192,963)	9,717
1968	99,468 (109,645)	3,755	1973	214,650 (236,612)	10,875
1969	105,109 (115,863)	4,959	1974	196.880 (217,024)	11,846
1970	112,925 (124,479)	5,839	1975	299,042 (329,639)	12,350
1971	134,665 (148,444)	7,985	1976	352,099 (388,125)	10,352

Source: Corps of Engineers, 1977.

Table 2-9

Kodiak Port - 1977 Tonnage and Capacities
(Short Tons)

Handling Category	In-bound	out-bound	Through-put.	Berth Occupancy High (1,2) Capacity	High (3) v/c	Berth Occupancy LOW (1,2) Capacity	LOW (V/C
Containerizable	156,798	137,833	294,631	382,500	(77)	“184,500	(160”)
RO/RO				100,000	-	-	-
Neobulk	3,303	1,733	5,036	102,000	(5%)	49,200	(10%)
Special	5,252	3,088	8,340	212,500	(4%)	102,500	(8%)
Dry Bulk	17,266	10,480	27,746	-	-	-	-
Liquid Bulk	103,274	220	103,494	417,000	(25%)	200,000	(52%)
Total	285,893 (65%)	153,394 (35%)	439,287 (100%)				

Notes: (1) Based on 340 available days and two berths, one at each major wharf.
(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.

Source: Frederic Hart-is, 1978.

Tonnages by Handling Category and Commodity. Dry freight that is containerizable represented two-thirds of the throughput tonnage in 1977. The container traffic now exceeds the estimated low capacity and is 77% of the high capacity. No other handling category could accommodate existing traffic. The figures suggest either that the ratio of vessel waiting time to service time is increasing or that the assumption on which capacity calculations have been based are not totally valid. Beginning in 1968, when Kodiak's throughput tonnage was 109 thousand metric tons (120 thousand tons), steady growth, except for a slight decrease in 1974, has occurred at an annual average rate of 15.5% to reach the present level of 398 thousand metric tons (439 thousand tons). Should this rate continue for containerizable traffic, the existing facilities will soon reach capacity.

Three commodities dominate Kodiak tonnage. Prepared fish and shellfish account for 27% of the total, distillate fuel for 19%, and miscellaneous commodities for 17%. The large capacity for fish processing in the area serves the fishing fleet that operates out of the community and also fish shipped to Kodiak by air and water from areas that have inadequate capacities.

Tonnages by Origin and Destination. Kodiak traffic can be divided into three principal types--inbound tonnage for local usage, inbound tonnage to be distributed to the Aleutians and Cordova, and outbound fish and shellfish. Inbound traffic originates primarily in Washington state for dry goods and California for liquid bulk. An estimated 25%

of the containers received in Kodiak are transshipped to other ports (Frederic Harris, 1978). Alaskan Peninsula destinations accounted for 17,116 metric tons (18,867 tons), Cordova for 6,678 metric tons (7,361 tons), and Dillingham for another 2,952 metric tons (3,254 tons). Lumber is the leading commodity in this traffic, amounting to approximately 25% of tonnage. Remaining tonnage is divided among a variety of commodities. Approximately 85,275 metric tons (94,000 tons) of containerizable traffic--mostly canned fish and shellfish--had Seattle as a destination. The ratio of fresh to canned fish shipped to Seattle is 6 to 1. Outbound traffic to foreign ports amounted to an equivalent of less than 15 containers in 1977, but this situation will change dramatically in 1979 when Sea-Land initiates container service to carry frozen fish to Japan from Kodiak and Dutch Harbor/Unalaska. The service will have an annual outbound capacity of approximately 3,000 temperature-controlled containers. A large overall increase in outbound tonnage is expected.

Summary. Kodiak's dual role as a distributor of goods to the Aleutians and Cordova and as a collector of fish and shellfish for exporting to Seattle and Japan will not only continue but expand. Facilities are already approaching capacity and will need to be upgraded in the near future. Kodiak's future as a major port is assured, irrespective of developments that might occur in the area related to oil and gas development or bottomfishing. The water-related support activities available in Kodiak, including a Coast Guard base, and its central location for freight distribution westward are advantages no other ports in the area can offer. The city's major freight facility is located at the footof

Pillar Mountain, which has been cited as a potential slide zone (Alaska Consultants, 1979). A surficial slide here in the early 1970's destroyed the State highway, and there is concern that in the event of a major earthquake the port could be destroyed. The U.S. Geological Survey has examined the area and determined some degree of movement. Determination of the exact extent of the instability requires further study, which will be undertaken in 1980 using funds from the State of Alaska.

A likely location for construction of a new small boat harbor is Dog Bay, which is located on the west side of Near Island. Attempts are being made at the Congressional level to secure funds for design and construction. A bridge or ferry service would be required to move people from Kodiak to the facility.

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.

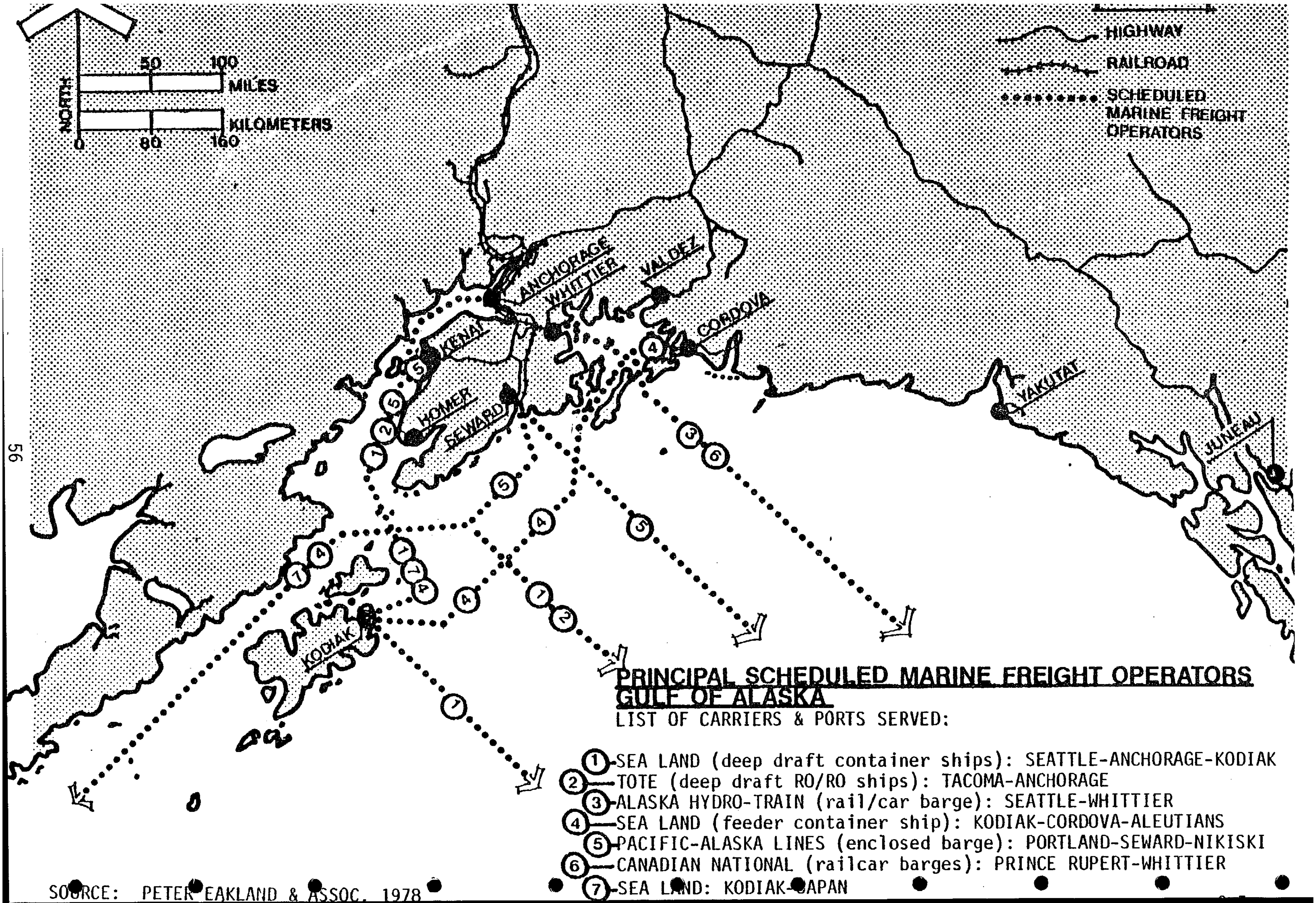
Individual carriers will be discussed in each of the three categories.

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 2-5.

Sea-Land. Sea-Land specializes in the shipment of 10.7 m (35 foot) containers initially over water 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 con-



PRINCIPAL SCHEDULED MARINE FREIGHT OPERATORS GULF OF ALASKA

LIST OF CARRIERS & PORTS SERVED:

① SEA LAND (deep draft container ships): SEATTLE-ANCHORAGE-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 (railcar barges): PRINCE RUPERT-WHITTIER
⑦ SEA LAND: KODIAK-JAPAN

SOURCE: PETER EAKLAND & ASSOC. 1978

tainers, 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 could hinder the development 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 capacity of 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 foot) 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 railcar barge service between Prince Rupert, B.C. and Whittier approximately once every 10 days. Tonnage for 1977 was 5,370 metric tons (5,919 tons), or only 2% of that carried by Crowley. The route primarily serves shipments originating in the Midwestern United States.

Pacific Alaska Lines (Crowley Maritime Corp.). Pacific Alaska Lines (PAL) began operating two barges in 1976 to meet specific markets at Seward and Nikiski. This is presently the only scheduled service into Seward. The 117.3 m (385 foot) by 29.9 m (85 foot) enclosed barges deliver freight in both 12.2 m (40 foot) and 6.1 m (20 foot) containers to Seward and then travel to Nikiski for up to 11,340 metric tons (12,500 tons) of bulk urea destined for Portland and Sacramento. A rack on top of the barge is used to carry mobile home units to Seward which cannot be shipped via TOTE or through Whittier because of tunnel clearance problems. PAL service is generally operated twice monthly during the summer and once monthly during the winter. Service to Seward was discontinued from March to July of 1979 because of lack of northbound cargo. The tariff is being rewritten in an attempt to attract more business.

PAL service offers 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 2-10 shows the characteristics of each vessel. Operationally, the major difference

Table 2-10

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.

between the two vessels is that the M.V. Bartlett permits ramp loading of vehicles at the bow and stern 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 exclusively in Prince William Sound. It provides twice-weekly service on the Valdez-Cordova route except for two months of winter lay-up time in October and November. The village of Ellamar is a flag stop for passengers only. Table 2-11 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 and 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

Table 2-11

Marine Highway System - Southwest System

Major Links	Direction	Link Volumes		Trips	Average Load Factors (1)	
		Passengers	Vehicles		Passengers	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	7.1	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.

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

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 levels on existing routes.

Table 2-12 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

Table 2-12

Southwest Ferry System Annual System Usage, 1971-77

Year	Passengers (Thousands)	% Change	Vehicles (Thousands)	% Change
1971	35		9.5	-
1972	38	9%	10.2	7%
1973	42	10%	11.5	13%
1974	45	7%	12.3	7%
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.

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 2-11 gives traffic data for the two vessels on major travel links.

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.

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 railcars 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 traffic to a given community. Among these characteristics are total tonnage, breakdown of tonnage by commodity and handling category, relationship between inbound and outbound cargo and amount of competition.

Table 2-13 shows Sea-Land tariffs for a variety of commodities from Seattle to Anchorage and major 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 2-13, several general statements can be made. Prices per 100 pounds

Table 2-13

Typical Freight Rates from Seattle

Transportation Cost per 100 Pounds in Dollars

	Appliances			Cement			Groceries		
Origin-Destination	Shipment Size	Tariff Type	Cost	Shipment Size	Tariff Type	Cost	Shipment Size	Tariff Type	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-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

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.

Table 2-13 (Continued)

Transportation Cost per 100 Pounds in Dollars

	Refrigerated Meat			Iron/Steel Products			Construction Machinery		
Origin-Destination	Shipment Size	Tariff Type	Cost	Shipment Size	Tariff Type	Cost	Shipment Size	Tariff Type	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-Seward	LTL	CO	17.1.2	LTL	CL	18.04	LTL	CL	18.04
				32,000# (TL)	CO	4.94	30,000# (TL)	CO	8.68

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.

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 (90,0001 b.) lots.

A comparison of the rates from Seattle to Anchorage, Kodiak, and Seward illustrate the effects of such factors as competition, the level of demand, and the relationship of marine and highway routes. Shipments from Seattle to Anchorage and Kodiak on Sea-Land travel on the same ships. One would expect comparable tariffs to be of the same magnitude because of similar handling costs but perhaps slightly less to Kodiak because of the shorter distance from Seattle. Of the six categories of goods for which tariffs are shown in Table 2-13, LTL rates are lower to Kodiak for four--appliances, cement, refrigerated meat, and construction machinery--but higher for the other two--groceries and iron/steel prodCuts. Kodiak's shorter distance from Seattle, although the' community is served as a backhaul stop by Sea-Land, and the competition of tug and barge operators also serving the area account for the instances of lower tariffs. For the exceptions, likely reasons are that stronger competition exists in the Anchorage market than the Kodiak market and that higher levels of demand at Anchorage produce an economy of scale.

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

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.

2.2.4 REGULATIONS

For marine freight operatiens, 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-built 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 legislation affects the size of tankers now serving the Alaska trade. If shipments could be made to Japan, larger, foreign-bottom ships could be used.

Federal agencies regulating interstate commerce are pushing ahead with deregulation of freight rates in all modes. These actions will cause rates to reflect the distribution of costs rather than what the "traffic will bear" (Frederic Harris, 1978).

2.3 Air Mode

The air mode has played an increasingly greater role in the transportation of freight and passengers since World War II. The need to ferry aircraft to Russia byway of Alaska and provide defense for Alaska enhanced the development of airports in the western Gulf of Alaska area as well as other parts of Alaska. Kodiak owes the existence of excellent ground facilities to World War II construction. Long distances between Alaska and lower 48 cities and between cities in Alaska and the infrequency of marine freight service have made air transportation a necessity to the economic welfare of Alaska and its citizens.

Anchorage serves as the State's major hub for air transportation. Commuter and air taxi operations emanate from airports in the Anchorage area, and major scheduled airlines have direct service from Anchorage International Airport to major cities in Alaska as well as Honolulu, the Midwest, and the Pacific Northwest In recent years, the airport has become a major international airport, serving polar routes between the Far East and Europe. Kodiak serves as a regional hub. 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, geogrpahical 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 at Kodiak and Anchorage are international-type airports. Each has runways over 2,134 m (7,000 feet) long. Seward does not serve as an intermediate point on intrastate routes or as a distribution point and has a general aviation service level.

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 operations which in turn affect the capacity. Table 2-14 gives the percentages of scheduled departures

Table 2-14

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
Kodiak	41,218	506	251	773	84.60%	Kodiak-Western Alaska, Wien, Western
Kodiak (Municipal)	11,192	327	157	1,851	63.26%	Kodiak-Western Alaska

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Notes: (1) Enplaned passengers are defined as boarding or departing passengers.
(2) Includes domestic and international traffic.

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

completed at western Gulf of Alaska airports serving carriers certificated by the Civil Aeronautics Board. Of the major airports, Kodiak has the lowest percentage. 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 2-15 and 2-16 list principal runway and navigation facilities.

2.3.1.1 Anchorage International Airport.

This facility handled 236,0000perations (landings and take-offs) in 1976 which is 77% of the capacity estimated in the 1971 Master Plan (Quinton-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.

Table 2-15

Western Gulf of Alaska Principal Airports - Runways and Ground Facilities

community	Location	Owner	Runway Heading	Length Meters (ft)	width Meters (ft)	Surface Type	Heliport	Terminal Building	Hangars	Fuel	Maintenance
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	Yes	Yes	Yes	Yes
Cordova	17.7 km (11 mi) ESE of town	State of Alaska	9-27	2,286 (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 (100)	Asphalt-treated	No	Yes	Yes	Yes	Yes
	2.7 km (1.7 mi) NE of town	State of Alaska	12-30	1,390 (4,560)	30 (100)	Asphalt-treated	No	No	Yes	Yes	Yes
			15-33	701 (2,300)	23 (75)	Asphalt-treated	No	No	Yes	Yes	No
Kodiak	8.05 km (5 mi) SW of town	State of Alaska	7-25 10-28 18-36	2,298 (7,539) 1.640 (5,379) 1,525 (5,002)	46 (150) 46 (150) 46 (150)	Asphalt Asphalt Asphalt	No	Yes	Yes	Yes	Yes
Kodiak (Municipal)	2.7 km (1.7 mi) S of town	city of Kodiak	Unavailable	879 (2,883)	(100)	Gravel	No	No	Yes	Yes	Yes

Sources: FAA, 1977: DOTPF, 1978.

Table 2-16

Western 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	Navig./Landing Aids[4]			
									Runway Heading	Lighting	Radio	Ot
Seward	GA	GU	5,000[5]	21	1	1 FW	No	Yes		Runway Lights, Rotating Beacon	SFO	
Kodiak	AC	AC	17,000	4	3	4 FW	Yes	Yes	25	REIL, VASI	LOC, DME, PAR/ASR, VORTAC, NDB	ATCT, RCO
Kodiak (Municipal)	GA	SP/GU	6,000	Unavailable	1		No	No		[Unavailable		

Notes: See following page.

Table 2-16(Cont.)

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 slopeindicator.

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 ('l'ACl?).

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

(5) Estimates for 1'976 were unavailable. Estimates from the 1975 FAA Ten-Year Plan are provided.

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

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 Wien 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 2-17 and 2-18. Incremental improvements in lighting and approach aids have been programed; but the current level of usage, approximately 5,000 operations per year, does not make such improvements critical at this time.

2.3.1.3 Kodiak

Kodiak has a major airport and a general aviation airport closer to town which has an adjacent seaplane base. In addition, a seaplant base is located near the downtown harbor. The airport which serves major carriers was originally part of the Naval Air Station, which has been taken over

Table 2-17

Operating Statistics of intrastate Scheduled Carriers

Route (1)	Carrier	Month, Year	Actual Flights	Seats per Flight (2)	Total Seats	Passengers	Load Factor
Anchorage-Seward	**M I**	January, 1978	31(3)	1.9	589	353(4)	0.60(5)
		July, 1978	*8(3)	19	1,672	1,003(4)	0.60(5)
Anchorage -Homer	AAI	January, 1978	181(3)	19	3,439	2,063(4)	0.60(5)
		July, 1978	212(3)	19	4,028	2,417(4)	0.60(5)

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

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

DHC-6 = 19 passengers(AAI).

(3) ForAAI, scheduled flights were used since actual data was not made available.

(4) An assumed load factor of 0.60 was used in the absence of actual data for AAI.

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

Source: Airline Schedule, 1978.

Table 2-18 .

Passenger Service Provided by Scheduled Carriers

Scheduled Carrier	Route	Minimum Required Service (1)	Summer 1978 Service	Winter 1978-79 Service
AAI	Anchorage-Kenai	3 fits./day (exe. Sunday)	26 fits./day min. (exe. Sunday)	21 fits./day min. (exe . Sunday)
	Kenai-Homer	6 fits./week	3 fits./day min.	5 flts./day min.
	Anchorage-Seward	3 fits./week	3 fits./day (exe. Sunday)	1 flt./day
Wien	Anchorage-Kodiak	(Unspecified)	2 fits./day min.	2 flts./day
	Anchorage-Seattle		1 non-stop flt./day (1979), no 1978 service	1 non-stop flt/day (1979-80), no 1978-79 service
	Kodiak-Seattle		2 fits./week(1979), no 1978 service	1 flt./week(1979-80). no 1979-80 service
Western	Kodiak-Seattle	--	3-4 fits./week	No service Oct. - April
	Anchorage-Seattle	--	9 fits./day	5 flts./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 (eXc. 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.

by the U. S. Coast Guard. The airport is now operated by the State of Alaska.

Estimated operations for 1977 were 24,083, broken down into military (1 1,780), general aviation (10,453), and air carrier (1 ,850) (McGuire, 1978). Major repairs to the airport's runways during the summers of 1977 and 1978 severely limited operations of large aircraft, particularly Western's Kodiak-Seattle service. The Coast Guard operates helicopters and Hercules C-130 cargo planes in its fisheries patrol and search and rescue missions. Increases are expected in Coast Guard operations and in general aviation, which has exhibited strong growth in the area. It is possible that land use conflicts will close Kodiak Municipal Airport resulting in substantially increased general aviation operations at the main airport.

Three scheduled carriers serve the area. Kodiak-western Alaska, as its name indicates, connects Kodiak with small villages on Kodiak Island and also serves Western Alaska from Dillingham. The airline selected the Kodiak-Seattle route under the Civil Aeronautics Board's free entry program but has been unable to initiate service because it cannot obtain a fuel allocation. Until recently, other services were limited to Wien's Kodiak-Homer-Anchorage route on an all-year round basis and Western's flights between Kodiak and Seattle between April and October. In April 979, Wien began Anchorage-Kodiak-Seattle passenger service twice a week. The service will be offered all-year round and possibly will be increased to four trips a week during the summer.

The State of Alaska recently completed a general land use and development plan for the airport which recognizes the need to plan for the growth expected in the Kodiak area.

2.3.2 CARRIERS

The Alaska Transportation Commission (ATC) regulates all common air carriers operating wholly within the State of 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 s between fixed-wing and rotary-wing (helicopter) operations. Table 2-19 shows the breakdown of air taxi operators within the study area. Names of carriers have been provided for Kodiak and Seward. In some cases, the same operator has rights in an area for both fixed-wing and rotary-wing operations. Operators must

Table 2-19

Study Area Air Taxi Operators

Number of Operators

Base of Operations	Fixed Wing		Rotary Wing		Selected List of Operators
	Less than 5,670 kg (12,500 lbs)	Greater than 5,670 kg (12,500 lbs)	Less than 5,670 kg (12,500 lbs)	Greater than 5,670 kg (12,500 lbs)	
Anchorage	40	4	1	6	
Seward	1	0	0	0	Harbor Air Service
Kodiak	4	0	0	0	Viking Air Service, Island Flying Service, Kodiak Air Taxi, Flirite
Soldotna	3	0	0	0	
Kenai/Nikiski	5	0	0	1	ERA Helicopters
homer	3	0	1	0	
Seldovia	1	0	0	0	

Source: Alaska Transportation Commission, 1978, provide “safe, adequate, efficient, and continuous service from and maintain bases of operation at listed locations (in their 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, particularly moving oil rigs from one location to another, but this work is declining. Sumner 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.

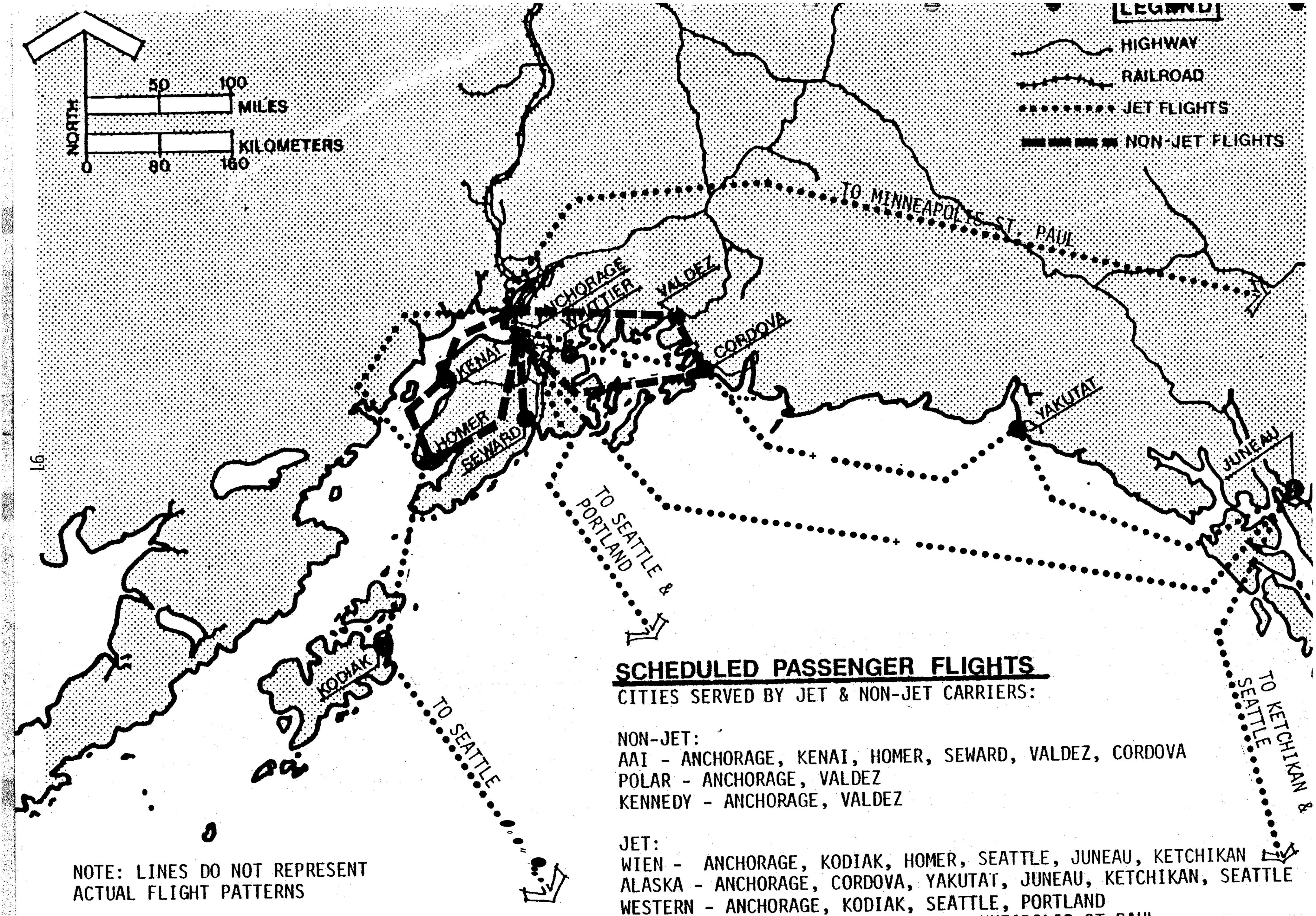
2.3.2.3 Scheduled Carriers

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 2-6 shows routes for carriers that operate jet and prop service.

<u>2.3.2.3.1 Trunk Airlines.</u> Federal deregulation of interstate passenger and freight operations, which will be phased in over the next five years, has already had impacts in Alaska and more are expected within the next year. Wien now operates freight routes 'to Seattle from Kodiak and from Anchorage via Juneau and Ketchikan. Also, Wien was able to establish one new passenger route which was not protected by an existing carrier and chose Kodiak-Seattle. The service was initiated in early March 1979. One expected result of deregulation is that Alaska travelers will be offered 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 not been issued by the CAB. They include Southeastern, West Coast, and Denver service. One or more of the carriers serving Alaska are involved in these investigations.

- <u>Alaska Airlines.</u> 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



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
NORTHWEST - ANCHORAGE, SEATTLE, MINNEAPOLIS-ST.PAUL

NOTE: LINES DO NOT REPRESENT ACTUAL FLIGHT PATTERNS

SOURCE: PETER EAKLAND & ASSOC. 1978

FIGURE 2-6

Alaska's major communities and our 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 stated its position as follows:

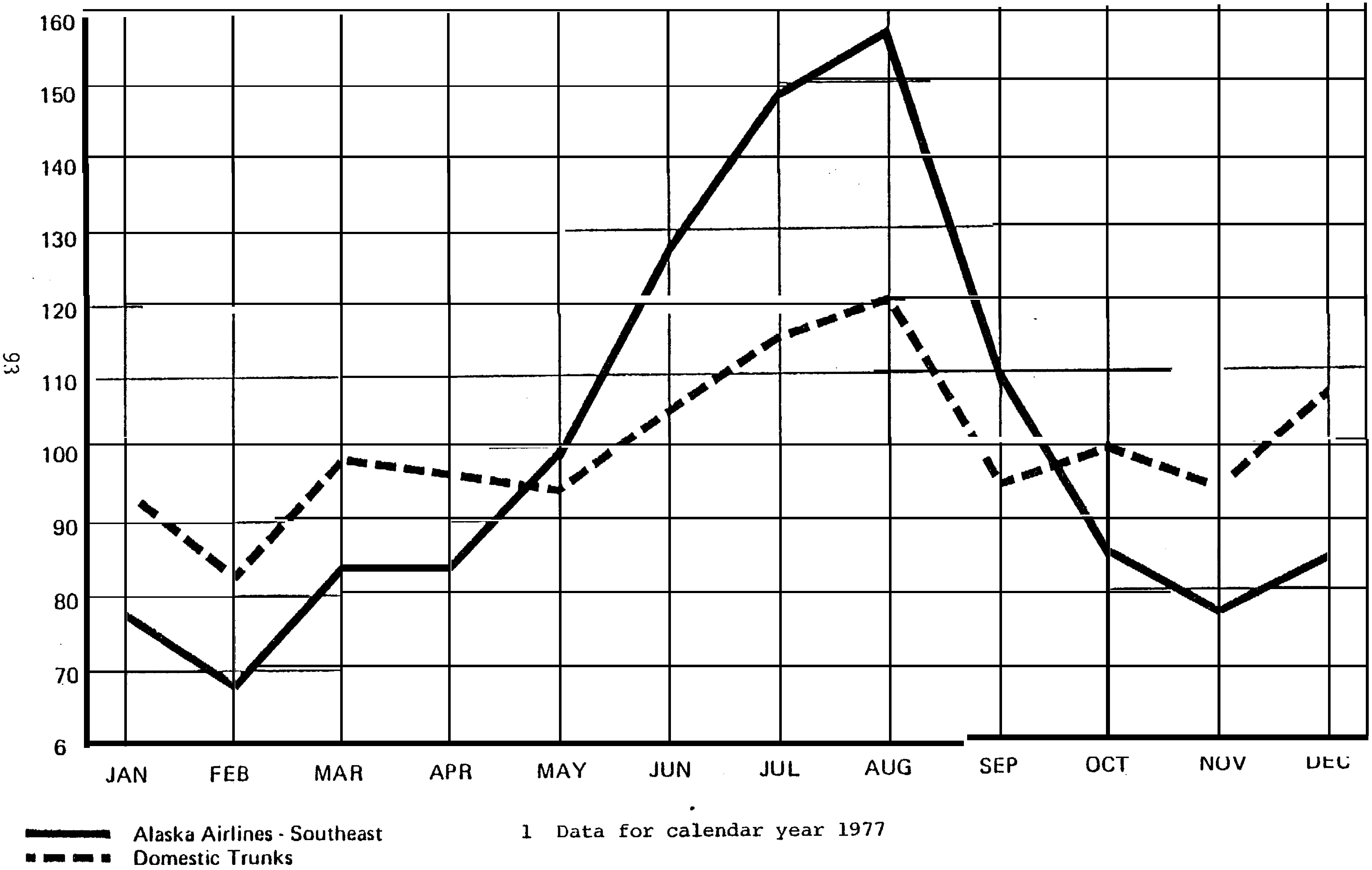
> Not only do the Juneau-Anchorage traffic volumes support the service to Yakutat and Cordova but the combined traffic including volumes generated by the smaller cities in fact provide travelers from Juneau to Anchorage with a broader pattern of scheduled service than they would otherwise receive. . . 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 2-7 shows that the monthly f" uctuation 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 fleetof 727-100 "and 727-200 aircraft. It currently has two 727-200, each with a seating capacity of 136, and has plans to purchase at least one more.

The carrier hopes to extend its service south into California and east to Denver and Minneapolis-St. Paul via Montana cities.

INDEX OF MONTHLY REVENUE PASSENGER MILES (1)



1 Data for calendar year 1977

Source: ER-586 Service ; C.A.B. Air Carrier Traffic Statistics

FIGURE 2-7

o Wien Alaska. Wien has two primary service areas . From both Fairbanks and Anchorage, it offers direct service to major Western and Interior Alaskan communities. Until recently, service south of Anchorage--its other area--was limited to the communities of Homer and Kodiak. This service was extended from Kodiak to Seattle beginning in April, 1979. In addition, Wien received authority at approximately the same time to provide direct service from Anchorage to Seattle as a resultof the CAB's West Coast Service Investigation and from Anchorage to Seattle via Juneau and Ketchikan as part of The Southeast Service Investigation. During 1979, it began operations on this route as well as on a Kenai-Seattle route. 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. Table 2-20 shows recent traffic data for Wien routes to and from Kodiak.

● Kodiak-Western-Alaska. The carrier operates four routes, three of which serve Kodiak Island. The Kodiak Island routes individually serve areas west, north, and south of the town of Kodiak. In all, the carrier serves 20 communities on the Island, including Kodiak itself (Alaska Transportation Commission, 1978).

Kodiak-Western Alaska flies a variety of small aircraft seating five and nine passengers and uses Kodiak Municipal Airport as

Table 2-20

Two-Way Traffic Data for Wien Service To and From Kodiak

City Pairs	Date	Passengers Enplaned	Passengers On board	Flights	Freight Metric Tons	Freight (Tons)	Load Factors Passengers	Load Factors Tons
Anchorage-Kodiak	January, 1978	4,640	4,640	89	581	(640)	58.78	56.13
	August, 1978	8,492	8,500	151	1,050	(1,157)	61.78	62.91
Anchorage-Homer	January, 1978	386	586	17	63	(69)	37.42	31.62
	August, 1978	249	387	18	39	(43)	55.68	43.50
Homer-Kodiak	January, 1978	377	624	9	66	(73)	69.80	59.10
	August, 1978	396	558	18	53	(58)	80.29	59.42

Source: Civil Aeronautics Board, 1979.

its primary base of operations. In the period July 1, 1976, to June 30, 1977, its total of 1,227 departures accounted for two-thirds of departures by domestic air carriers in the Kodiak area. Its reliability of operations is quite low as during this same period only 63% of scheduled departures from Kodiak Municipal Airport were completed (Table 2-14). Such low reliability can be expected for service to small villages because of low demand and unpredictable weather conditions.

Tables 2-21 and 2-22 summarize the operations of Kodiak-Western Alaska airlines for 1976 and 1977. Table 2-21 includes all of the company's operations. In both years, January was the low traffic month and August the high traffic month. In 1977, August passenger enplanements were approximately four times the January figure and the load factor was 67% higher.

Table 2-22 provides data for the major communities on Kodiak Island. Data show Kodiak Municipal Airport as the hub for the carrier's operations. Passenger enplanements at Kodiak are four to five times greater than for the next largest community. A listing of communities in decreasing order of passenger enplanements for the quarter ending September 30, 1977, is as follows: Kodiak, Larsen Bay, Old Harbor, Ouzinkie, Port Lions, Port Baily, Moser Bay, and Akhiok. Of these communities, only Port Lions and Kodiak have the Marine Highway System available as an alternative form of scheduled passenger transportation.

Table 2-21

Operating Statistics for Kodiak-Western Alaska Airlines, 1976-1977(1)

Year	Month	Passengers Enplaned	Rev. Pass-Miles(000)	Avail. Seat Miles(000)	Load Factor(2)	Rev. Ton Miles(3)	Avail. Ton-Miles(3)	Load Factor(2)	Revenue Departures Performed
1976	January	1,378	69	159	0.43*	13,190	30,118	0.44	1,060
	February	1,283	69	153	0.45	11,856	28,545	0.42*	996
	March	1,655	90	180	0.50	15,871	35,396	0.45	1,109
	April	1,785	91	190	0.48	17,926	37,178	0.48	1,226
	May	2,413	131	254	0.52	21,121	50,462	0.42	2,231
	June	2,646	154	283	0.54	23,368	55,392	0.42	3,4″62
	July	3,290	197	313	0.63	28,997	59,561	0.49	2,692
	August	3,424	195	296	0.66**	29,913	57,658	0.52**	1,928
	September	2,232	132	237	0.56	21,664	46,344	0.47	1,490
	October	1,359	87	184	0.47	16,013	37,653	0.43	1,356
	November	1,308	75	156	0.48	13,899	31,715	0.44	1,264
	December	1,389	71	158	0.45	15,017	30,566	0.49	1,361
1977	January	939	49	126	0.39*	11,455	25,061	0.46	862
	February	948	48	120	0.40	10,059	23,827	0.42*	841
	March	1,282	73	152	0.48	“13,211	“29,814	0.44	992
	April	1,585		166	0.49	14,478	32,476	0.45	1,061
	May	2,023	17;	219	0.53	17,595	42,384	0.42*	1,404
	June	2,605	163	275	0.59	22,155	-0-	-0-	1,848
	July	3,346	205	327	0.63	27,477	60,839	0.45	2,141
	August	3,736	220	337	0.65**	29,977	64,227	0.47**	2,198
	September	2,187	131	220	0.60	21.154	70.800	0.30	1,564
	October	-----------------DATA MISSING							
	November	1,308	75	156	0.48	13,899	31,715	-0-	1,064
	December	1,286	59	118	0.50	10,783	41,264	-0-	1,064

NOTES : (1) Data includes routes Western Alaska routes as well as those on Kodiak Island.
(2) Asterisk (*) denotes lowest traffic month during year. Double asterisk (**) denotes highest month.
(3) Freight data includes passengers.

SOURCE : CAB Form 41, Schedule T-l(6) as on file at Alaska Transportation Commission

Table 2-22

Kodiak-Western Alaska Airlines Traffic Statistics, 1976-1977(1)

Community Activity(2)	Quarter Ending March 1976	June 1976	Dec. 1976	March 1977	June 1977	Sept. 1977
Akhiok						
Plane Departures	40	64	28	26	64	71
Pass. Enplaned	103	113	69	80	141	162
Frt. Enplaned (Tons)	0.18	0.39	0.09	0.55	0.56	
Kodiak (Municipal)						
Plane Departures	372	573	371	294	573	768
Pass. Enplaned	1,224	2,529	1,237	969	2,399	2,534
Frt. Enplaned (Tons)	46.74	73.68	52.94	38.42	64.65	65.38
Mail Enplaned (Tons)	32.98	40.63	35.47	39.76	36.09	35.33
Kodiak						
Plane Departures	16	16	9	6	16	7
Pass. Enplaned	21	54	24	10	48	16
Frt. Enplaned (Tons)	3.14	2.08	0.91	0.47	2.11	0.694
Larsen Bay						
Plane Departures	59	149	72	69	149	214
Pass. Enplaned	126	236	165	152	303	547
Frt. Enplaned (Tons)	0.29		0.80	1.37	0.42	0.61
Moser Bay						
Plane Departures	16	44	10	15	44	72
Pass. Enplaned		31		1	28	150
Frt. Enplaned (Tons)	0.79	0.65			0.07	0.35
Old Harbor						
Plane Departures	118	154	137	86	154	188
Pass. Enplaned	356	507	325	234	390	483
Frt. Enplaned (Tons)		0.76	1.01	0.73	0.53	0.27
Quzinkie						
Plane Departures	120	141	97	91	141	1559
Pass. Enplaned	318	319	270	250	332	302
Frt. Enplaned (Tons)	0.09	0.28	0.17	0.04	0.21	0.08
Port Baily						
Plane Departures	24	69	15	19	69	130
Pass. Enplaned	6	23	6	6	34	19 *
Frt. Enplaned (Tons)	0.10	0.11			0.04	0.68
Port Lions						
Plane Departures	111	127	87	87	127	142
Pass. Enplaned	248	322	207	181	225	198
Frt. Enplaned (Tons)	0.29	0.34	0.30	0.13	0.15	0.540

Notes: (1) Data is missing for the third quarter of 1976 and the fourth quarter of 1977.
(2) Plane departures include scheduled and non-scheduled operations.

Source: CAB Form 41, Schedule T-3(a)

Kodiak-Western Alaska has been included as a trunk carrier since its operating rights do not carry a restriction on aircraft size and because its routes serve the function of a trunk carrier although on a smaller scale than the other carriers described. Kodiak-Western Airlines received permission in the spring of 1979 to operateon the Kodiak-Seattle route but did not do so at that time because of the inability to locate a guaranteed fuel supply in Seattle.

- Northwest Orient Airlines. Service levels to Anchorage by Northwest Orient Airlines are shown on Table 2-18. 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 Kodiak-Seattle route, which it operates only from April to October three to 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 (Moore, 1978).

2.3.2.3.2 Commuter Airlines. One commuter airline, Alaska Aeronautical Industries (AAI), serves the Kenai Peninsula communities of Seward, Homer, Kenai, and Soldotna from Anchorage. All three of the communities are within 241 km (150 miles) of Anchorage and are reached without an intermediate stop, except for Homer whose flights sometimes stop at Kenai enroute. Only Homer is currently served by a trunk carrier and that service never exceeds one flight per day in each direction. Commuter carriers operating aircraft with 5 to 19 passenger seats can offer greater frequency than trunk carriers at comparable rates for a given demand. Only through the use of a commuter can a passenger make a round-trip to or from Anchorage and Homer on the same day. Table 2-18 indicates that AAI’s operations within the study area emphasize service to Kenai.

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

5,670kg (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.

2.3.4 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 Department of Transportation has jurisdiction over many of the state's airports. Of those terminal facilities analyzed in this report, only Kodiak 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. In the spring of 1979, decisions were made in the West Coast and Southeast Service Investigations and additional routes were authorized for all certificated carriers which were a party to the investigations. Additional decisions are pending in the Denver and Northwest Investigations which will affect service provided by Alaskan carriers to Seattle. 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. The next level of importance are twelve regional centers, of which Kodiak is the only one within the study area.

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

2.3.5 TECHNOLOGY

Table 2-23 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

Table 2-23

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-Seward	AAI	121 (75)	$ 22.00	13.0 (29.3)	0:35	208 (129)
Anchorage-Kodiak	Wien	399 (248) 399 (240)	$ 47.70 $ 47.70	11.9 (19.2)	0:50 (737) 0:80 (FH 227)	480 (298) 299 (186)
Anchorage-homer	AAI	190 (118)	$ 27.50	14.S (23.3)	0:50	229 (142)
Anchorage-Chicago	Northwest	4,569 (2,039)	$211.64	4.7 (7.5)	5:37 (747)	813 (505)

Source: Airline Tariff Schedules, 1979.

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.

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 of 44 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 2-8). The two highways have both been designated Federal-aid Primary routes. The Sterling Highway is F-21 and the Seward Highway F-31.

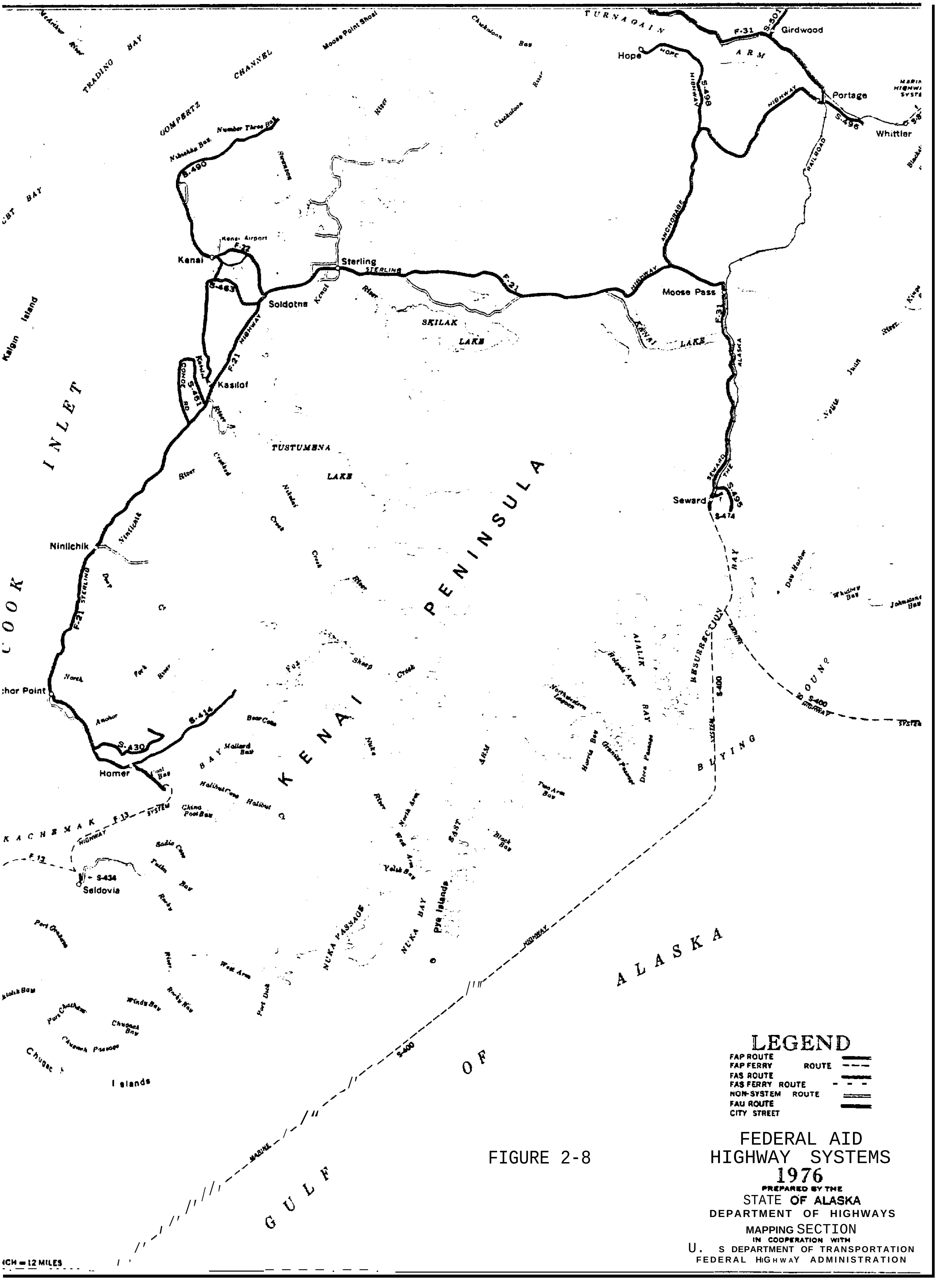


FIGURE 2-8

FEDERAL AID
HIGHWAY SYSTEMS
1976
PREPARED BY THE
STATE OF ALASKA
DEPARTMENT OF HIGHWAYS
MAPPING SECTION
IN COOPERATION WITH
U. S 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 practical capacity for a rural two-lane road is 900 vehicles per hour in both directions (Highway Research Board, 1965). Practical capacity represents a free-flowing condition 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. Factors are applied to the practical capacity based on lane and shoulder width, the extent of sight-distance restrictions that limit passing, and the percentage of trucks and buses.

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 2-24 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 2-24 shows a seven-year history of annual average daily traffic (AADT) at the Ninilchik, Moose Pass, and Silvertip traffic recording stations and of population increases for the adjacent census divisions. The Kenai Peninsula has increasingly become an important recreational destination for Anchorage residents which accounts for some of the traffic growth. In addition, the census districts of Kenai and Seward

Table 2-24

Traffic and Population Growth - Kenai Peninsula

	Annual Average Daily Traffic						Census Division Population					
Year	Ninilchik AADT(1)	% Change	Moose Pass AADT(2)	% Change	Silvertip AADT(3)	% Change	Anchorage	% Change	Kenai	% Change	Seward	% Change
1970	169		550	-	924		126,333		14,250	-	2,336	
1971	674	-0. 7%	548	-0.4%	977	5.7%	1,35,777	7.5%	14,289	0.3S	7,593	11.0%
1972	767	13.8%	554	1.1%	1,088	11.4%	144,215	6.2%	13,923	-2.6%	2,386	-8.0%
1973	861	12.3%	552	-0.4%	1,222	12,3%	149.440	3.6%	13,808	-0.8%	2.446	2.5%
1974	1,095	27.2%	613	11.1%	1,422	16.4%	153,112	2.5%	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%
1976	1,285	9.0%	771	11.3%	1,552	-2.6%	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: 00TPF, 1978,

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 " eveling 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 Kenai Peninsula communities from Anchorage.

Road condition information was obtained from surveys contained in 1972, 1975, and 1976 by the Departmentof 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 2-26.

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 practical capacity and no deficient miles occurred for either

Table 2-25

Traffic Conditions for Kenai Peninsula Primary Routes

				1977 Traffic(1)			
Highway	Route Segment	Distance km (mi.)	Capacity (Vehicles/Hour)(2)	AADT(3)	30th Highest Hour	Peak-Hr. Factor(4)	Volume/ Capacity(5)
Seward Highway (FAP-31)	Seward (Bear Lake Rd.) - Sterling Hwy. Jet.	47.6 (29.6)	398	808	149	0.18	0.37
	Sterling Hwy. Jet.- 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	268	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: DOH, 1973, DOTPF, 1978,

Table 2-26

Results of Condition Surveys for Kenai Peninsula Primary Routes

Highway	Route Segment	1972(1)			1975(1)			1976(1)		
		Deficiency/ Par Rating(2)	Weighted Factor(3)	% Deficient Miles	Deficiency/ Par Rating(2)	Weighted Factor(3)	% Deficient Miles	Deficiency/ Par Rating(2)	Weighted Factor(3)	% Deficient Miles
Seward Highway (FAP-31)	Seward (Bear Lake Rd.)-Sterling Hwy. Jct.	18/30	12.2	100%	17/25	16.6	100%	17/25	16.1	100%
	Sterling Hwy. Jct.-Girdwood	18/30	14.6	100%	17/25	16.3	72a	17/25	16.3	72%
Sterling Highway (FAP-21)	Homer (West End Rd.) -Ninilchik	18/30	18.8	12%	17/25	19.5	0%	17/25	19.6	0%
	Ninilchik-Soldotna	18/30	18.0	58$	17/25	19.5	0%	17/25	20.0	0%
	Soldotna-Sterling Hwy. Jet.	18/30	14.6	100%	17/25	15.8	100%	17/25	16.8	70%

Notes: (1) The methodology for the 1972 report differed from that of the two later reports, which means the values are not completely comparable.

(2) Deficiency is the rating value established by the state as 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: DOH, 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 150% 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, that stretch of road is used primarily for commuter and other local trips. Second, major improvements have been made to this route segment since 1972 and more are in progress at this time.

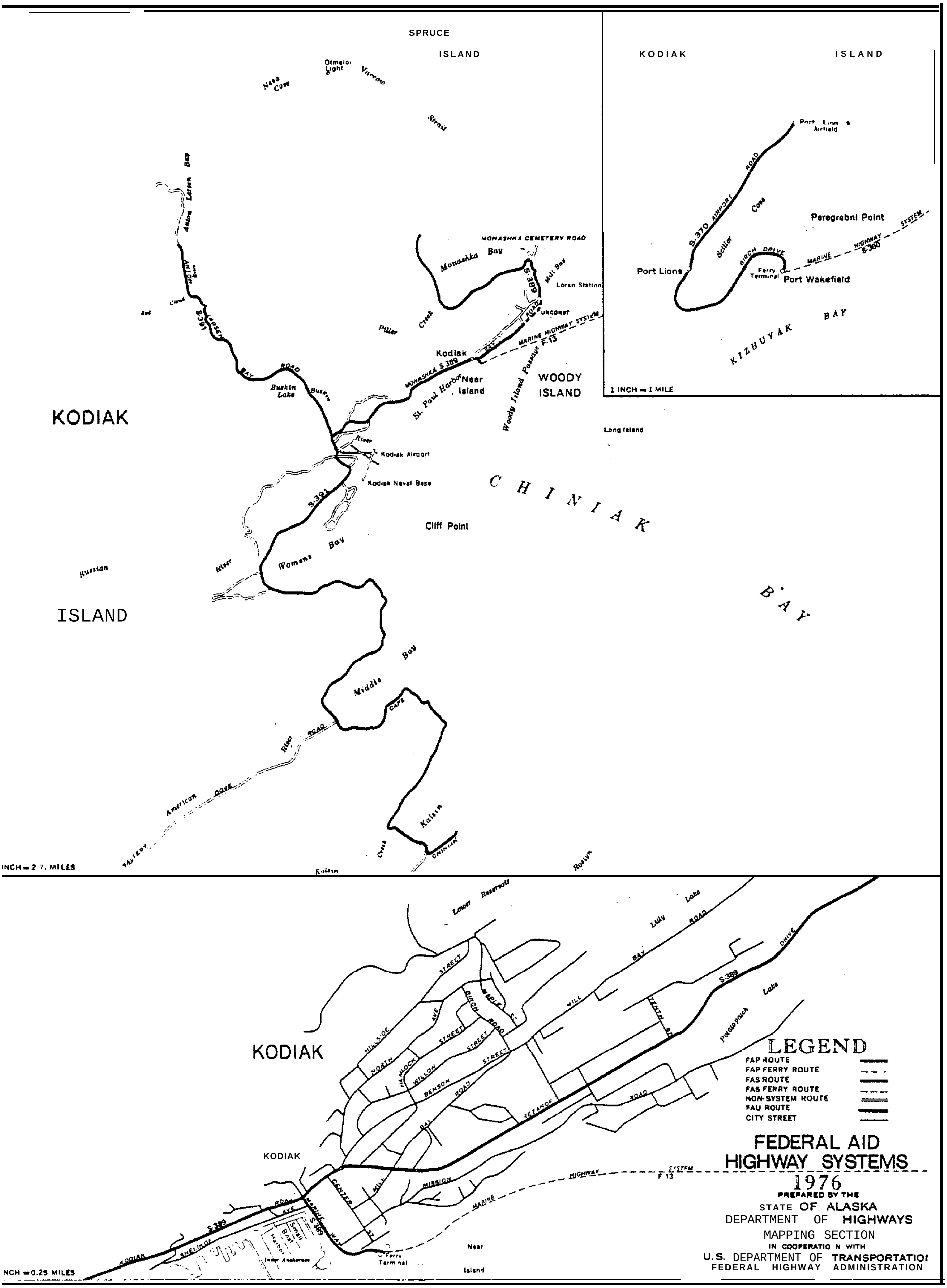
The southerly route segment has a low capacity (37%) and a low AADT. Monthly traffic figures show high fluctuations, ranging from an MADT-to-AADT ratio of 200% in July to less than 50% in the winter months. Although capacity is currently not a problem, this route segment produced the lowest ratings in 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 1 owes t.

Traffic growth has leveled offon 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.

2.4.1.3 Kodiak Road System.

Figure 2-9 shows the road system connected to the Cityof Kodiak. The road system on Kodiak Island will be discussed because of the need to use other than local roads to connect the community with Ugak Bay, the most likely site for an oil terminal. The major highway for the area follows the coastline of Kodiak Island from Cape Chiniak on the south to the City of Kodiak and then north to Mill Bay and Monashka Bay. The route consists of two Federal-aid Secondary Routes designated by the

Figure 2-9.


SPRUCE
ISLAND
Otmeloi Light
Narrow Strait
Nesa Cove
Anton Larsen Bay
ANTON LARSEN BAY ROAD
S 391
Red Cloud
Buskin Lake
Buskin River
Monashka Bay
MONASHKA CEMETERY ROAD
S 389
Mill Bay
Loran Station
UNCONST
MARINE HIGHWAY SYSTEM F 13
Pillar Creek
Kodiak
MONASHKA S 389
St. Paul Harbor
Near Island
Woody Island Passage
WOODY ISLAND
KODIAK
ISLAND
Long Island
Kodiak Airport
Kodiak Naval Base
S 391
Cliff Point
CHINIAK
BAY
Russian River
Womens Bay
Middle Bay
CAPE
ROAD
American River
Kalsin
Creek
CHINIAK
Rosiva
SALTERY
INCH = 2 7, MILES
KODIAK
ISLAND
Port Lions Airfield
S 370 AIRPORT ROAD
Settler Cove
Peregrebni Point
BIRCH DRIVE
Ferry Terminal
Port Wakefield
Port Lions
MARINE HIGHWAY SYSTEM S 360
KIZHUYAK BAY
1 INCH = 1 MILE
Lower Reservoir
Lilly Lake
MILL BAY ROAD
S 389 DRIVE
STREET
BIRCH
MAPLE ST.
ROAD
HILLSIDE
AVE
NORTH
STREET
HEMLOCK
WILLOW
STREET
BENSON
ROAD
STREET
TENTH ST.
Potatopatch Lake
KODIAK
REZANOF
ROAD
BAY
KODIAK
CENTER
MILL
MISSION
HIGHWAY SYSTEM F 13
MARINE
ROAD
MARINE WAY S 389
ST.
S 389
SHELIKOF AVE
KODIAK
Small Boat Harbor
Near Anchorage
Ferry Terminal
Near Island
INCH = 0.25 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 COOPERATIO N WITH
U.S. DEPARTMENT OF TRANSPORTATIO
FEDERAL HIGHWAY ADMINISTRATION

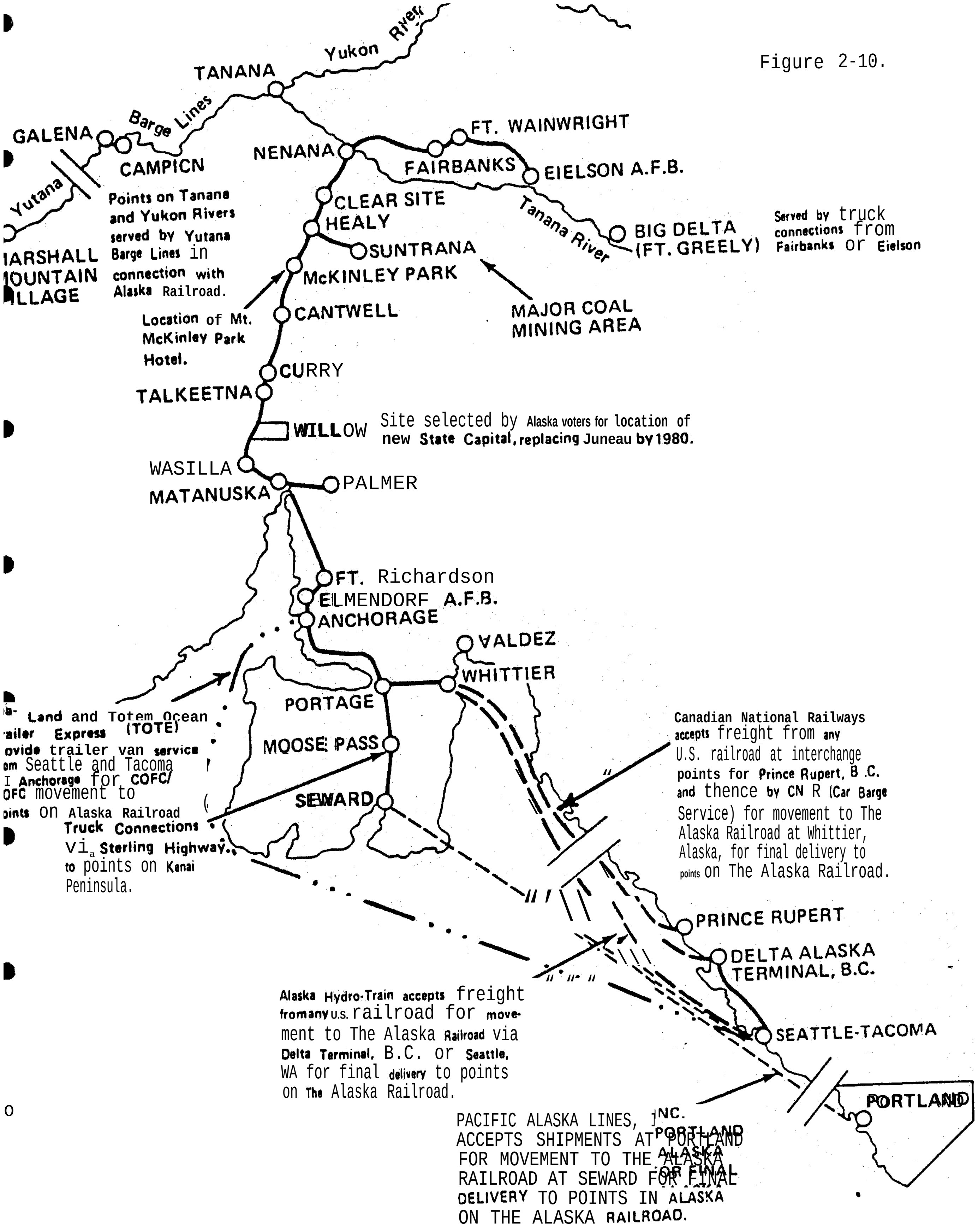
State of Alaska. It is called the Kodiak Island Highway (S-391) from Cape Chiniak to the vicinity of the airport where it meets Anton Larsen Bay Road. At this point, it becomes Kodiak Road (S-389). Average daily traffic in 1977 was estimated at 700 vehicles between Saltery Cove Road and the Kodiak Road junction. Major traffic generators on this route segment include the airport and the Coast Guard Base. Traffic on Kodiak Road ranges from 3,200 vehicles daily between the junction and the beginning of downtown Kodiak to 6,900 vehicles in the city center.

The most likely location for a service base is in Women's Bay, which currently is used primarily for docking the three Coast Guard vessels stationed at Kodiak. An oil terminal and LNG plant have been proposed to be located at Saltery Cove in Ugak Bay. The area is accessible by the Saltery Cove Road, which intersects the Kodiak Island Highway 19.3 km (12 mi.) from the airport and 33.8 km (21 mi.) from downtown Kodiak. The road, passable only by 4-wheel drive vehicles, is approximately 30.6 km (19 mi.) long. The first 14.7 km (9.1 mi.) of the road was removed from the state maintenance system in 1975 and is not claimed for revenue-sharing by the Kodiak Island Borough at the present time. The area served by the road is frequented by hunters in the summer and fall.

2.4.2 RAILROAD

The Alaska Railroad serves three ports of entry--Whittier, Seward, and Anchorage. Figure 2-10 shows the existing system and connecting marine services. Most of the railroad's inbound traffic passes through Whittier

Figure 2-10.



Points on Tanana and Yukon Rivers served by Yutana Barge Lines in connection with Alaska Railroad.

Served by truck connections from Fairbanks or Eielson

Location of Mt. McKinley Park Hotel.

Site selected by Alaska voters for location of new State Capital, replacing Juneau by 1980.

a- Land and Totem Ocean
ailer Express (TOTE)
ovide trailer van service
om Seattle and Tacoma
I Anchorage for COFC/
OFC movement to
oints on Alaska Railroad

Truck Connections via Sterling Highway to points on Kenai Peninsula.

Canadian National Railways accepts freight from any U.S. railroad at interchange points for Prince Rupert, B.C. and thence by CN R (Car Barge Service) for movement to The Alaska Railroad at Whittier, Alaska, for final delivery to points on The Alaska Railroad.

Alaska Hydro-Train accepts freight from any U.S. railroad for movement to The Alaska Railroad via Delta Terminal, B.C. or Seattle, WA for final delivery to points on The Alaska Railroad.

PACIFIC ALASKA LINES, INC. ACCEPTS SHIPMENTS AT PORTLAND FOR MOVEMENT TO THE ALASKA RAILROAD AT SEWARD FOR FINAL DELIVERY TO POINTS IN ALASKA ON THE ALASKA RAILROAD.

Source: Alaska Railroad, 1978.

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.

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.

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 rail cars 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 2-27 relates principal cities within the study area to the operating zones used by the Alaska Transportation Commission. Common motor 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

Table 2-27

Operating Zone	Name	Representative Cities
3	Kenai Peninsula	Seward, Whittier, Homer
5	South Central Alaska	
5A	Valdez Subzone	
5B	Anchorage Subzone	Anchorage
8	Kodiak-Afognak	Kodiak

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

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 on-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 regional and 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 capacityof 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 (Hartig, 1979).

2.5 Summary of Existing Conditions

The adequacy of regional and local transportation systems within the study area varies by mode, location, and time of year. Seasonal variations occur for all existing transportation systems serving Alaska, but unfortunately not all available data has been disaggregate by month. For the marine mode, tonnages are available on an annual basis, and seasonal effects have been assessed qualitatively. For scheduled air passenger services, peak travel occurs during the summer season, and the emphasis has been on analyzing traffic during the month of August. Intercity roads on the Kenai Peninsula also peak during the summer season, but the analysis has centered around the 30th highest hour, which eliminates the effects of traffic on major' holidays.

For the marine mode, a comparison of existing tonnage and computed capacities shows Kodiak's dry freight facilities to be closest to the point where major additions in capacity will be required. The problem is more acute for containerizable freight than for liquid bulk. The former in Kodiak exceeded the computed low capacity threshold and was 77% of the high capacity threshold while the latter was only 52% of the low capacity threshold (Table 2-9). The port with the next highest volume to capacity ration is Whittier, where 1977 dry goods tonnage was 81% of the low capacity figure and 57% of that for high capacity (Table 2-4). Whittier is followed by Anchorage, where both liquid bulk and containerized facilities operated in 1977 at approximately 50% of low capacity figures (Table 2-1). Seward's throughput tonnage did not exceed 10% of the low capacity in any category. Carriers at present do not experience capacity problems, even during peak demands. In fact, a falling offof demand after construction of the Trans-Alaska Pipeline has created excess capacity, and strong competition for traffic has developed.

For the air mode, runway capacity looms as a problem only in the Anchorage area. The proposed solution for both Merrill Field and Anchorage International Airport is to divert training and general aviation activities as much as possible to satellite airports such as Birchwood. The primary purpose of the North-South runway at International Airport is to provide improved safety of operations when crosswinds develop. Only a minor increase in runway capacity will result. Terminal facilities require improvements in both large and small communities. Additional space will soon be required at International Airport for both domestic and international passenger accommodations. At Kodiak, increased jet traffic to Seattle has created the need for additional facilities, and at Seward a basic permanent structure is needed to meet the needs of the commuter airline and the air taxi serving the community. Private or community funds will be required to make terminal improvements at Seward and Kodiak. Although the State of Alaska owns and operates the airports, only in Anchorage and Fairbanks does it fund terminal improvements.

Beginning in 1978, the effects of deregulation on routes regulated by the Civil Aeronautics Board reached Alaska. First, freight services were deregulated, and Flying Tiger and Wien emerged as important interstate air freight carriers serving Alaska. Next, competition was allowed in

Southeastern Alaska and from Kodiak to Seattle. Wien received routes from Alaska to Seattle for the first time, and several continental United States air carriers received authority to serve Alaska for the first time. The long-term effects of deregulation, which is to recomplete by 1984, are unknown. Initial results have shown an increase in the level of service on major routes but a constraint on fare increases only on the heavily traveled Anchorage to Seattle nonstop flights.

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 Western Gulf of Alaska Lease Sale No. 46.

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:

- <u>Existing transportation demand and supply</u>. 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 the supply of transportation. Annual tonnage 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 size of aircraft and a given passenger occupancy figure. 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).

- o <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 ofa straight-line relationship between demand and population.

A single base case exists for Kodiak. The data are presented in the mean base case. No discussion of Kodiak demands is provided 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 Seward, the base case data are the same as the OCS cases for Sale No. 55 (Northern Gulf). 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 Kodiak forecasts where only one set of base forecasts has been made. Data has 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)
   Low 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%

5. Northern Gulf of Alaska (Lease Sale No. 55): Low, Mean, and High Scenarios[1]

Sources:
1. Peter Eakland and Associates, 1979
2. Pernela, 1976
3. Frederic 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, p. A-45). 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 NORTHERN GULF OF ALASKA SCENARIOS

Transportation requirements for the Northern Gulf of Alaska lease sale scenarios have been previously prepared (Eakland, 1979). Major activities are summarized below for each scenario as described by Dames and Moore (1978):

- Low (Exploration Only) - Exploration occurs on all three shelves--Yakutat, Middleton, and Yakataga. Supplies are provided from both Seward and Yakutat. Rig and platform employees are rotated through Cordova and Yakutat. No construction of major service base occurs.

- Mean - Development occurs in both the Yakutat and Middleton Shelves. A small oil terminal (100,000 bbls/day) and small LNG plant (312 mmcfd) are built on Hinchinbrook Island, and in

Yakutat, a medium-sized oil terminal (250,000 bbls/day) and medium-sized LNG plant (1 bcfd). Construction support bases are located in Yakutat and Seward and a pipecoating plant is constructed in Seward.

- High - Development occurs in all three shelves but impacts from development of the Yakataga Shelf are limited because oil is loaded offshore. Oil and LNG facilities constructed at Yakutat (a 700,000 bbls/day oil terminal and a 2 bcfd LNG plant) are larger than those for the mean scenario, as is the LNG plant on Hinchinbrrok Island (750 mmcfd); however, the oil terminal on Hinchinbrook remains the same size (100,000 bbls/day).

Only those movements of goods and passengers which are destined for or pass through Anchorage, Seward, Whittier, and Kodiak are considered in this study.

3.2.3 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 ships rather than on rail barges; thus, shippers will use Seward. The major factor influencing transportation activities in Seward will be activities occurring in the Northern Gulf of Alaska's mean and high scenarios. They include support for offshore drilling and pipelaying, and construction of a service base and pipecoating plant. Population growth for the community will not be excessive, since its support role becomes minor once development is completed. Population growth due to the Northern Gulf mean scenario is 400 persons in 1989 but falls to 50 persons by 1993.

Three base cases exist for Seward which have been carried forward from local impact cases developed for the Northern Gulf of Alaska lease sales. Seward, along with Kodiak, has promise as a regional center 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 economic 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. The growth during the study period will result from large-scale development projects as well as normal, incremental growth (Table 3-2). Although unaffected by the development projects, Kodiak is expected to have a strong economy as it expands its traditional roles in the fishing and transportation industries. As shown in Table 3-2, a 50% increase in the base population of 9,027 (1978) is forecast by 1987 (growth factor of 1.538) and almost a 100% increase by the end of the study period (growth factor of 1. 977). Despite Seward's expected role in Northern Gulf OCS activities, the economy for the community is, overall, not as strong as Kodiak's. A 50% growth over the base year population is not forecast until 1995, and the growth rates throughout the study period fall behind those for the state as a whole. Anchorage's growth factors exceed those for Kodiak and the State for a given year, and its population is forecast to be 166% 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 1982 and remain ahead for the rest of the study period. The Southcentral Region, where both Seward and Kodiak 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.

Both Seward and Kodiak are potential sites 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, Whittier, Kodiak, and Seward. 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 developments have been included with normal growth where existing facilities would be used.

3.3.2.2 Terminals

For Seward, Northern Gulf of Alaska direct OCS freight requirements--consumables, drilling, and construction--have been shown separately because they might not use existing facilities, particularly once development begins. From 1981-1984, Seward tonnage related to base developments produces figures which, excluding Northern Gulf of Alaska oil and gas activities, are not reached again until 1994. In no year does the total of all categories exceed even the low threshold value. The highest figure is 2.6 which is reached in 1998 and is due principally to output from the pipecoating plant. Seasonal differences, particularly for construction and pipelaying, heighten the impact of tonnages. Year-round drilling will result in a relatively constant level of freight shipments, despite greater productivity during the summer months. The assumed construction of a support base in this scenario occurs because of the need for dedicated berth space during peak demand periods and considerable land-side storage areas as well as handling capacities of the present facilities. The separate support base means that construction equipment and materials most likely would be delivered directly to the construction site.

Fuel does not reach computed threshold values in Seward. The highest value is 2.9 compared to a low threshold of 3.3 and occurs in 1989. As explained in the Appendix, fuel and cargo ships share the same docks in Seward, which has required an allocation of dock space to each activity.

In the mean base case, requirements for service base berths will produce greater impacts than tonnage in Seward. Requirements peak in 1998 with three berths, based on 131 supply boat roundtrips during the peak months. More than one berth is required in only four years of the study period. Three berths will require a minimum of 183 m (600 feet) of linear docking space.

Whittier is not expected to experience any congestion, as the freight growth factors fall short of even low threshold values for the entire study period (Table 3-4). It should be noted that all OCS freight destined for Seward has been assumed to move directly to Seward. Depending upon the source of materials and whether rail access is provided to the service base, some of this freight might like"ly go through Whittier.

Anchorage will experience the beginnings of congestion in the late 1990's for dry freight but existing berths will still be adequate. Petroleum throughput for the Port of Anchorage will reach the low theshold value by 2000. Without diversion of some fuel to the Nikiski pipeline, the value would be 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.

Kodiak dry freight shipments are already at the low threshold value, and by 1982 will have reached the high capacity level. Further discussion of the meaning of the threshold values would be appropriate at this time. Basically, when the low capacity value is reached, existing facilities are adequate; but a waiting time for berths exists if random arrival of vessels is assumed. At the high capacity level, additional freight can still be accommodated, but the service level decreases as the ratio of waiting time to berth time increases; and additional facilities become justified. Freight increases at Kodiak will produce an additional problem--land storage. The use of Kodiak as a collection and distribution point for freight services to Cordova, the Aleutian Islands, and the small communities on Kodiak Island creates an increasing demand for storage space. Only one of the main city docks has enclosed warehouse space at this time.

3.3.2.3 Carriers

Existing carriers are forecast to increase their services as population within the study area increases. 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 the 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.

The possible exception regarding major new carriers is American President Lines which recently initiated service from Unalaska to Japan. Given a flourishing bottomfish industry in either Seward or Kodiak, its cargo ships would certainly consider stopping at ports along its return route to Tacoma in order to build back-haul traffic. Likely back-haul ports are Kenai and Ketchikan. Without an additional ship, 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 vehicle bottlenecks occur during peak summer seasons. The links to Kodiak from Seward and Homer had vehicle load factors in 1976 only slightly in excess of 50% during the summer season. Should high load factors 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.

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, Kenai, Homer, Seward, Valdez, and Kodiak. Valdez has taken the lead by presenting a $48 million bond issue to the voters in April, 1979, which was overwhelmingly approved. With the exception of Kodiak, adequate port capacity exists at present, 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 lower the forecast growth rate at existing ports.

Hydroelectric power has the potential for serving Seward, Anchorage, and Kodiak. Should prospective sites be developed at Bradley Lake near Homer, Terror Lake near Kodiak, or at Susitna, fuel shipments particularly to Seward and Kodiak would diminish because they now depend upon diesel generators for electrical generation.

Seward is forecast to provide a key role in the developmentof the Northern Gulf oil and gas fields. The extent of development which actually occurs in each of the three shelves will determine the extent that Seward is impacted. As a result of the call for nominations, no leases in either the Middleton or Yakataga Shelves will be sold in Lease Sale No. 55. Other issues related to Northern Gulf of Alaska development in the mean case include the following: (1) whether or not a pipecoating plant is located in Seward; (2) location and sizeof the support base to be constructed; and (3) whetheror not the support base will have access by land and/or rail. In addition, the schedule of other developments relative to Northern Gulf of Alaska activities is significant. Presently, Northern Gulf activities come on the heels of gas pipeline construction and development of gas fields for the Pacific-LNG plant. Delay of either or both of these projects would cause overlap with Northern Gulf development.

In the near future, Kodiak must decide where and to what extent it wishes to expand its port' facilities. An assessment of the geologic hazards posed by Pillar Mountain will impact the decision-making. That decision will affect later decision-making by oil companies and marine carriers. Kodiak's strategic location and lack of land access to major population centers effectively prevents other ports from assuming its existing roles.

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 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.

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 and in Kodiak for fuel and the high capacity service level to be reached in Kodiak for dry freight. Freight increases at Seward and Whittier will be pronounced during the early 1980's because of non-Gulf of Alaska development but can easily be accommodated. High tonnages will occur at Seward during development of Northern Gulf oil and gas fields but construction of a support base will minimize impacts on existing services.

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 always additive since both types of demand will use the same facilities and the same carriers. No new runways 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 3-5 shows forecast traffic above base year figures for the mean base case. 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 70.9% of total growth, its lowest level during the study period. Enplaned passengers from July 1, 1976, to June 30, 1977, totaled 888,000 (FAA, 1978). By 2000, additional peak weekly traffic of 16,290 is expected, which converts to approximately 567,500 annual enplanements (16,290 x 52 weeks/yr. x 2/3). This figure shows the dominance of Anchorage-Seattle traffic in the airport's overall passenger operations.

For the Seward-Anchorage link, nonlocal employee travel related to Lease Sale No. 55 initially contributes more to air passenger growth than local population growth, in contrast with the Anchorage-Seattle link. Population-related growth first exceeds nonlocal travel in 1986. Existing service of three flights per day using 19-passenger aircraft will likely reach capacity in 1985, when maximum demand of 169 passengers could occur.

An additional flight per day will be satisfactory for the remainder of the study period. Diversion of a percentage of nonlocal employees to land transportation can be expected and is discussed under land modes.

Kodiak links, unaffected by any of the base case developments, are assumed to be impacted only by population growth. The base level for Kodiak-Anchorage service is based on the sum of traffic to both Anchorage and Homer. Existing peak service of three flights per day, if in all-passenger mode, is forecast to be adequate until the early 1980's when an additional flight would be required. For the Kodiak-Seattle link, an existing peak service level of one flight per day and a 60% load factor is assumed. The beginning of competitive service on this route and extensive construction work on Kodiak's runways the past two summers makes use of recent traffic data inappropriate. Even a 50% increase in service would not be required during the study period.

Rotary-wing operators will be used to transport personnel from offshore oil and gas activity worksites to service bases. An average of one helicopter round-trip per week from Seward is forecast for the mean base case (Eakland, 1979).

General aviation operations can be expected to increase, particularly in Kodiak and Anchorage, commensurate with population increases. At the major facilities in both communities, general aviation operations exceed those for air carriers (FAA, 1977). Training operations exceed both categories, reaching approximately one-third of total operations at

Anchorage and one-half at Kodiak. The percentage of general aviation and air carrier operations are 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 28,520m^2 (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 constructed 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.

Runway reconstruction at Kodiak's airport, which took place in the 1977 and 1978 construction seasons, will be continued in 1981 with rehabilitation of runway 18-36 and seal coating of runway 10-28. In addition, 1.2 hectares (3 acres) of tiedown space will be provided for general aviation, and runway lighting will be replaced (DOTPF, 1978).

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 communityor 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.

3.3.3.3 Carriers

Major carriers on interstate routes from Anchorage and Kodiak to Seattle and further south will gradually shift the mix of planes toward wide-body jets. At present, only five of the 18 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. Kodiak-Western Alaskan is anticipated to initiate Kodiak-Seattle service once start-up problems have been resolved.

No changes in the Anchorage-Seward market are anticipated, except for an additional flight per day when demand warrants.

3.3.3.4 Issues

Federal and State regulation 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 deregulation provided for increased competition on major passenger routes into Alaska from the Pacific Northwest. It is likely that the Alaska Transportation Commission, which has authority over intrastate air carriers, will lag behind the CAB in deregulation. 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.

Aside from regulation, issues vary from community to community. In Anchorage, a major issue is where to divert pilot training operations currently handled at Merrill Field and Anchorage International Airport. Another issue is whether the capital projects contained in the massive $250 million Master Plan for Anchorage International Airport can be completed on schedule.

At Kodiak, a major issue is the future of Kodiak Municipal Airport, which is the base of operations for Kodiak-Western Alaska Airlines and several air taxi operators. Land use conflicts eventually might lead the local government to shift operations to the main airport. If Merrill Field in Anchorage can be used as a precedent, the field will continue to be used for the foreseeable future. An institutional mechanism for expanding the passenger facilities needs to be found because of increased passenger service to the community.

Growth in the Seattle-Kodiak market could eventually lead to jet flight extensions to communities in Western Alaska such as Bethel, Dillingham, and Galena. This possibility would be increased by the emergence of a strong bottomfishing industry.

For Seward, the issue is whether traffic can increase to such a level that the service designation for the airport can be raised from General Aviation (GA). If so, corresponding design improvements would be more likely.

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 and Kodiak. 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, with smaller increases in service to and from Seward and Kodiak. 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 reasonably-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 $8-10 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 for less than could be achieved by providing 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 road needs on the Kenai Peninsula 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.

Without any major developments, increases in Kodiak's vehicle traffic will be limited principally to populated areas. The manner in which this traffic will be handled requires analysis having a local rather than a regional perspective.

Should port developments occur in Homer or Kenai and be able to attract a major shipper on a weekly basis, the need for trucking from Anchorage to the Kenai Peninsula will diminish. Demand for bus service will increase to and from Seward as a result of OCS oil and gas activities, general population growth, and higher gas prices. During construction of the Alyeska pipeline and terminal facilities, both bus and plane services increased between Valdez and Anchorage. Seward's shorter road distance from Anchorage. Seward's shorter road distance from Anchorage and its less-developed air facilities will cause proportionately higher usage of buses compared to the Valdez experience. Based on 112 peak non" ocal employees rotated through Seward in 1986, an additional four trips per week could be justified. Should problems develop with supplies of gas for automobiles, bus service can be expected to increase, particularly during the summer when fishing and recreational boating are at their peak in Kenai Peninsula ports.

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 and Whittier to Anchorage has never had a congestion problem, even during 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. An attempt is underway to have State primary routes declared part of the

Interstate system. If approved by the Federal Highway Administration, the State could receive additional funding. 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.

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. No impacts are expected in Kodiak beyond the city limits. No impacts on truck carriers are expected, unless major port development occurs in Kenai.

3.3.5 SUMMARY OF MEAN BASE CASE

Terminal impacts for the marine mode can be expected firstat Kodiak and later at Anchorage. Marine mode impacts at Seward will depend upon how Northern Gulf of Alaska OCS transportation requirements are handled. For the air mode, the extent of impacts on landing facilities depends upon the ability to divert training operations to feeder airports. Passenger terminal expansion will occur in Anchorage and needs will exist in Kodiak as two new airlines likely will enter interstate service. 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

Table 3-2

Community Areawide Population Forecasts for Base Case

Year	Seward[1]	Kodiak[2]
	Base Populations	
1978	2,600	9,027
	Factors to Produce Base Case Forecasts[3]	
1981	1.046	1.139
1982	1.063	1.198
1983	1.095	1.260
1984	1.140	1.329
1985	1.234	1.390
1986	1.225	1.440
1987	1.232	1.538
1988	1.266	1.525
1989	1.395	1.550
1990	1.440	1.583
1991	1.395	1.625
1992	1.361	1.688
1993	1.387	1.734
1994	1.422	1.774
1995	1.503	1.814
1996	1.509	1.845
1997	1.555	1.878
1998	1.602	1.901
1999	1.652	1.944
2000	1.703	1.977

Notes: (1) Seward and Seward fringe area. Includes impact of Sale No. 55 (Northern Gulf of Alaska) mean case.

(2) Population figures for Kodiak Road Connected Area.

(3) Population Factor for Year X = $\frac{\text{Population Year X}}{\text{1978 Population}}$

Source: Alaska Consultants, 1979.

Table 3-3

Regional Population Projections: Mean Base Case (BM)

Year	Statewide	Anchorage	Southcentral	Fairbanks
	Base-Year Populations			
1977	410,660	190,188	58,958	57,700
	Factors to Produce Forecasts[1]			
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	1.111	1.149	1.053	1.139
1982	1.187	1.238	1.076	1.329
1983	1.229	1.290	1.076	1.409
1984	1.227	1.286	1.100	1.334
1985	1.250	1.314	1.123	1.375
1986	1.293	1.365	1.159	1.442
1987	1.344	1.427	1.187	1.524
1988	1.395	1.490	1.224	1.599
1989	1.445	1.551	1.263	1.670
1990	1.492	1.609	1.303	1.736
1991	1.525	1.656	1.291	1.791
1992	1.557	1.704	1.283	1.849
1993	1.596	1.759	1.299	1.916
1994	1.638	1.817	1.314	1.987
1995	1.685	1.881	1.338	2.061
1996	1.737	1.952	1.368	2.142
1997	1.788	2.023	1.391	2.226
1998	1.841	2.099	1.413	2.312
1999	1.901	2.184	1.438	2.410
2000	1.962	2.266	1.465	2.511

Note: (1) Population Factor for Year X = $\frac{\text{Population year X}}{\text{1977 Population}}$

Source: ISER, 1979.

Table 3-4

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

Year After Lease Sale	Calendar Year	Anchorage(1) Dry Bulk	Anchorage(1) Petroleum	Whittier (1) Dry Bulk	Whittier (1) Petroleum	Kodiak Dry Bulk	Kodiak Petroleum
1	1981	1.1	1.1	2.0	1.9	1.1*	1.1
2	1982	1.3	1.2	2.1	1.9	1.2**	1.2
3	1983	1.3	1.3	1.8	1.6	1.2**	1.3
4	1984	1.3	1.3	1.8	1.6	1.2**	1.3
5	1985	1.3	1.3	1.3	1.0	1.3**	1.4
6	1986	1.4	1.4	1.4	1.0	1.3**	1.4
7	1987	1.4	1.4	1.4	1.0	1.4**	1.5
8	1988	1.5	1.5	1.5	1.0	1.4**	1.5
9	1989	1.5	1.5	1.5	1.0	1.4**	1.6
10	1990	1.6	1.6	1.6	1.0	1.5**	1.6
11	1991	1.6	1.6	1.6	1.0	1.5**	1.6
12	1992	1.7	1.7	1.7	1.0	1.5**	1.7
13	1993	1.8	1.7	1.7	1.0	1.6**	1.7
14	1994	1.8	1.8	1.8	1.0	1.6**	1.8
15	1995	1.9	1.8	1.8	1.0	1.6**	1.8
16	1996	2.0*	1.9	1.9	1.0	1.7**	1.9
17	1997	2.0*	2.0	2.0	1.0	1.7**	1.9
18	1998	2.1*	2.1	2.0	1.0	1.7**	1.9
19	1999	2.2*	2.1	2.1	1.0	1.8**	1.9
20	2000	2.3*	2.2	2.2	1.0	1.8**	2.0*
Threshold Value for Low Capacity		1.9	2.2	2.7	No		1.9
Threshold Value for High Capacity		2.7	3.5	3.9	Increase	1.1	4.0
Low Value (year)		1.1 (1981)	1.1 (1981)	1.3 (1985)	Expected	1.1 (1981)	1.1 (1981)
High Value (year)		2.3 (2000)	2.2 (2000)	2.2 (2000)		1.8 (1999)	2.0 (2000)
Value Exceeding Low Capacity		*					
Value Exceeding High Capacity		**					

Note: (1) Source - Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-4 (Continued)

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

		Seward (1)					
		Dry Bulk				Petroleum	
Year After Lease Sale	Calendar Year	Mean Base and Base Development	Consumables (Inbound)	Drilling (Throughput)	Construction (Throughput)	Mean Base (Inbound)	Drilling (Throughput)
1	1981	2.4		0.2		1.1	0.4
2	1982	2.5		0.2		1.1	0.6
3	1983	1.8		0.2		1.1	1.0
4	1984	1.8		0.4		1.1	1.2
5	1985	1.3		0.4	0.4	1.2	1.4
6	1986	1.4		0.4	0.2	1.2	1.6
7	1987	1.4		0.4	0.2	1.2	1.2
8	1988	1.5		0.4	0.7	1.2	1.6
9	1989	1.6		0.4	0.2	1.3	1.6
10	1990	1.6		0.2		1.3	0.6
11	1991	1.6		0.2		1.3	0.6
12	1992	1.7		0.2		1,3	0.4
13	1993	1.7				1.4	
14	1994	1.8				1.4	
15	1995	1.8				1.5	
16	1996	1.9				1,5	
17	1997	1.9				1.5	
18	1998	2.0				1.6	
19	1999	2.1				1.6	
20	2000	2.2				1.7	
Threshold Value for Low Capacity		3.8				3.3	
Threshold Value for High Capacity		5.4				4.6	
Low Value (year)		1.3 (1984)				1.1 (1981-84)	
High Value (year)		2,0 (2000)				1.7 (2000)	
Value Exceeding Low Capacity		*					
Value Exceeding High Capacity		**					

Note: (1) Source - Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-5
Increased Air Travel (Total Weekly Trips) from Kodiak, Seward and Anchorage - Mean Base Case (BM)(1, 2,4)

	Kodiak-Anchorage[3]	Kodiak-Seattle[3]	Seward-Anchorage			Anchorage-Seattle		
Year	Mean Base Growth	Mean Base Growth	Mean Base Growth	Mean No. Gulf	Total	Mean Growth	Mean Devel.(1)	Total
1 (1981)	147	65	12	12	24	1,918	957	2,875
2 (1982)	209		16	18	34	3,063	1,162	4,225
3 (1983)	275	1;:	23	30	53	3,732	1,535	5,267
4 (1984)	347	152	34		68	3,680	1,520	5,200
5 (1985)	412	181	57	1?;	169	4,040	683	4,723
6 (1986)	464	204	54	46	100	4,697	778	5,475
7 (1987)	568	249	56	22	78	5,494	628	6,122
8 (1988)	554	243	64	28	92	6,305	897	7,202
9 (1989)	580	255	95	44	139	7,090	1,188	8,278
10 (1990)	615	270	106	24	130	7,836	1,019	8,855
11 (1991)	659	289	95	10	105	8,441	820	9,261
12 (1992)	726	318	87	4	91	9,058	722	9,780
13 (1993)	744	340	93	4	97	9,766	628	10,394
14 (1994)	816	358	102	4	106	10,512	47	10,559
15 (1995)	858	377	121	4	125	11,335	24	11,359
16 (1996)	891	391	123	4	127	12,249	8	12,257
17 (1997)	926	406	134	4	138	13,162	1	13,163
18 (1998)	950	417	145	4	149	14,140	1	14,141
19 (1999)	995	437	157	4	161	15,234	1	15,235
20 (2000)	1,030	442	169	4	173	16,289	1	16,290

Lowest % Growth (year)

Threshold Values[4]

3 fits/day 794	1.5 fits/day	3 fits/day	80	50% increased service	6,433
4 fits/day 1,410 (jet)	(jet)-462	4 fits/day (commuter)	213	100% increased service	12,866

NOTES: (l)''Growth" traffic is based on local population growth beyond 1977-1978

(2) ''Development" and "No. Gulf" traffic is based on non-local employees on development projects

(3) Single base case has been developed for Kodiak. It has been treated as the mean base case

(4) Threshold values based on 110 passenger jets for Kodiak routes, 19 passenger commuter plane for Seward and mix of jets for Anchorage-Seattle.

SOURCE : Peter Eakland and Associates, 1979 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 preceding lease sales in the Lower Cook Inlet, Beaufort Sea, and Northern Gulf of Alaska. Exploration in the Lower Cook Inlet sale will have been virtually completed in 1981. No development produces lower population levels in Anchorage and Seward.

Table 3-6 shows factors which are a ratio of forecast to base year regional populations. For Seward, results of the low OCS case are carried forward from the Northern Gulf of Alaska impact assessment (Peter Eakland & Associates).

3.4.2 WATER MODE

3.4.2.1 Description of Activities

Significant differences in forecasts of waterborne commerce due to lack of economic discoveries in the Northern Gulf of Alaska will occur only in Seward (Table 3-7). Kodiak base year factors in the low base case are unchanged from the mean base case for both fuel and dry freight. For Anchorage and Whittier, only slight shifts occur.

3.4.2.2 Terminals

Impacts occurred at Anchorage, Seward, and Kodiak in the mean base case. For Seward, impacts are reduced because of the lack of direct OCS impacts after 1984. No additional facilities will be required for either non-OCS or OCS freight requirements. A single, dedicated berth for supply boats will be adequate during the 1981-1984 exploration period in the Northern Gulf. No change from the mean base to the low base case exists for Kodiak. At Anchorage, the largest difference is 20% of the base tonnage level and occurs in the late 1980's and early 1990's. At the end of the study period, the difference is only 10%, and the low capacity threshold will be first exceeded in 1995, one year later than in the mean base case. For fuel, the low capacity threshold is reached in 2000, two years later than in the mean base case. At Whittier, the difference never exceeds 10% of the port's base year tonnage figures and no impacts are expected.

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 lack of new OCS development activities, particularly in the Beaufort Sea.

3.4.2.4 Issues

The absence of oil and gas development and production phases in the Northern Gulf of Alaska removes the port expansion issue for Seward that existed in the mean base case. Traffic to make port expansion feasible in that community will have to come exclusively from other sources. Other issues discussed in the mean base case remain.

3.4.2.5 Summary of Impacts

Compared to the mean base case, port demands will not change in Kodiak; and in Anchorage and Whittier, similar demand levels will occur one to two years later because of lower population growth. Impacts in Seward will be measurably reduced. For carriers, lesser demand will exist for contract tug and barge operations due to lower levels of OCS activity in the Beaufort Sea and Northern Gulf of Alaska.

3.4.3 AIR MODE

3.4.3.1 Description of Activities

Low base case development will not cause any change in travel on the Kodiak-Seattle and Kodiak-Anchorage links. Table 3-8 shows the forecasts for the Seward-Anchorage and Anchorage-Seattle links. For the Seward-Anchorage link, there are no OCS impacts after 1984. Nonlocal employee travel is at its highest in the first year of exploration in 1981 - 42 trips per week.

The total could be accommodated with existing service. After 1984, the forecasts are virtually the same as those for the mean base case.

Low base case conditions cause a 19% drop in passenger traffic in 1981 on the Anchorage-Seattle link compared to the mean base case. The forecast 525 passenger reduction compared to BM in that year gradually increases to 1,458 in 1989 and then drops back to 811 by 2000. One helicopter round-trip per week from Seward will be adequate during the four years of exploration.

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 exceeds 20% of the forecast growth in any one year. The timing of increases is shifted several years, but basic needs remain unchanged.

The need for additional ground facilities in Seward is diminished.

3.4.3.3 Carriers

Demand for scheduled carriers will remain approximately the same. Business for contract cargo carriers and helicopter operators will be less, but principally because of lack of discoveries off Yakutat and in the Beaufort Sea.

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 in the Anchorage-Seattle and Seward-Anchorage markets, particularly after 1984 when exploration will end for preceding lease sales. Continuing population growth will not change the need for improvements in ground facilities at Anchorage International Airport. Differential impacts on air carriers serving Anchorage, Seward, and Kodiak will be minimal.

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 capacity of the motor carrier industry can be expected since no developments 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 more to lack of development in the Beaufort Sea than any other OCS activities.

3.4.4.3 Issues

For road construction, the funding problem remains paramount. The railroad and the trucking industry respond to state-wide 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.

The exception is Seward where lack of Northern Gulf development will reduce the need for marine and air facility improvements. Road needs will not change dramatically, as they are based primarily on recreational rather than local traffic.

Table 3-6

Regional Population Projections: Low Base Case (BL)

Year	Statewide	Anchorage	Southcentral	Fairbanks(1)
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Factors to Produce Forecasts(2)		
1981	1.101	1.141	1.018	1.139
1982	1.177	1.228	1.047	1.329
1983	1.218	1.280	1.036	1.409
1984	1.213	1.274	1.044	1.334
1985	1.230	1.297	1.053	1.375
1986	1.264	1.337	1.069	1.442
1987	1.302	1.384	1.090	1.524
1988	1.344	1.435	1.113	1.599
1989	1.387	1.489	1.136	1.670
1990	1.428	1.540	1.163	1.736
1991	1.466	1.594	1.157	1.791
1992	1.504	1.645	1.175	1.849
1993	1.547	1.705	1.195	1.916
1994	1.591	1.764	1.216	1.987
1995	1.637	1.828	1.238	2.061
1996	1.683	1.892	1.259	2.142
1997	1.734	1.964	1.281	2.226
1998	1.787	2.039	1.303	2.312
1999	1.846	2.122	1.328	2.410
2000	1.906	2.203	1.355	2.511

Notes: (1) Values for Fairbanks are the same as Mean Base Case (BM).
(2) Population Factor for Year X = $\frac{\text{Population Year X}}{\text{1977 Population}}$

Source: ISER, 1979; Peter Eakland and Associates, 1979.

Table 3-7

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

		Anchorage(1)		Whittier(1)		Kodiak	
Year	Calendar Year	Dry Bulk	Petroleum	Dry Bulk	Petroleum	Dry Bulk	Petroleum
1	1981	.1	1.1	2.0	1.9	1.1*	1.1
2	1982	.3	1.2	2.0	1.9	1.2**	1.2
3	1983	.3	1.3	1.8	1.6	1.2**	1.3
4	1984	.3	1.3	1.8	1.6	1.3**	1.3
5	1985	.3	1.3	1.3	1.0	1.3**	1.4
6	1986	.4	1.3	1.3	1.0	1.4**	1.4
7	1987	.4	1.4	1.4	1.0	1.4**	1.5
8	1988	.5	1.4	1.4	1.0	1.4**	1.5
9	1989	1.5	1.5	1.5	1.0	1.5**	1.6
10	1990	1.6	1.5	1.5	1.0	1.5**	1.6
11	1991	1.6	1.6	1.6	1.0	1.5**	1.6
12	1992	1.7	1.7	1.6	1.0	1.6**	1.7
13	1993	1.7	1.7	1.7	1.0	1.6**	1.7
14	1994	1.8	1.8	1.8	1.0	1.6**	1.8
15	1995	1.9	1.8	1.8	1.0	1.7**	1.8
16	1996	1.9	1.9	1.9	1.0	1.7**	1.9
17	1997	2.0*	2.0	1.9	1.0	1.7**	1.9
18	1998	2.1*	2.0	2.0	1.0	1.8**	1.9
19	1999	2.2*	2.1	2.1	1.0	1.8**	1.9
20	2000	2.3*	2.2	2.2	1.0	1.8**	2.0*
Threshold Value for Low Capacity		1.9	2.2	2.7	No Increase Expected	-	1.9
Threshold Value for High Capacity		2.7	3.5	3.9		1.1	4.0
Low Value (year)		1.1 (1981)	1.1 (1981)	1.3 (1985-86)		1.1 (1981)	1.1 (1981)
High Value (year)		2.3 (2000)	2.2 (2000)	2.2 (2000)		1.8 (2000)	2.0 (2000)

Value Exceeding Low Capacity *

Value Exceeding High Capacity **

Note: (1) Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-7 (Continued)

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

Seward (1)

		Dry Bulk				Petroleum	
Year	Calendar Year	Low Base and Base Development	Consumables (Inbound)	Drilling (Throughput)	Construction (Throughput)	Low Base (Inbound)	Drilling (Throughput)
1	1981	2.4		0.2		1.1	0.6
2	1982	2.5		1.2		1.1	1.0
3	1983	1.8		0.2		1.1	1.4
4	1984	1.8				1.1	0.2
5	1985	1.3				1.2	
6	1986	1.4				1.2	
7	1987	1.4				1.2	
8	1988	1.5				1.2	
9	1989	1.6				1.3	
10	1990	1.6				1.3	
11	1991	1.6				1.3	
12	1992	1.7				1.3	
13	1993	1.7				1.4	
14	1994	1.8				1.4	
15	1995	1.8				1.5	
16	1996	1.9				1.5	
17	1997	1.9				1.5	
18	1998	2.0				1.6	
19	1999	2.1				1.6	
20	2000	2.2				1.7	
Threshold Value for Low Capacity		3.8				3.3	
Threshold Value for High Capacity		5.4				4.6	
Low Value (year)		1.3 (1985)				1.1 (1981-84)	
High Value (year)		2.4 (1981)				1.7 (2000)	
Value Exceeding Low Capacity		*					
Value Exceeding High Capacity		**					

Note: (1) Source - Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-8

Increased Air Travel (Total Weekly Trips) from Seward and Anchorage - Low Base Case (BL)(1, 2, 3, 4)

	Seward-Anchorage(4)			Anchorage-Seattle(4)		
Year	Low Base Growth	Low No. Gulf	Total	Low Base Growth	Low Devel.(1)	Total
1 (1981)	13	42	55	1,815	510	2,325
2 (1982)	18	38	56	2,934	748	3,682
3 (1983)	22	26	48	3,603	1,220	4,850
4 (1984)	29	7	36	3,526	1,061	4,587
5 (1985)	40		40	3,822	173	3,995
6 (1986)	41		41	4,336	171	4,497
7 (1987)	42		42	4,941	243	5,184
8 (1988)	43		43	5,597	388	5,985
9 (1989)	58		58	6,292	528	6,820
10 (1990)	71		71	6,948	501	7,449
11 (1991)	74		74	7,643	558	8,201
12 (1992)	77		77	8,299	485	8,784
13 (1993)	86		86	9,071	464	9,535
14 (1994)			96	9,830	39	9,869
15 (1995)	1:;		106	10,654	18	10,672
16 (1996)	116		116	11,477	5	11,482
17 (1997)	127		127	12,403		12,403
18 (1998)	138		138	13,368		13,368
19 (1999)	150		150	14,436		14",436
20 (2000)	162		162	15,478		15,478

Lowest % Induced (Year) 23.6% (1981)

Threshold Values

3 fits/day (commuter)	80
4'fits/day (commuter)	213

50% service increase	6,433
100% service increase	12,866

NOTES:
(1) "Growth" traffic is based on local population growth beyond 1977-1978
(2) "Development" and "No. Gulf" traffic is based on non-local employees on development projects
(3) Single base case has been developed for Kodiak. It has been treated as the mean base case
(4) Threshold values based on 110 passenger jets for Kodiak routes, 19 passenger commuter plane for Seward, and mix of jets for Anchorage-Seattle

Kodiak is assumed to be isolated from impacts of previous lease sales, although transshipment to Cordova in 1977 represented 6% of outbound freight tonnage from Kodiak.

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, Beaufort Sea and Northern Gulf of Alaska lease sales. Discoveries at the 5% probability level will result in direct OCS transportation demands for employees and freight but also indirect demands resulting from population increases at the local and regional levels. Regional population factors are shown in Table 3-9. A high base case does not exist for Kodiak, since it was not included among local communities examined in previous lease sales. For Seward, the high OCS case developed for the Northern Gulf lease sale has been used. The transportation of goods through the ports of Anchorage, Seward, and Whittier will increase as will passengers through air terminals in Anchorage and Seward. The ports will be affected by all of the lease sales although impacts in Seward will derive principally from Northern Gulf activities. Anchorage's passenger terminal will be impacted by all lease sales while impacts at Seward's terminal will be limited to the Northern Gulf sale.

3.5.2 WATER MODE

3.5.2.1 Description of Activities

For the Ports of Anchorage, Seward, and Whittier, increases in regional population, compared to the mean base case, produce corresponding increases in population-related tonnage (Table 3-10). At Anchorage and Whittier, the difference in any one year from the mean base case for dry goods and fuel is never more than 10% of base year tonnage. At Seward, the largest difference for population-related tonnage is 20% for dry freight and 30% for fuel.

At Seward, the increases in tonnage due to higher levels of development in the Northern Gulf are more dramatic. Differences from the mean base case are slight until the late 1980's when throughput tonnages for drilling and construction become four to five times greater than those forecast for the mean base case. The highest total for drilling in the high base is a base year factor of 1.8 compared to 0.4 in the mean base case. The largest high base construction figure is 1.4 (1989) with a corresponding 0.7 mean base figure. High tonnage figures for the years 1987-1989 are due primarily to outbound concrete-coated pipe for use in offshore pipelines. The highest one-year total of the two activities is 3.0 in the high case (1989) and 1.1 in the mean base case (1988).

3.5.2.2 Terminals

At Anchorage, the low capacity threshold for dry freight is first exceeded in 1995, one year earlier than in the mean base case. A two-year shift occurs for petroleum shipments. The low capacity threshold is reached in 1998 for the high base case and in 2000 for the mean base case.

Construction of a support base is assumed at Seward. Without construction of such a facility, severe congestion would result during the development phase. Given an adequate service base, existing facilities will be able to handle forecast traffic. The largest base year tonnage factor for all tonnage except Northern Gulf OCS activities is 2.5 compared to a low theshold value hod 3.8. Peak monthly supply boat round-trips increase from 131 in 1986 for the mean base case to 250 in 1998 for the high base case. An increase of minimum dedicated berths from three to five is required. Total linear berthing space required would be 3,048m (1,000 ft.). More than two berths are required only for four consecutive years, 1988-1991, in the high base case.

3.5.2.3 Carriers

No changes from the base case are forecast for scheduled carriers, although the higher level of activity in Seward should help generate traffic to sustain the Seattle-Seward market for Pacific-Alaska Lines.

A higher demand for contract tug and barges will exist, primarily because of high development in the Beaufort Sea, but given adequate lead time, the necessary equipment can be made available.

3.5.2.4 Issues

No new issues arise in the high base case, but some have greater significance because of the higher level of development. Chief among these are questions related to the Seward OCS operations, such as location of the support base, logistics for the pipe-coating plant, access for the support base, and sizeof the support base.

3.5.2.5 Summary of Impacts

Low theshołds are reached at the Port of Anchorage for fuel and dry freight two and one years earlier, respectively, in the high case. At Seward, no additional general cargo facilities are required but two additional berths at the service base are required compared to the mean base case.

3.5.3 AIR MODE

3.5.3.1 Description of Activities

A higher level of development and production activities will produce air traffic demands of a higher magnitude and of longer duration than were experienced during the mean base case. Table 3-11 shows traffic increases for population growth and development on the Seward-Anchorage and Anchorage-Seattle links. The traffic increase on the Anchorage-Seattle link is substantial because it is impacted by all previous lease sales. By 1984, the increase over the mean base case is 1,500 persons per week. In the next year, the difference peaks at 1,653 weekly travelers which is 35% of the mean base case figure. The difference remains relatively steady until the early 1990's and then falls gradually to 1,160 by the end of the study period. The year in which service is expected to double is advanced one year to 1996. Despite the major increases in traffic during the development phase of OCS activities, no pronounced peaking occurs. Only in one year is total forecasted traffic less than that of the previous year. This fact emphasizes the market segment that is tied to Anchorage's population base.

Differences from the mean base case for the Seward-Anchorage link are proportionately less than for the Anchorage-Seattle link because it is affected by only one lease sale. Peak weekly trips increase from 167 in the mean base to 200 in the high base case. High traffic occurs during development (1990) rather than at the end of the study period which shows the dominance of direct OCS-induced demand. Between 1984 and 2000, additional trips fall between the range of traffic justifying an additional flight per day using commuter airline equipment which is estimated to be 80-213 passengers. Such service could be provided by the existing carrier using commuter-type aircraft.

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 early 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. From a terminal-use perspective, the 2,581 development trips have a greater impact than 4,169 trips originating locally in Anchorage. Of course, a certain percentage of this latter group also does not change from the mean base case as long as secondary facilities can be constructed to provide for training and general aviation operations. No major differences in impacts are noted at Seward although the need for a passenger terminal there becomes more pronounced.

3.5.3.3 Carriers

Despite the greater increase in traffic, no new routes are anticipated. Carriers should be able to meet increased demands on existing routes. Service to Seward is limited by local traffic but also because no scheduled flights are available from there to any other community than Anchorage. The large demand due to petroleum industry activities could lead to direct flights to Anchorage by a carrier such as Braniff with extensive routes in the south and southwest of the country.

3.5.3.4 Issues

No new issues emerge in the high base case. 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 plans.

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 similar levels of congestion to occur one year earlier. As in the mean base case, four bus trips a week to and from Seward above existing conditions would be adequate to handle nonlocal employees generated by OCS activities.

3.5.4.2 Railroad

Additional traffic will occur on the Alaska Railroad, particularly due to increased OCS development in the Beaufort Sea.

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 cause an earlier need for port improvements in Anchorage and passenger facilities at Anchorage International Airport. The timing of separate facilities in Seward to accommodate OCS development activities does not change but additional berths and land-side storage are required. 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 3-9

Regional Population Projections: High Base Case (BH)

Year	Statewide	Anchorage	Southcentral	Fairbanks(1)
		Base-Year Populations(2)		
1977	410,660	190,188	58,958	57,700
		Factors to Produce Forecasts		
1981	1.106	1.145	1.041	1.139
1982	1.184	1.231	1.099	1.329
1983	1.241	1.298	1.145	1.409
1984	1.267	1.324	1.226	1.334
1985	1.316	1.381	1.290	1.375
1986	1.365	1.445	1.291	1.442
1987	1.418	1.511	1.318	1.524
1988	1.473	1.577	1.375	1.599
1989	1.519	1.635	1.403	1.670
1990	1.557	1.678	1.455	1.736
1991	1.598	1.739	1.452	1.791
1992	1.633	1.787	1.445	1.849
1993	1.672	1.844	1.454	1.916
1994	1.715	1.903	1.473	1.987
1995	1.761	1.966	1.491	2.061
1996	1.808	2.031	1.515	2.142
1997	1.862	2.105	1.544	2.226
1998	1.917	2.184	1.567	2.312
1999	1.978	2.271	1.593	2.410
2000	2.040	2.355	1.616	2.511

Notes: (1) Fairbanks values are the same as Mean Base Case (BM).
(2) Population Factor for Year X = $\frac{\text{Population Year X}}{\text{1977 Population}}$

Source: ISER, 1979.

Table 3-10

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

	Anchorage (1)		Whittier(1)		Kodiak	
Year	Dry Bulk	Petroleum	Dry Bulk	Petroleum	Dry Bulk	Petroleum
1	1.1	1.1	2.0	1.9	1.1*	1.1
2	1.3	1.2	2.1	1.9	1.2**	1.2
3	1.3	1.3	1.8	1.6	1.2**	1.3
4	1.3	1.3	1.8	1.6	1.3**	1.3
5	1.4	1.4	1.4	1.0	1.4**	1.4
6	1.5	1.5	1.4	1.0	1.4**	1.4
7	1.5	1.5	1.6	1.0	1.5**	1.5
8	1.6	1.6	1.6	1.0	1.5**	1.5
9	1.7	1.6	1.6	1.0	1.5**	1.6
10	1.7	1.7	1.7	1.0	1.5**	1.6
11	1.8	1.7	1.7	1.0	1.6**	1.6
12	1.8	1.8	1.8	1.0	1.6**	1.7
13	1.9	1.9	1.8	1.0	1.7**	1.7
14	1.9	1.9	1.9	1.0	1.7**	1.8
15	2.0*	2.0	2.0	1.0	1.7**	1.8
16	2.1*	2.0	2.0	1.0	1.8**	1.9
17	2.1*	2.1	2.1	1.0	1.8**	1.9
18	2.2*	2.2	2.2	1.0	1.8**	1.9
19	2.3*	2.3*	2.2	1.0	1.8**	1.9
20	2.4*	2.4*	2.3	1.0	1.9**	2.0*
Threshold Value for Low Capacity	1.9	2.2	2.7	No Increase Expected		1.9
Threshold value for High Capacity	2.7	3.5	3.9		1.1	4.0
Low Value (year)	1.1 (1981)	1.1 (1981)	1.4 (1985-86)		1.1 (1981)	1.1 (1981)
High Value (year0	2.4 (2000)	2.4 (2000)	2.3 (2000)		1.9 (2000)	2.0 (2000)
Value Exceeding Low Capacity	*					
Value Exceeding High Capacity	**					

Note: (1) Source - Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-10 (continued)

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

	Seward (1)					
	Dry Bulk				Petroleum	
Year	High Base and Base Development	Consumables (Inbound)	Drilling (Throughput)	Construction (Throughput)	High Base (Inbound)	Drilling (Throughput)
1	2.4		0.2		1.1	0.4
2	2.5		0.2		1.1	0.8
3	1.9		0.4		1.1	1.2
4	1.9		0.6	0.5	1.2	2.2
5	1.4		0.4	0.5	1.2	2.0
6	1.5		0.2	0.2	1.2	0.6
7	1.6		0.2	1.1	1.3	0.6
8	1.7		0.6	1.3	1.4	2.0
9	1.7		1.6	1.4	1.5	4.6
10	1.8		1.8	0.3	1.6	6.0
11	1.8		1.0		1.6	2.8
12	1.8		0.4		1.5	1.6
13	1.8		0.2		1.5	1.0
14	1.9				1.5	
15	2.0				1.5	
16	2.0				1.5	
17	2.1				1.6	
18	2.2				1.6	
19	2.2				1.7	
20	2.3				1.7	
Threshold Value for Low Capacity	3.8				3.3	
Threshold Value for High Capacity	5.4				4.6	
Low Value (year)	1.4 (1985)				1.1 (1981-83)	
High Value (year)	2.4 (1981)				1.7 (2000)	
Value Exceeding Low Capacity	*					
Value Exceeding High Capacity	**					

Note: (1) Source - Eakland, Northern Gulf of Alaska Transportation Systems Impact Analysis (Draft), 1979.

Source: Peter Eakland and Associates, 1979.

Table 3-11

Increased Air Travel (Total Weekly Trips) from Seward and Anchorage - High Base Case (BH) (1, 2, 3,4)

Year After Lease Sale	Year	Seward-Anchorage High Base Growth	Seward-Anchorage High Devel.	Seward-Anchorage Total	Anchorage-Seattle High Base Growth	Anchorage-Seattle High Devel.'1)	Anchorage-Seattle Total
1	1981	12	15	27	1,866	764	2,630
2	1982	17	26	43	2,973	1,294	4,267
3	1983	24	38	62	3,835	2,227	6,062
4	1984	43	115	157	4,169	2,581	6,750
5	1985	52	70	122	4,902	1,461	6,363
6	1986	53	36		5,726	1,251	6,977
7	1987	69	39	1::	6,575	744	7,319
8	1988	105	36	141	7,424	1,389	8.813
9	1989	125	60	185	8,170	1,541	9,711
10	1990	136	64	200	8,724	1,360	10,084
11	1991	139	52	191	9,508	1,362	10,870
12	1992	114	29	143	10,126	1,070	11,196
13	1993	114	14	128	10,859	943	11,802
14	1994	110	14	124	11,618	112	11,730
15	1995	126	14	140	12,429	47	12,476
16	1996	126	14	140	13,265	14	13,279
17	1997	137	14	151	14,217	3	14,220
18	1998	148	14	162	15,234	3	15,237
19	1999	160	14	174	16,252	3	16,357
20	2000	171	14	185	17,434	3	17,437

	Seward-Anchorage		Anchorage-Seattle
Lowest % Induced (Year)	26.8% (1984)		61,8%(1984)
Threshold Values			
3 fits/day	80	50% service increase	6,433
4 fits/day	213	100% service increase	12,866

NOTES :
(1) "Growth" traffic is based on local population growth beyond 1977-1978
(2) "Development" and "No. Gulf" traffic is based on non-local employees on development projects
(3) Single base case has been developed for Kodiak. It has been treated as the mean base case
(4) Threshold values based on 110 passenger jets for Kodiak routes, 19 passenger commuter plane for Seward, and mix of jets for Anchorage-Seattle

Source: Pete Eakland and Associates, 1979.

4.0 WESTERN 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 level. The analysis of local impacts focuses on the communities of Seward, Kodiak, and Anchorage. The analysis of regional impacts focuses on routes, especially for the marine mode and intercity roads on the Kenai Peninsula.

Figure 1-2 shows the location of areas selected for development in the Middle Albatross and Tugidak Basins. 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 south of major shipping lanes. Two 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 Kodiak’s port facilities, and (2) conflicts between commercial carriers and supply boats in the approach to Kodiak’s port facilities and where routes from Seward cross commercial routes. 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 Western 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 low-OCS-low base case (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 Western 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 and Kodiak--total population forecasts are made for each scenario, since only a single base forecast is made. At the regional level, 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, low capacity threshold values for dry bulk will be reached in 1995 and for petroleum in 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 will be adequate during the study period if training operations can be eliminated. Priorities at Anchorage are first for air facilities and later for marine facilitites, but the reverse situation exists at Kodiak. The community's port facilities are already at the computed low capacity threshold figure and will reach the high capacity figure by 1981. Runway capacity will be adequate but with two and possibly three carriers offering Kodiak-Seattle service and with forecast traffic increases on the Kodiak-Seattle link, passenger facilities will require upgrading in the near future.

At Seward, existing facilities will be adequate for population-related growth. A separate construction support base to be built in 1985 will serve boats and barges supplying offshore work sites in the Middleton and Yakataga Shelves. Also, Seward will serve as one of several entry ports for development activities in the Interior, particularly during the early 1980's.

The separation of OCS and non-OCS marine transportation activities after 1985 will eliminate potential congestion at existing port facilities. Gradual expansion of general and commuter aviation activities at Seward increases the need for the construction of a modest passenger terminal.

4.3 Mean-OCS-Mean Base Case (MBM)

4.3.1 FACTORS CAUSING GROWTH

Direct OCS-related transportation demands are the results of activities shown in Table 4-4. No exploration or development is expected to occur in the Tugidak Basin. Construction is limited to a service base at Women's Bay in Kodiak. An economic discovery of oil is made in the Albatross Basin, but the find is inadequate to support a pipeline to shore and an oil terminal. No economic discoveries of gas occur. Seward will provide all logistics support for exploration activities. Kodiak and Seward will divide logistics support requirements during development, and Kodiak will provide full support during production. Helicopter transportation will be required to move employees between offshore work sites and airports; and scheduled carriers are assumed to transport nonlocal employees from Seward and Kodiak to their residences in the lower 48 or elsewhere in Alaska.

Table 4-1 shows the incremental base year factors for the two regions in the study area--Anchorage and Southcentral Alaska (excluding Anchorage). Fairbanks is assumed to have the same values for the MBM case as for the mean base case. Additional population growth does not even reach 1% of the base year population for the Anchorage region and exceeds this value during only one year in the Southcentral Region.

For the local level, Table 4-2 shows the population forecasts for the three OCS scenarios and Table 4-3 shows these data converted into incremental base year growth factors. For the mean base case, the highest increase for Seward is 2.3% of the base year population, which occurs in 1986, and 1.2% for Kodiak, in 1988.

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. Tables 4-5 and 4-6 show the tonnages required for drilling operations supplied by Kodiak and Seward, respectively. Seward is assumed to provide all support during exploration and one-half of the support during development.

Addition of Western Gulf exploration more than doubles OCS activities in the Port of Seward for 1981-1982. Total OCS-related tonnage for fuel in 1982 will be over 100% greater than the existing throughput tonnage, but for dry freight, the increase will be only 50%. Highest total OCS tonnages for drilling will occur in 1988 when the Northern and Western base year throughput factors are 0.4 and 0.2, respectively, for dry freight and 1.5 and 0.8 respectively, for fuel. By this time, the support base will have been operational for several years.

For the years 1986-1989, Western Gulf tonnages at Kodiak will be the same as those in Seward. Total direct OCS drilling tonnages will be only one-third of those in Seward because Kodiak does not provide support for any previous lease sales. Base year throughput factors are lower because

Kodiak's 1977 throughput tonnage is approximately five times that of Sews rd. All OCS industrial freight in Kodiak is assumed to be handled by a separate support facility.

The only additional construction required in the MBM case is the support base in Kodiak. Facilities constructed in Seward for the mean scenario in the Northern Gulf are assumed to be adequate for Western Gulf support. An estimated nine barges will be required at the Kodiak work site in 1984 (Table 4-7).

Requirements for consumables in the mean scenario are modest, never exceeding the equivalent of one container per month in Seward nor five per month in Kodiak (Table 4-8).

Supply Boat Movements and Berths. Table 4-9 shows the estimated number of supply boat round-trips from Seward and Kodiak based on assumptions contained in Table A-10. One berth at each support base is adequate to serve Western Gulf activities alone. Combining Northern and Western Gulf mean scenario requirements at Seward (Table 4-10) does not change maximum berth requirements of three. In only one year--1985--are berth requirements increased. The increase is from one to two berths. Platform installation commences one year earlier in the Western Gulf than in the Middleton Shelf of the Northern Gulf.

Induced Growth. No changes in port activity occur at any of the facilities analyzed--Kodiak, Anchorage, Seward, or Whittier--that cause increases in the base year factors for a given year as great as 10%. The small amount of Western Gulf OCS development results in low incremental growth in permanent populations at the regional and local levels.

Transportation of Oil and Gas. Oil tanker traffic will begin in 1987 and continue throughout the study period (Table 4-11). Peak traffic will be in 1989-1990 and amount to 26 tankers per year or one every two weeks.

4.3.2.2 Summary of Impacts

Terminals. No changes in demand from the mean base case occur at either Whittier or Anchorage port facilities because their demand is primarily population-related and in the case of Whittier includes base case development activities. Changes in population-related demand at Kodiak and Seward are also limited but these communities also receive industrial OCS tonnage.

Impacts at Kodiak are minimized by basing all support activities out of Seward until a support base is constructed. The support base requires only a single berth but a design permitting simultaneous berthing of two ships, such as was constructed for Yakutat, likely would be provided. In this case, approximately 122 lineal m (400 ft.) of berthing space would be required. At Seward, "existing facilities would be used for exploration. Despite concurrent exploration in the Middleton Shelf (Northern Gulf) and Albatross Basin (Western Gulf), existing facilities will be adequate unless large seasonal differences exist. The potential for congestion is most likely before the support facility is built. In the early 1980's, not only will existing facilities be supporting concurrent exploration of the Northern and Western Gulf, but they will also serve as an entry port for breakbulk cargo to be used in development activities in the Interior and on the North Slope. Totals for indirect growth, base development, and Northern and Western Gulf activities produce a base year throughput tonnage factor in 1982 of 3.0 for dry freight, which is below the low and high capacity thresholds of 3.78 and 5.42. Large seasonal differences would have the effect of lowering the threshold numbers but are not expected except for construction materials. Should congestion occur, non-OCS cargo could enter through the alternative ports of Whittier, Anchorage, and for some goods, possibly Valdez. Fuel tonnage is expected to come closer to the low capacity threshold than dry freight. At Seward, the thresholds are variable, since both dry freight and fuel vessels use the Alaska Railroad dock. Adjustments could be made if one commodity reaches a threshold before the other.

An analysis of cumulative supply boat berth requirements provides a different perspective for looking at the potential for congestion at Seward. The size of the base to be constructed in 1985 does not change, but the timing of its need may have shifted one year. In the mean base case, one berth is adequate until the year of construction, but in the MBM case, an additional berth is needed during 1985. The equivalent of two dedicated berths at existing facilities could lead to congestion on" isolated occasions.

Carriers and Routes. Scheduled carriers carry most of the population-related tonnage. Therefore, the MBM case will not cause them to provide any significant increases in service. The low level of additional construction will bring little additional business to contract carriers. Traffic increases can be expected on the Marine Highway System links serving Kodiak. The system provides the only scheduled marine service between Kodiak and Seward.

Despite the small number of annual tanker sailings, the establishment of a sea lane would minimize damage to fishing equipment off the east coast of Kodiak Island.

Issues. Determining the location of additional general cargo facilities is a major issue in Kodiak. It is possible that these facilities and the support base could be jointly developed.

For Seward, the issue is the timing of support base construction and the actual division of support activities between Kodiak and Seward. A minor issue concerns the development of medium and long-range plans for the Marine Highway System in Southcentral Alaska. Other issues discussed in the mean base case remain unchanged.

4.3.3 AIR MODE

4.3.3.1 Description of Activities

Employee Movements.

- Helicopters. Seward figures heavily in materials support for Western Gulf of Alaska OCS activities, but rotation of offshore personnel will occur principally through Kodiak due to its proximity to fields. One helicopter trip per week will suffice for the three years of exploration. Forecast weekly round trips peak at 75 for Kodiak during exploration, then fall to 0 before development begins and then rapidly increase to 175 in 1986 before finally falling below 15 for the remainder of the study period (Table 4-12). An estimated 13 helicopter trips per week from Kodiak would be required during the peak year, 1986.

- Intrastate and interstate carriers. All nonlocal employees are assumed to return to their home residences while offduty. 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 four links, as follows: Kodiak-Seattle, Kodiak-Anchorage, Seward-Anchorage, and Anchorage-Seattle. Jets are assumed for all routes except Seward-Anchorage which is best suited for 19 passenger commuter-type aircraft.

Table 4-13 shows the trip assignments on these links. The Kodiak-Seattle link, which is estimated to carry 75% of non-Alaskan employees, will receive the greatest number of trips but the highest number is only 82 trips per week and is reached in 1985. The Anchorage-Seattle and Seward-Anchorage links are less affected by mean scenario Western Gulf activities than by development activities in the mean base case (Table 4-14).

- Population movements and total passenger traffic. Increases from the BM to the MBM case in population-related passenger traffic are minor. For example, in 1988 on the Kodiak-Anchorage link, the increase is only 12 trips per week to 566 (Table 4-14).

Passenger traffic increases based on population increases and non-local OCS employment are both assumed to use scheduled carriers and, thus, are additive. Overall increases are minor on the Seward-Anchorage and Anchorage-Seattle links. Few employees rotate through Seward. For those rotating through Kodiak, three-fourths are assumed to go southbound from Kodiak rather than north to Anchorage and then south to Seattle and beyond.- The Kodiak-Seattle route in 1986 is expected to increase from 204 to 290 trips a week, a 42% increase caused almost exclusively by out-of-state OCS employees. This figure is not reached again until 1991 when population growth makes up for the loss of temporary construction employment. Direct OCS trips on the Kodiak-Anchorage links compared to the Kodiak-Seattle link are somewhat less and the popu-

Iation-generated traffic greater. The result is the crestion of a relatively flat demand between 1987 and 1990 rather than pronounced peaking. Taken together, the two links in 1986 will see a 23% increase from the BM to the MBM case in enplanements from 668 to 821 per week during the peak season. The 821 figure represents a 54% increase over the estimated base year figure of 1,516.

4.3.3.2 Summary of Impacts

Terminals. The basic need and timing of terminal improvements in Anchorage do not change from the base case. Significant additional traffic passing through Kodiak during exploration, much of it on a year-round basis, will heighten the need for improved passenger terminal facilities at least by 1985 when development activities commence. A hangar for maintaining and storing helicopters is needed by 1981 when exploration begins. The MBM case produces no additional air terminal needs in Seward.

Carriers. The need for service increases will occur slightly earlier on the Kodiak links than in the mean base case and at the same time on the other two links. On the Kodiak-Anchorage link, the upper theshold for three flights per week will be reached in 1993 rather than 1994 for the BM case. The jump from 288 more passengers in 1993 to 408 the following year--a 29% increase--will lead to additional flights per week but short of four per week. As demand on the link increases during the study period, another carrier likely will be given authority to operate it by the Alaska

Transportation Commission. The most likely candidates would be Western, AAI, or perhaps Kodiak-Western Alaska.

Issues. Issues for the air mode different from the mean base case focus on Kodiak. Who will develop needed improvements in passenger terminal facilities? And how will the ATC handle increased demand on the Kodiak-Anchorage link?

4.3.4 LAND MODES

4.3.4.1 Roads

No incremental impacts are expected on the road system in the study area. Low additional population growth compared to the mean base case will result in congestion on the Seward Highway occurring at the same time. At Kodiak, OCS-related truck traffic will be limited since OCS tonnage almost exclusively will pass over support base docks.

Offshore employees will be de" ivered directly to the Kodiak airport by helicopters. A modest amount of traffic will be generated by employees working at the support base and by trucks going to the support base from the airport and city docks, but the increase will be insignificant compared to base traffic levels and will not produce congestion. Employment at the support base once constructed does not exceed 20 persons, and truck traffic would not exceed one or two trips per day.

4.3.4.2 Railroad

The mean OCS scenario will not cause any discernible impacts on Alaska Railroad activities. Virtually no cargo destined for Kodiak travels over the Alaska Railroad. Some OCS traffic destined for Seward may be routed through Whittier. How much depends upon the advantages of rail car shipments versus alternative handling methods for a given commodity.

4.3.4.3 Issues

No additional issues emerge from the MBM case and problem areas established in the mean base case remain unchanged.

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

For the marine mode, the only additional demand on facilities is accommodating direct OCS tonnage requirements at Seward and Kodiak. Seward is assumed to have a support base constructed for serving development in the Northern Gulf and it will not require expansion. Existing facilities will be adequate during exploration.

Existing port facilities are nearing congestion in Kodiak, which makes support of exploration activities impractical. A support base will be constructed in 1984 for support of development, and a single berth will be adequate.

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
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Incremental Factors		
1981	0.001	0.001	0.007	
1982	0.002	0.001	0.007	
1983	0.001	0.001	0.004	
1984	0.005	0.005	0.009	
1985	0.004	0.004	0.008	
1986	0.003	0.003	0.010	
1987	0.002	0.003	0.005	
1988	0.002	0.002	0.006	
1989	0.001	0.002	0.004	
1990	0.001	0.001	0.004	
1991	0.001	0.001	0.005	
1992	0.001	0.001	0.005	
1993	0.001	0.001	0.005	
1994	0.001	0.001	0.005	
1995	0.001	0.001	0.005	
1996	0.001	0.001	0.005	
1997	0.001	0.001	0.005	
1998	0.001	0.001	0.005	
1999	0.001	0.001	0.004	
2000				

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

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

Source: ISER, 1979

Table 4-2

Community Areawide Population Forecasts for Base and OCS Cases

	Seward (1)				Kodiak (3)			
Year	Non-Ocs (4)	Low OCS (2)	Mean OCS (2)	High OCS (2)	Non-Ocs	Low Ocs (2)	Mean Ocs (2)	High Ocs (2)
1981	2,720	2,796	2,772	2,764	10,282	10,314	10,304	10,302
1982	2,764	2,840	2,816	2,868	10,817	10,849	10,839	10,861
1983	2,846	2,872	2,872	2,950	11,376	11,388	11,388	11,532
1984	2,964		2,964	3,184	12,000		12,094	12,280
1985	3,209		3,263	3,495	12,546		12,612	12,956
1986	3,186		3,244	3,406	12,998		13,096	13,484
1987	3,202		3,220	3,468	13,387		13,467	13,983
1988	3,291		3,303	3,535	13,768		13,878	14,986
1989	3,678			3,858	13,996		14,058	15,292
1990	3,744			3,940	14,291		14,353	15,593
1991	3,626			3,762	14,670		14,732	15,940
1992	3,539			3,655	15,234		15,310	16,493
1993	3,607			3,705	15,649		15,725	16,861
1994	3,696			3,792	16,017		16,093	17,245
1995	3,907			4,003	16,379		16,455	17,623
1996	3,923			4,019	16,659		16,735	17,919
1997	4,044			4,140	16,949		17,025	18,209
1998	4,166			4,262	17,160		17,236	18,420
1999	4,294			4,390	17,552		17,622	18,812
2000	4,429			4,525	17,844			19,104

Notes: (1) Seward and Seward fringe area.
(2) For OCS cases, only those numbers are shown that are different from non-OCS case.
(3) Population figures for Kodiak Road Connected Area.
(4) Non-OCS includes impact of Northern Gulf of Alaska Mean Case.

Source: Alaska Consultants, 1979.

Table 4-3

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

	Seward			Kodiak		
Year	Low Ocs	Mean Ocs	High Ocs	Low Ocs	Mean Ocs	High Ocs
1981	0.029	0.020	0.017	0.004	0.002	0.002
1982	0.029	0.020	0.040	0.004	0.002	0.005
1983	0.010	0.010	0.040	0.001	0.001	0.018
1984		0.000	0.085		0.011	0.031
1985		0.021	0.110		0.007	0.045
1986		0.023	0.085		0.011	0.054
1987		0.007	0.102		0.009	0.011
1988		0.004	0.094		0.012	0.135
1989			0.089		0.007	0.144
1990			0.075		0.007	0.144
1991			0.052		0.007	0.141
1992			0.045		0.008	0.140
1993			0.038		0.008	0.134
1994			0.037		0.008	0.136
1995			0.037		0.008	0.138
1996			0.037		0.008	0.140
1997			0.037		0.008	0.140
1998			0.037		0.008	0.140
1999			0.037		0.008	0.140
2000			0.037			0.140

Note: (1) F_I = Incremental factor = $\frac{\text{Incremental Population Change}}{\text{Population 1978}}$

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

Source: Alaska Consultants, 1979

Table 4-4

Albatross 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
1981	1	2				5								
1982	2	2				6								
1983	3	1				3								
1984	4													KCSB(1/1)
1985	5		1S											
1986	6				2		8							
1987	7			2	2		16				14			
1988	8			2	2		16				29			
1989	9			2			4				40			
1990	10										40			
1991	11										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
(2) Based on estimated wells drilled by July of each year.
(3) KC SB(l/1) = Facility (Years under Construction/Years to Construct); KCSB = Kodiak Construction Service Bas

Source: Dames & Moore, 1979

Table 4-5

Logistics Requirements for Kodiak-Based Drilling-Mean Resource Scenario

	Albatross Field Tonnage (Short Tons)				Inbound (1)(2)		Outbound (3)	Base Freight Throughput Factors (4)	
Year	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges	Fuel Tankers	Supply Boats	Dry Freight	Fuel
1 (1981)									
2									
3									
4									
5 (1985)									
6	1,380	2,316	4,116	8,036	1	1	13	0.02	0.04
7	2,760	4,632	8,232	16,072	2	2	25	0.04	0.08
8	2,760	4,632	8,232	16,072	2	2	25	0.04	0.08
9	690	1,158	2,058	4,018	1	1	7	0.01	0.02
10 (1990)									
11									
12									
13									
14									
15 (1995)									
16									
17									
18									
19									
20 (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 throughput factors are twice the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-6

Logistics Requirements for Seward-Based Drilling-Mean Resource Scenario

	Albatross Field Tonnage (Short Tons)				Inbound (1)	(2)	Outbound(3)	Base Freight Throughput Factors(	
Year	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges	Fuel Tankers	supply Boats	Dry Freight	Fuel
1(1981)	2,291	6,510	11,570	21,696	2	3	51	0.3	1.1
2	2,749	7,812	13,884	18,080	2	3	62	0.3	1.3
3	1,375	3,906	6,942	10,848	1	2	32	0.2	0.6
4									
5(1985)									
6	1,380	2,316	4,116	8,036	1	1	20	0.1	0.4
7	2,760	4,632	8,232	16,072	2	2	38	0.2	0.8
8	2,760	4,632	8,232	16,072	2	2	38	0.2	0.8
9	690	1,158	2,058	4,018	1	1	11	0.1	0.2
10(1990)									
11									
12									
13									
14									
15(1995)									
16									
17									
18									
19									
20(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 throughput factors are twice the dry freight and fuel tonnages divided by base year tonnage.

Source: Peter Eakland and Associates, 1979.

Table 4-7

Mean Resource Level Scenario - Oil. production and Transportation

Oil Production	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Albatross Basin														
Off shore Loading (MMBBL)	9.5	17.8	23.7	23.7	21.2	16.5	12.9	10.1	7	9	6.2	4.9	3.8	2.3	0.5
Oil Tanker Traffic														
Albatross Basin														
Offshore Loading (Oil Tankers/year)	11	20	26	26	23	18	14	11	9	7	6	5	3	1

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.

Source: Peter Eakland and Associates, 1979.

Table 4-8

Average Monthly Consumable Demands, Western Gulf

Mean Scenario

Year	Tons(1)		Containers(2)	
	Seward	Kodiak	Seward	Kodiak
1 (1981)	27.6	0	2	0
2	27.9	0	2	0
3	14.0	0	1	0
4	0	70.4	0	5
5(1985)	1.7	38.6	1	3
6	1.5	41.1	1	3
7	0	18.9	0	2
8	0.2	15.6	1	2
9		4.4		1
10(1990)		4.4		1
11		4.4		1
12		8.1		1
13		8.1		1
14		8.1		1
15(1995)		8.1		1
16		8.1		1
17		8.1		1
18		8.1		1
19		6.2		1
20 (20430)				

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

Source: Alaska Consultants, 1979; Peter Eakland and Associates, 1979.

Table 4-9

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

	Middle Albatross Basin						
Year	Exploration	Development	Production	Total Seward-Based Trips	Berth Requirements	Total Kodiak Based Trips	Berth Requirements
1 (1981)	24			24	1		
2	24			24	1		
3	12			12	1		
4				0	0		
5(1985)		43		22	1	22	1
6		40		20	1	20	1
7		40		20	1	20	1
8		40		20	1	20	1
9			4			4	1
10(1990)			4			4	1
11			4			4	1
12			4			4	1
13			4			4	1
14			4			4	1
15(1995)			4			4	1
16			4			4	1
17			4			4	1
18			4			4	1
19			4			4	1
20(2000)			4			4	1

Source: Peter Eakland and Associates, 1979.

Table 4-10

Seward-Based Supply Boat Berth Requirements - Mean Base Cases

Year	N. GuI f-Mean Base Case Rd. Trips. /M,	Berth Reg.(1)	Low OCS-Mean 8ase Case W. Gulf-Low OCS Rd. Trips/Mo.	Total Rd. Trips/MO.	Berth Reg.(1)	Mean OCS-Mean Base Case W. Gulf-Mean OCS Rd. Trips/Mo.	Total Rd. Trips/Mo.	Berth Reg.(1)	High OCS-Mean Base Case W. Gulf-High OCS Rd. Trips/Mo.	Total Rd Trips/lb;	Berth Reg.(1)
1 (1981)	12	1	36	48	2*	24	36	1	24	36	1
2	12	1	36	48	2*	24	36		48	60	2*
3	24	1	24	48	2*	12	36	1	48	72	2*
4	24	1		24	1	0	24	1	144	168	3*
5 (1985)	36	1			1	22		2*	140	176	3*
6	131	3		1;!	3	20	1!%	3	138	269	5*
7	52	2		52	2	20	72	2	144	196	4*
8		2		48	2	20	68	2	114	162	3*
9	1::	3		115	3		115	3	96	211	4*
10 (1990)	28	1		28	1		28	1	85	113	3*
11	32	1		32	1		32	1	48	80	3*
12	32	1		32	1		32	1	30	62	2*
13	6	1		6	1		6	1	11	17	1
14	6	1		6	1		6	1	11	17	1
15 (1995)	6	1		6	1		6		11	17	1
16	6	1		6	1		6	1	11	17	
17	6	1		6	1		6	1	11	17	1
18	6	1		6	1		6		11	17	1
19	6	1		6	1		6		11	17	1
20 (2000)	6	1		6	1		6		11	17	1

Notes: (1) Asterik (*) indicates years in which an increase over base case berth requirements is necessary.

Source: Peter Eakland and Associates, 1979.

Table 4-11

Estimated Barges and Tonnage for Construction Activities - Mean Scenario

Location	Facility	1984
Seward (1)	No additional construction activities	
Kodiak (2)	Construction Camp - Women’s Bay	4
	Support Base - Women’s Bay	3
	Construction Equipment	2
		9
	Estimated Tonnage at 6,000 short tons/barge	54,000

Notes: (1) Facilities to be constructed for Norther Gulf of Alaska scenario not included.

Source: Peter Eakland and Associates, 1979.

Table 4-12

Weekly Helicopter Round Trips from Service Bases in Western Gulf

Mean Scenario

Year	Kodiak Total Offshore Average Monthly Employment(1)	Peak Weekly Round Trips(2)	Helicopter Trips er Week(3)
1 (1981)	234	78	6
2	236	79	6
3	118	40	3
4	0	0	0
5 (1985)	484	162	12
6	524	175	13
7	232	78	6
8	166	56	4
9	16	6	1
10 (1990)	16	6	1
11	16	6	1
12	41	14	1
13	41	14	1
14	41	14	1
15 (1995)	41	14	1
16	41	14	1
17	41	14	1
18	41	14	1
19	28	10	1
20 (2000)			

Notes: (1) Total employment includes offsite plus onsite personnel. 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 per month) X (2.0 Peak factor) ÷ 4.3 weeks per month

(3) Based on 14 passengers per trip

Source: Peter Eakland and Associates, 1979.

Table 4-13

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

	Seward-Anchorage				Kodiak-Anchorage				Kodiak-Seattle		Anchorage-Seattle			
Year	Intra (1.0)	Inter (1.0)	Total Weekl y Trips	Commuter Plane Equivalent(1)	Intra (1.0)	Inter (.25)	Total Weekly Trips	Jet(z) Plane Equivalent	Total Weekly Trips Inter (.75)	Jet(2) Pl ane Equivalent	SWD Inter (1.0)	KOD Inter (.25)	Total Weekly Tri ps	Jet(2) Plane Equivalent
1 (1981)	9	14	23	1.3	12	12	24	0.3	34	0.4	14	12	26	0.3
2	9	15	24	1.3	12	12	24	0.3	34	0.4	15	12	27	0.3
3	5	7	12	0.7	6	6	12	0.2	18	0.2	7	6	13	0.2
b	0	0	0	0	40	10	50	0.5	30	0.3	0	10	10	0.1
5 (7985)	4	1	5	0.3	21	28	49	0.5	82	0.8	1	28	29	0.3
6	3	1	4	0.3	28	27	55	0.5	81	0.8	1	27	28	0.3
7	0	0	0	0	18	10	28	0.3	30	0.3		10	10	0.1
8	1	0	1	0.1	17	7	24	0.3	21	0.2		7	7	0:1
9					8	1	9	0.1	1	0.1		1	1	0.1
10 (1990)					8	1	9	0.1	1	0.1		1	1	0.1
11					8	1	9	0.1	1	0.1		1	1	0.1
12					13	1	14	0.2	1	0.1		1	1	0.1
13					13	1	14	0.2	1	0.1		1	1	0.1
14					13	1	14	0.2	1	0.1		1	1	0.1
15 (1995)					13	1	14	0.2	1	0.1		1	1	0.1
16					13	1	14	0.2	1	0.1		1	1	0.1
17					13	1	14	0.2	1	0.1		1	1	0.1
18					13	1	14	0.2	1	0.1		1	1	0.1
19					10	1	11	0.1				1	1	0.1
20 (2000)														

Notes: 1 Commuter aircraft assumed to have a capacity of 19 passengers.
2 Jet aircraft assumed to have a capacity of 110 passengers.

Source: Peter Eakland and Associates, 1979.

Table 4-14

Induced and OCS Weekly Air Travel - Mean OCS Mean Base Case (MBM)(1, 3, 4, 5)

	Kodiak-Anchorage			Seward-Anchorage				Kodiak-Seattle			Anchorage-Seattle			
Year	Mean OCS Growth.	Mean W. Gulf OCS	Total Weekly Trips	Mean OCS Growth	Mean N. Gulf OCS	Mean W. Gulf OCS	Total Weekly Trips	Mean OCS Growth	Mean W. Gulf OCS	Total Weekly Trips	MBM Growth	Mean W. Gulf OCS	Mean Base Devel. (2)	Total Weekly Trips
(1981) 1	149	24	173	16	12	23	51	66	34	100	1,930	26	957	2,913
2	211	24	235	20	18	24	62	93	34	127	3,075	27	1,162	4,264
3	276	12	288	26	30	12	68	121	18	139	3,745	13	1,535	5,293
4	35B	50	408					157	30	187	3,?45	10	1,520	5,275
5	419	49	468	62	112	5	174	184	82	266	4,079	29	683	4,791
6	476	55	531	60	46	4	110	209	81	290	4,735	28	778	5,541
7	577	28	605	58	22	0	80	253	30	283	5,533	10	628	6,171
8	566	24	590	65	28	1	94	249	21	270	6,331	7	897	7,235
	588	9	597					258	1	259	7,103	1	1,188	8,292
(1990)1:	601	9	610					264	1	265	7,849	1	1,019	8,869
11	667	9	676					292	1	293	8,453	1	820	9,274
12	734	14	748					322	1	323	9,071	1	722	9,794
13	783	14	797					343	1	344	9,779	1	628	10,408
14	825	14	839					362	1	363	10,524	1	47	10,572
15	867	14	881					380	1	381	12,262	1	24	12,287
16	900	14	914					395	1	396	13,175	1	8	13,184
17	934	14	948					410	1	411	14,153	1	1	14,155
18	959	14	973					420	1	421	15,247	1	1	15,249
19	1,004	11	1,015					440	0	440	16,302	0	1	16,303
(2000)20														
Lowest % Induced (year)			86.1% (1981)				41.0% (1981)			66.6% (1981)			66.2:. (1981)	
Threshold Values	3 fits/day (jet) 794 4 fits/day (jet) 1,410			3 fits/day (commuter) 80 4 fits/day (commuter) 213				1.5 fits/day (jet) 462			50% service increase 6,433 100% service increase 12,866			

Note: (1) Values not shown are unchanged from the base case

(2) Includes out-of-state employee travel for mean scenario of Northern Gulf OCS lease sale

(3) "Growth" traffic is based on local population growth beyond 1977-78

(4) "Development" and "No Gulf" traffic is based on non-local employees on development projects

(5) Threshold values based on 110 passenger jets for Kodiak routes, 19 passenger commuter planes for Seward, and a mix of jets for Anchorage-Seattle

Source: Peter Eakland and Associates, 1979

The MBM case will not change the timing of facility needs except perhaps in Kodiak where a larger air passenger terminal would be helpful. The link receiving the highest percentage increase in traffic will be Kodiak-Seattle, but impacts should be slight since three carriers currently have operating authority on it.

No significant impacts on the Alaska Railroad will occur in the MBM case. Low employment in the Kodiak and the absence of onshore processing facilities will limit road traffic generated by mean scenario activities.

4.4 Low OCS-Mean Base Case

4.4.1 FACTORS CAUSING GROWTH

The low OCS scenario involves exploration of the Albatross and Tugidak Fields from 1981 to 1983, using Seward as the sole support base. Growth in transportation demand over that forecast for the mean base case will be limited in time and scope. Material requirements are limited to those needed in drilling 17 exploration wells (Table 4-16). No construction activity is anticipated. Increases in permanent population at the local and regional levels will be small and will recede quickly to base case levels after the first two years of exploration. Helicopter operations will be the only OCS activity in Kodiak.

Table 4-15 shows differences from the mean base case for regional populations. The factors are a ratio of incremental population increases divided by 1977 populations. Factors never exceed 1% of the base year population and never more than 0.1% in Anchorage. In Seward, the factor is 2.9% in 1982 and 1983 but the impacts do not go beyond 1983 (Table 4-4). Differences in Kodiak are considerably less, only 0.4% in 1981 and 1982.

4.4.2 WATER MODE

4.4.2.1 Description of Activities

Industrial Freight. During the first two years of drilling, two rigs operate in the Albatross Field and one in the Tugidak Field (Table 4-15). A single rig orperates one-half of the final year in each field. The total of 17 wells drilled compares to 14 exploration wells in the mean scenario. The modest increase in activity causes only 0.1 and 0.5 increases, respectively, for dry freight and fuel in the base year throughput factors for 1981 (Table 4-1 3). Consumables require the equivalent of three containers per month during the first two years (Table 4-18).

Supply Boat Movements and Berths. Addition of the Western Gulf activities to Seward increases monthly supply boat round-trips to 48 for all three years of exploration (Table 4-19, 4-10). This figure compares to 36 for the MBM case during these years.

4.4.2.2 Summary of Impacts

Terminals. Exploration activities remain relatively constant among the scenarios. Interestingly, more potential exists for congestion of existing facilities in the LBM than the MBM case because in this case, exploration is assumed to take place in both the Albatross and Tugidak basins. The equivalent of one supply boat berth was adequate in the MBM case until 1985. LBM forecasts make two berths a necessity from 1981 to 1983 (Table 4-10).

For Kodiak, the LBM case is identical to the BM case since all marine logistics for Western Gulf OCS activities are handled through Seward. The modest impacts created in the MBM case by the construction of a two berth support base at Kodiak are eliminated.

Carriers. No differences in carrier operations from the MBM case will be observed during the exploration phase. Demand for scheduled carriers will be unchanged but that for contract carriers compared to the MBM case will diminish during the late 1980's and early 1990's. Lack of economic discoveries will produce a reduced demand for expansion of Marine Highway System services.

Issues. Perhaps the most important issue for the marine mode in the LBM case is the timing of large development projects in the State that might use Seward as an entry point for construction material. Delays will reduce the potential for conflict at Seward's existing facilities. After 1983, Western Gulf activities will cease and after 1985, a separate support base will exist for Northern Gulf activities. Other issues identified for the BM case remain unchanged.

4.4.3 AIR MODE

4.4.3.1 Description of Activities

Employee Movements.

- Helicopters. Offshore employees will be routed through Kodiak primarily. During the first two years of exploration, eight weekly helicopter round-trips based in Kodiak will be required and one in Seward (Table 4-20). In 1983, requirements in Kodiak will fall to three helicopter round-trips per week.

- Intrastate and Interstate Movements. Table 4-21 shows the assignment of interstate (non-Alaskan) and intrastate (nonlocal Alaskan) weekly trips to links. The highest volume for direct OCS weekly trips, 53, occurs in 1981 and 1982 on the Kodiak-Seattle link. No changes from the mean base case occur after 1983 on the Seward and Kodiak links.

- Population Movements - Induced Growth. Table 4-22 shows increased air passenger traffic for population-related growth during the study period for the LBM case. The sum of direct and indirect travel is also shown. Slight increases in total traffic compared to the MBM case occur on all links during exploration but never exceed 20 additional passengers per week. No changes from the MBM case occur after 1983 on Seward and Kodiak links.

4.4.3.2 Summary of Impacts

Terminals. Air impacts at Kodiak will be less during the LBM than the MBM case and the impact assessment closely resembles that for the BM case.

Carriers. Traffic druing the period 1981-1983 will approximate that for the MBM case and that for the BM case during the remainder of the study period. Steady growth will occur in Kodiak enplanements without the peaking that existed in the MBM case which assumed construction of a support base.

Issues. Issues have previously been discussed as part of either the BM or MBM cases.

4.4.4 LAND MODE

4.4.4.1 Roads

Road impacts are based primarily on a high level of truck traffic or congestion caused by population increases. The lack of new developments in the LBM case and the low population increases make the situation for the road system identical to that in the mean base case.

4.4.4.2 Railroad

One change from the MBM case is possible. Due to additional activities before the support base in Seward is constructed, routing materials destined for Seward through Whittier could help alleviate congestion should it develop.

4.4.4.3 Issues

No issues have been identified which are different from the BMor MBM cases.

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

Due to the low level of development in the Western Gulf mean scenario, differences between the LBM and MBM cases are relatively minor. A slightly higher level of exploration in the LBM cases produces a need for the equivalentof two supply boat berths from 1981 to 1983 at Seward but the size of the service base required later does not change. The potential for congestion occurs only during the exploration phase. The upper limit for three flights per day using 19-passenger aircraft from Seward is approached two years earlier than in the MBM case.

Absence of marine support activities in Kodiak eliminates the need for a support base. During exploration, approximately 20 more enplanements per

Table 4-15

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

Year	Statewide	Anchorage	Southcentral	Fairbanks
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Incremental Factors		
1981	0.001	0.001	0.008	
1982	0.002	0.001	0.009	
1983	0.001	0.001	0.003	
1984	0.001	0.001		
1985	0.001	0.001		
1986	0.001	0.001		
1987		0.001		
1988		0.001		
1989				
1990				
1991				
1992				
1993				
1994				
1995				
1996				
1997				
1998				
1999				
2000				

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; Peter Eakland and Associates, 1979.

Table 4-16

Exploration and 95% Resource Level Scenario, Transporati on-Related Activities

Calendar Year	Year After Lease Sale	Albatross Field		Tugidak Field	
		Rigs	Wells	Rigs	Wells
1981	1	2	4.8	1	2.4
1982	2	2	4.8	1	2.4
1983	3	1	1.4	1	1.2

Source: Dames and Moore, 1978.

Table 4-17
Logistics Requirements for Seward-Based Drilling - Exploration Scenario

	Albatross Field Tonnage (Short Tons)				Tugidak Field Tonnage (Short Tons)				Inbound(1)	(2)	Out-bound(3)	Base Year Throughput Factors(4)	
Year	Drill Pipe	Dry Bulk	Fuel	Drill Water	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges	Fuel Tankers	supply Boats	Dry Freight	Fuel
1(1981)	2,199	6,250	11,107	17,357	1,100	3,125	5,554	8,678	2	4	74	0.4	1.6
2	2,199	6,250	11,107	17,357	1,100	3,125	5,554	8,678	2	4	74	0.4	1.6
3	641	1,823	3,240	5,062	550	1,562	2,777	4,339	1	1	18	0.1	0.3
4													
5(1985)													
6													
7													
8													
9													
10(1990)													
11													
12													
13													
14													
15(1995)													
16													
17													
18													
19													
20(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 throughput factors are twice the dry freight and fuel tonnages divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-18

Average Monthly Consumable Demands, Western Gulf

Exploration Scenario

Year	Tons(1)		Containers(2)	
	Seward	Kodiak	Seward	Kodiak
1 (1981)	41.5	0	3	0
2	41.5	0	3	0
3	14.0	0	1	0
4				
5 (1985)				
6				
7				
8				
9				
10 (1990)				
11				
12				
13				
14				
15 (1995)				
16				
17				
18				
19				
20 (2000)				

Notes: (1) Tons = (Offshore onsite + Onshore onsite non-local employment) X (300 lbs./person) ÷ (2,000 lbs./ton).
(2) Containers = Tons/(l 5 tons/container).

Source: peter Eakland and Associates, 1979.

Table 4-19

Monthly Supply Boat Round-Trips by Service Base - 95% Resource Level Scenario

Year	Albatross Basin Exploration	Tugidak Basin Exploration	Total Seward-Based Trips	Berth(1) Requirements	Total Kodiak-Based’ Trips	Berth(1) Requirements
1 (1981)	24	12	36	1	0	0
2	24	12	36	1	0	0
3	12	12	24	1	0	0
4						
5 (1985)						
6						
7						
8						
9						
10 (1990)						
11						
12						
13						
14						
15 (1995)						
16						
17						
18						
19						
20 (2000)						

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

Source: Peter Eakland and Associates, 1979.

Table 4-20

Meekly Helicopter Round Trips from Service Bases in Western Gulf

Exploration Scenario

	Kodiak		
Year	Total Offshore Average Monthly Employment(1)	Peak Weekly Round Trips(2)	Helicopter Trips per Week(3)
1(1981)	366	122	9
2	366	122	9
3	124	41	3
4			
5(1985)			
6			
7			
8			
9			
10(1990)			
11			
12			
13			
14			
15(1995)			
16			
17			
18			
19			
20(2000)			

Notes: (1) Total employment includes off site plus onsite personnel . All offshore tasks have been included except supply/anchor/tug boats and include surveys, rigs, platforms, platform installations, and offshore pipeline construction.

(2) Peak weekly trips = (0.717 round trips per month) X (2.0 peak factor) ÷ 4.3 weeks per month

(3) Based on 14 passengers per trip

Source: Peter Eakland and Associates, 1979.

Table 4-21

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

	Seward-Anchorage				Kodiak-Anchorage				Kodiak-Seattle		Anchorage-Seattle			
Year	Intra (1.0)	Inter (1.0)	Total Weekly Trips	Commuter Plane Equivalent(1)	Intra (1.0)	Inter (.25)	Total Weekly Trips	Jet(2) Plane Equivalent	Total Weekly Trips Inter (.75)	Jet(2) Plane Equivalent	SWO Inter (1.0)	KOD Inter (.25)	Total Weekly Trips	Jet(2) Plane Equivalent
1 (1981)	14	24	38	2.0	21	18	39	0.4	53	0.5	24	18	42	0.4
2	14	24	38	2.0	21	18	39	0.4	53	0.5	24	18	42	0.4
3	5	9	14	0.8	10	6	16	0.2	18	0.2	9	6	15	0.2
4														
5(1985)														
6														
7														
8														
9														
10 (1990)														
11														
12														
13														
14														
15 (1995)														
16														
17														
18														
19														
20 (2000)														

Notes: (1) Commuter aircraft assumed to have a capacity of 19 passengers.
(2) Jet aircraft assumed to have a capacity of 110 passengers.

Source: Peter Eakland and Associates, 1979.

Table 4-.22

Induced and OCS-Related Weekly Air Travel - Low OCS-Mean Base Case (LBM)(1, 4, 5, 6)

	Kodiak-Anchorage (2)			Seward-Anchorage				Kodiak-Seattle (2)			Anchorage-Seattle			
Year	Low Ocs Growth	Low W. Gulf OCS	Total Weekly Trips	Low OCS Growth	Low W. Gulf OCS	Mean Base (3) Devel.	Total Weekly Trips	Low OCS Growth	Low W. Gulf OCS	Total Weekly Trips	LBM Growth	Low W. Gulf OCS	Mean Base (3) Devel	Total Weekly Trips
1	1151	39	190	18	38	12	68	67	53	120	1,930	42	957	2,887
2	213	39	252	23	38	18	79	94	53	147	3,075	42	1,162	4,237
3	276	16	292	26	14	30	70	121	18	139	3,732	15	1,535	5,267
4											3,680		1,520	5,200
5											4,040		683	4,723
6											4,697		778	5,475
7											5,494		628	6,122
8											6,318		897	7,215
9														
10 (1990)											7,823		1,019	8,842
11														
12											9,045		722	9,767
13														
14														
15											11,348		24	11,372
16											12,236		8	12,244
17														
18														
19														
20 (2000)														
Lowest % Induced (year)			72. 9% (1982)				26.5% (1981)			55.8% (1981)				65.9% (1981)
Threshold Values	3 fits/daY (jet)		794		3 fits/day (commuter)		80		1 fit/day (jet)	154			50% service increase	6,433
													100% service increase	12,866

Notes:
(1 Total weekly trips not shown are unchanged from the appropriate base case
(2 Kodiak and Seward LBM traffic values are also the values for the Low OCS-Mean Base Case (LBL)
(3) Mean Base Devel. includes trips forecast for Northern Gulf of Alaska low scenario
(4) "Growth" traffic is basedon local population growth beyond 1977-1978
(5) "Development" and "No. Gulf" traffic is based on non-local employees on development projects
(6) Threshold values vased on 110 passenger jets for Kodiak routes, 19 passenger commuter planes for Seward, and a mix of jets for Anchorage-Seattle

Source: Peter Eakland and Associates, 1979.

week on both the Kodiak-Anchorage and Kodiak-Seattle links is expected in the LBM case.

No changes are expected for the land modes.

4.5 High OCS-Mean Base Case (HBM)

4.5.1 FACTORS CAUSING GROWTH

Growth in transportation demand from OCS activities has indirect and direct components. The direct component relates to the construction and drilling activities that are assumed to take place. Tables 4-24 and 4-25, respectively, show exploration, development, and production activities related to the Albatross and Tugidak Basins. Increases over the mean scenario are substantial. Seven platforms will be installed as opposed to only one in the mean base case. The higher. level of activity will lead to greater employment of local people, nonlocal Alaskans, and non-Alaskans. The latter two categories will be required extensively during exploration and development and most likely will use air travel on rotation trips.

Indirect, or induced transportation demand, will result from increases in local and regional population as a result of Western Gulf activities. Local populations and incremental growth factors are shown on Tables 4-12 and 4-13, respectively. The incremental factors for theMBM case, which are a ratio of the population change from the base case to the 1978 population, reach a high of2.3% in Seward and 1.1% in Kodiak. In comparison, the highest factors for the high scenario are 11.0% in Seward and 14.4% in Kodiak. Seward's gains occur primarily in the development phase while Kodiak's occur in development but also in production which begins in 1988.

Regional differences are similarly higher. The highest incremental factor for the Anchorage region in the MBM case was 0.005 which increases to 0.027 for the HBM case. A factor of at least 2% is maintained in the region beginning in 1985.

4.5.2 WATER MODE

4.5.2.1 Description of Activities

Industrial Freight. Industrial freight is divided into three categories: (1) drilling-related equipment; (2) construction-related equipment; and (3) consumables. The Western Gulf high scenario calls for the drilling of 322 exploration and development wells compared to only 58 wells for the mean Scenario. Exploration in the Albatross Basin begins in 1981 but not until 1984 in the Tugidak Basin. Tables 4-26 and 4-27 show the tonnage by commodity which will be shipped to drilling sites from Kodiak and Seward, respectively. As in the mean scenario, Seward is expected to handle all logistics for exploration. During development, support will be split evenly between Seward and Kodiak. The base year throughput factors for dry drilling commodities are 0.6 or greater at Seward for every year between 1982 and 1991 except one. During the same period, Seward's fuel throughput factors are 2.5 or greater every year except three. The peak year is 1984 when the dry freight and fuel throughput factors for the Western Gulf are 1.1 and 4.5, respectively. An estimated seven barges and ten fuel tankers would be required to transport the commodities to Seward.

Peak throughputs at Kodiak's support base are somewhat less because it supports only development activities, although it is likely that exploration in the Tugidak Basin which occurs after development of the support base could be partially supported from Kodiak. Peak tonnage occurs in 1990 when five barges and seven tankers would be required on the inbound journey. The lower throughput factors of 0.2 and 0.7 for dry freight and fuel, respectively, reflect the considerably higher base year tonnages at Kodiak. The base year factors are useful for showing the magnitude of tonnages but do not affect congestion at Kodiak because no use of existing facilities is contemplated.

Construction activities begin in 1983 (Table 4-28) and include a support base at Kodiak (Women's Bay), an oil terminal and LNG plant at Ugak Bay, and onshore and offshore pipelines to fields in the Albatross Basin. The 1983 schedule for construction of the support base is one year earlier than in the mean scenario. The marginal economics of the resources to be developed require extraction as early as possible.

Materials for the oil terminal and LNG plant will be delivered directly to Ugak Bay. Construction camp materials initially will be located both at Women's Bay and Ugak Bay but after 1983 will be only at Ugak Bay. To reduce peak workforce requirements, the oil terminal will be constructed after completion of the LNG facility. Peak transportation demands for construction are in 1983 but, as noted, several destinations are involved.

At Seward, construction activities are limited to concrete-coating of pipe for offshore pipelines. Uncoated pipe is assumed to arrive the year before installation. No offshore pipelines are required in the Western Gulf mean scenario. The Western Gulf high scenario, which has offshore rig installation beginning in 1985, is one year ahead of the mean scenario for the Northern Gulf.

During the height of construction activity, an equivalent of 20 containers of consumables will be required (Table 4-29). Peak flow in Seward will be only four containers.

Supply Boats and Berth Requirements. Supply boat round-trips have been developed based on the schedule of activities in each basin. Table 4-30 shows monthly round trips for supply boats based in Kodiak and Seward. The largest number of trips at Seward is 144 in 1984 and 1987. The largest number at Kodiak is 117 in 1988. Three dedicated berths will be adequate to serve these levels of demand. Table 4-10 shows total berth requirements at Seward by adding needs for the Northern Gulf mean scenario to those for the Western Gulf high scenario. The peak demand is for five berths in 1986. A need for two berths exists after the first year and for three berths as early as 1984.

Induced Growth. Table 4-31 shows the base year throughput factors for the HBM case at major ports. Regional population growth is insufficient to produce changes from the mean base case as great as 10% of the base year tonnages at any of the major entry ports. Changes, however, do occur at local levels. At Kodiak, changes of at least 10% occur for dry bulk and petroleum for the remainder of the study period. For 12 of the years, the difference is 20% which corresponds to 60,876 metric tons (67,104 tons). Fuel increases by 10% each year from the BM case except in 1985 when the increase is 20%. A 10% increase in fuel occurs from 1984 to 1992 for Seward. No increases in factors for dry freight occurs at Seward since tonnage there is primarily regional in nature and does not respond proportionately to increases in local population.

Transportation of Oil and Gas. Oil and gas production for the high (5%) scenario in the Western Gulf are shown in Table 4-32. The highest number of tanker sailings/year from the Ugak Bay terminal would be 76 in 1990. This compares with a maximum of 26 sailings during peak production for the mean scenario. The LNG plant will have 101 sailings as a maximum. In the Tugidak Basin, the only production occurring will be offshore loading of oil. Maximum production there will be in 1993-1995 and will result in 26 sailings per year. Maximum oil production from both basins occurs in 1991 and results in 85 tanker sailings per year.

4.5.2.2 Summary of Impacts

Terminals. Indirect growth in transportation demand does not produce meaningful changes from the mean base case except in Kodiak. By the time increases occur in 1983, the high capacity threshold of 1.1 has already been exceeded. The potential for congestion intensifies beginning in 1983. Specific plans will have to be developed soon if implementation is to occur before that date. Incremental impacts on marine terminal facilities would be limited to Kodiak and Seward which receive direct OCS transportation demands in the high scenario. Kodiak's impacts are minimized because no support activities are scheduled until a service base is constructed. The support base there must provide at least 183 lineal m (600 ft.) of docking space, which is the minimum requirement for simultaneous berthing of three supply ships.

At Ugak Bay, two berths are required to handle the peak number of oil tanker sailings. Each berth must be able to accommodate ships 305 m (1,000 ft.) in length. Assuming similar turnaround times for LNG ships and oil tankers, two berths of the same length will be required to serve the LNG plant.

The construction of the support base in Seward was based on the development schedule for the Northern Gulf mean scenario. In order to have the service base ready at the time three berths are first needed, construction would have to be moved ahead two years. Capacity estimates considered the Alaska Railroad dock a two-berth facility and the city dock a one-berth facility. Although assumed to be only one berth for capacity purposes, one side of the Alaska Railroad dock dedicated to OCS operations could provide space for two supply boats.

Impacts can also be assessed by looking at forecast tonnages. In 1984, the base year throughput tonnage would be 3 3, comprised of induced growth and base development (1.8), Northern Gulf drilling (0.4), and Western Gulf drilling (1.1). The figure falls short of the low capacity threshold of 3.78. The fuel tonnage factor would be 6.8: induced growth (1.1), Northern Gulf drilling (1.2), and Western Gulf drilling (4.5). This figure exceeds the high threshold capacity of 4.64.

Adjustments can be made to the initial 80-20 split of available capacity to account for a higher percentage of use by fuel carriers. A change to 71-29 would place fuel at the high threshold level and dry freight at the low threshold level.

Because of the number of variables involved, it is difficult to predict exactly when congestion would occur or to what extent. Seasonality of demands will heighten the potential more than the base year factors indicate. On the other hand, possible routing through Whittierof some inbound commodities and the use of efficient on-loading procedures for supply boat operations could serve to minimize congestion. Nevertheless, congestion is a real possibility during exploration and early development without timely construction of a support base.

Carriers and Routes. Existing carriers will receive increased traffic due to population growth and also will transport a percentage of direct OCS traffic, such as consumables and miscellaneous parts and supplies. For Kodiak, which already receives weekly scheduled service by

Sea-Land, field operators might reserve space for 5-10 containers per sailing. Five containers per week would satisfy the peak demand for consumables. Increased traffic to Seward would help justify more frequent scheduled service. Pacific-Alaska Lines, the present carrier, is assessing whether demand is sufficient to continue such service.

The high scenario dramatically increases the need for establishing sea lanes for oil tankers and LNG ships. The high scenario has a peak of 177 trips from Ugak Bay by either LNG or oil tankers. On the average, by counting inbound and outbound trips, a ship will pass fishing grounds east of Kodiak Island approximately once a day during peak production in 1990. This level of traffic is 28% of that forecast for tankers serving the trans-Alaska pipeline in 1981. South of Kodiak Island, traffic from offshore loading in the Tugidak Basin would have to be added.

Issues. A major issue concerns the timing of the construction of support base sites in Kodiak and, particularly, Seward. Another issue is how Kodiak will respond to increasing demands on its port facilities. Finally, in both Seward and Kodiak, pending developments other than Western Gulf OCS activities could change the base case conditions and thus change the potential impact of OCS actions. Bottomfishing falls into this category for both Seward and Kodiak, but particularly the latter. For Seward, the timing of Northern Gulf OCS and large construction projects that require breakbulk cargo shipments will heavily influence impacts.

4.5.3 AIR MODE

4.5.3.1 Description of Activities

Employee Movements.

- Helicopters. Helicopters"are required to move offshore employees to and from major airports and to carry small amounts of freight. Most employees will be rotated through Kodiak. Offshore employment rotated through Kodiak steadily increases to a peak of 1,990 average monthly employees in 1987 (Table 4-33) and then declines to a steady level of 328 once full production is reached. Helicopter trips per week peak at 48 in 1994, but for six consecutive years, 1985-1990, there are more than 40 trips per week. Required helicopter trips per week out of Seward never exceeds two.

- Intrastate and Interstate Carriers. Table 4-34 shows the trip assignments for nonlocal employees rotated through Kodiak and Seward. The Kodiak-Seattle link receives the greatest number of trips during the development phase when a high percentage of out-of-state employment occurs. High values are 374 in 1985 and 360 in 1987. Otherwise, the Kodiak-Anchorage link dominates. During production, 106 direct OCS trips are generated and of these 90 trips, or 85%, are forecast to occur on the Kodiak-Anchorage link.

Population Movements - Induced Growth. Table 4-35 shows the induced traffic combined with direct-OCS traffic. For the Anchorage-Seattle link where population is the dominant factor, the steady growth in passenger demand after completion of the Northwest gas pipeline in 1984 is similar to the pattern exhibited by the mean scenario. Patronage 50% greater than that existing in 1977 will occur one year earlier in the BM case than in the MBM case.

On the Seward-Anchorage route, steady population growth is combined with direct OCS traffic generated by the high Western Gulf scenario and the mean Northern Gulf scenario. In the MBM scenario, no differences from the mean base case occurred after 1988, whereas in the HBM case all years show greater traffic. The high value for increased traffic of 259 trips in 1985 will require more than four flights per day. Traffic falls to less than half of this value in 1992 but climbs back to 195 by the end of the study period.

Substantial increases in traffic from the MBM to the HBM case occur on Kodiak routes. On the Kodiak-Seattle link, 1.5 jet flights per day were forecast to be adequate in theMBM case throughout the study period, but in the HBM case will be inadequate after 1984. HBM traffic in 1985 is more than double that forecast for the same year in the MBM case. Most of the Increase during exploration and development is due to travel by out-of-state employees, but by 1990, approximately 70 additional trips per week can be attributed to population increases over the MBM case. Similar large traffic increases on the Kodiak-Anchorage link are expected. The growth rate for population-related travel is assumed to be the same as on the Kodiak-Seattle link. Induced travel plays a larger role in traffic increases on the Kodiak-Anchorage link because of the higher base year patronage. Induced travel never falls below 59.6% of any total increase whereas it falls as low as 32.0% for the Kodiak-Seattle route. In theMBM case, three jet flights a day become inadequate in 1993, while for the MBM case this frequency becomes inadequate i n 1987. The drop in employee travel in the late 1980's and early 1990's is offset by an increase in population-related travel, and the result is a relatively constant traffic demand.

By 1985, annual passenger enplanements on certificated air carriers at Kodiak's major airport will exceed base year figures by approximately 46,000 passengers. This represents a 113% increase from July 1, 1976 to June 30, 1977 traffic data (Table 2-14) and 88% above base year figures (Table A-5). The comparable percentages for the MBM case, respectively, are 62% and 48%.

4.5.3.2 Summary of impacts

Terminals. For Kodiak, passenger handling improvements are required much earlier in the HBM than in the MBM case. Implementation of these improvements before the start of service base construction in 1983 would help keep congestion to a minimum.

A major storage and maintenance hanger for helicopter operations will also be required. An average of 6-7 flights per day will be required during the development phase. A fleet of six aircraft probably could be justified taking into account peaking of operations, reserve requirements and downtime for maintenance; however, more aircraft would be required if capacity is less than an average of 14 passengers per craft.

Increases on the Kodiak-Anchorage link will impact Anchorage airport facilities as well as those in Kodiak, but even during the development stage, increased passengers on that link do not exceed 15% of the total increase on the Anchorage-Seattle link.

Potential impact differences on facilities in Seward from the MBM to the HBM case are minor despite a 49% increase to 259 trips in 1985. This is due to relatively low activity during the production phase. A modest passenger terminal will suffice in both cases.

Carriers. Saturation of existing services will occur early in the study period for all links, but existing carriers should be able to accommodate the forecast demands with incremental fleet additions. The two southbound links both have competitive service at this time. Demand out of Seward may not justify the entry of another carrier. However, on the Kodiak-Anchorage link, now served exclusively by Wien, several carriers might attempt to enter the market as demand increases.

At Kodiak, a major commitment by at least one helicopter operator will be required. The carrier or carriers would most likely operate in both contract and air taxi modes and serve OCS and non-OCS clients.

Issues. A principal issue is how the Alaska Transportation Commission will respond to increased demand on intrastate routes and the demand for helicopter services in Kodiak. Another issue concerns the development of the U.S. Coast Guard station which provides aerial patrol of the 200-mile fishing limit. The future role of Kodiak Municipal Airport, financing of passenger facility improvements , and the completion date for construction of Anchorage's terminal improvements have previously been identified and are also relevant in the HBM case.

4.5.4 LAND MODES

Roads. Population growth in Anchorage would not be sufficient to change the timing of congestion on the road to the Kenai Peninsula by a year. Trucks will continue to play an important role in moving foodstuffs and LTL goods to Seward, although regular scheduled marine freight by PAL service likely will continue. Truck movements for OCS activities would be related to consumables and miscellaneous industrial supplies, particularly the latter. Such traffic, probably not greater than one truck per day, will produce negligible impacts. If buses were to accommodate travel to Anchorage by nonlocal employees, six buses per week would be required during peak OCS activities to accommodate the 176. trips. Recent experience with construction activities in Valdez suggests the likelihood of this approach. Four buses were required in the MBM case.

In Kodiak, freight destined for the oil terminal and LNG plant during construction and thereafter will first arrive in Kodiak at the city docks, the airport, and the service base and then be delivered by truck. The major impact will involve major upgrading of the Saltery Cove Road, which is approximately 19 miles long, to secondary road standards. At present, it is an unmaintained, dirt road suitable only for four-wheel drive vehicles. The road will be used by permanent employees going to and from work each day as well as by heavy trucks and miscellaneous light trucks. The relatively light traffic value at present of 700 vehicles per day (average annual daily traffic) beyond the Kodiak Road junction suggests that congestion will not be a problem. During construction years, truck traffic will be heavy during break-up conditions in early spring. Deterioration of paved surfaces could result if load limits are not adhered to. The land surrounding Saltery Cove Road is a favorite spot for hunting, and the new road will make it more accessible. Conflicts could develop between industrial and recreational traffic. Impacts from the road will depend upon who assumes maintenance responsibility and the land uses that are allowed to develop along the road and at Ugak Bay.

Railroad. No differences from the MBM case are expected in the HBM case. The slight changes in Anchorage population are not expected to change the base year throughput tonnage figures. OCS industrial tonnnage

Table 4-23

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
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Incremental Factors		
1981	0.001	0.001	0.007	
1982	0.002	0 .002	0.015	
1983	0.008	0.007	0.029	
1984	0.018	0.015	0.063	
1985	0.024	0.022	0.082	
1986	0.023	0.022	0.058	
1987	0.025	0.027	0.061	
1988	0.025	0.026	0.065	
1989	0.025	0.025	0.070	
1990	0.025	0.026	0.071	
1991	0.024	0.025	0.065	
1992	0.023	0.024	0.063	
1993	0.020	0.022	0.047	
1994	0.019	0.020	0.043	
1995	0.019	0.020	0.049	
1996	0.019	0.020	0.051	
1997	0.020	0.021	0.051	
1998	0.019	0.021	0.050	
1999	0.020	0.021	0.050	
2000	0.020	0.021	0.050	

Note: (1) $'_I$ = Incremental factor = $\frac{\text{Incremental Population Change}}{\text{Population 1977}}$

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

Source: ISER, 1979

Table 4-24

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

Calendar Year	Year After Lease Sale	Explor. Rigs	Platforms Installed (1)	Oev. Rigs Jan.	Oev. Rigs July	Wells Drilled Explor./Delin.	Wells Drilled Oil Dev.	Wells Drilled Gas Dev.	Pipe Constr. (mi.) Onshore	Pipe Constr. (mi.) Offshore	011 Production Wells (2) fshore Loading	011 Production Wells (2) Onshore Loading	Gas Production Wells (2) (Non-Assoc./Assoc.)	Onshore Facility Construction (3)
1981	1	2				4								
1982	2	4				12								
1983	3	4				12								KCSB(1/1), KLNG(0.5/2.5)
1984	4	6	1S			15								KLNG(1.5/2.5)
1985	5	4	1S		1	10			1.0	47.3				KCSB(1/1), KLNG(2.5/2.5)
1986	6	2	1S	1	2	5		2		23.1			4/0	KOIL(1/2.5)
1987	7		2S	2	5		8	6		49.8			12/0	KOIL(2/2.5)
1988	8		1S	5	8		32	10	1.0	23.1		14	24/0	KOIL(2.5/2.5)
1989	9			8	8		48	10					32/0	
1990	10			8	6		52	4				1:;	32/0	
1991	11			6	2		24					149	32/0	
1992	12			2			4					160	32/0	
1993	13											160	32/0	
1994	14											160	32/0	
1995	15											160	32/0	
1996	16											160	32/0	
1997	17											160	32/0	
1998	18											160	32/0	
1999	19											160	32/0	
2000	20											160	32/0	

Notes: (1) S = Steel
(2) Based on estimated wells drilled by July of each year.
(3) KCSB = Kodiak Construction Service Base (1983 construction for oil development, additional construction in 1985 for gas development); KLNG = Kodiak LNG Terminal; KOIL = Kodiak Oil Terminal.

Source: Dames & Moore, 1979; Peter Eakland and Associates, 1979.

Table 4-25

Tugidak 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 (Non-Assoc./Assoc.)	Onshore Facility Construct on
1981	1													
1982	2													
1983	3													
19G4	4	2				6								
19G5	5	2				6								
1986	6	2				6								
1937	7	2				2								
1988	8													
1989	9		1s											
1990	10				2		8							
1991	11			2	2		16				14			
1992	12			2	2		16				29			
1993	13			2			4				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
(2) Based on estimated wills drilled by July of each year.

Source: Dames & Moore, 1979; Peter Eakland and Associates, 1979.

Table 4-26

Logistics Requirements for Kodiak-Based Drilling - 5% Resource Scenario

	Albatross Field Tonnage (Short Tons)				Tugidak Field Tonnage (Short Tons)				Inbound(1)(2)		Out-bound(3)	Base Year Throughput Factors(4)	
Year	Drill Pipe	Dry Bulk	Fuel	Drill Water	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges	Fuel Tankers	supply Boats	Dry Freight	Fuel
1 (1981)													
2													
3													
4													
5 (1985)													
6	503	926	1,646	3,214					1	1	5	0.0	0.0
7	2,890	5,094	9,054	17,678					2	2	27	0.0	0.2
8	8,036	13,894	24.694	48.214					4	5	73	0.1	0.5
9	10,796	18,526	32,926	64,286					5	7	98	0.2	0.6
10 (1990)	9,976	16,906	30,046	58,662	1,380	2,316	4,116	8,036	5	7	101	0.2	0.7
11	4,140	6,948	12,348	24,108	2,760	4,632	8,232	16,072	4	5	61	0.1	0.4
12	690	1,158	2,058	4,018	2,760	4,632	8,232	16,072	2	3	31	0.1	0.2
13					690	1,158	2,058	4,018	1	1	7	0.0	0.0
14													
15 (1995)													
16													
17													
18													
19													
20 (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 throughput factors are twice the dry freight and fuel tonnage divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-27

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

	Albatross Field Tonnage (Short Tons)				Tugidak Field Tonnage (Short Tons)				Inbound(1)(2)		Out-bound(3)	Base Year Throughput Factors(4)	
Year	Drill Pipe	Dry Bulk	Fuel	Drill Water	Drill Pipe	Dry Bulk	Fuel	Drill Water	Dry Goods Barges	Fuel Tankers	supply Boats	Dry Freight	Fuel
1(1981)	1,833	5,208	9,256	14,464					2	2	28	0.[illegible]	0.8
2	5,498	15,624	27,768	43,392					4	6	82	0.[illegible]	2.5
3	5,498	15,624	27,768	43,392					4	6		0.6	2.5
4	6,873	19,530	34,710	54,240	2,749	7,812	13,884	21,696	7	10	1[illegible]	1.1	4.5
5(1985)	4,582	13,020	23,140	36,160	2,749	7,812	13,884	21,696	5	8	110	0.8	3.4
6	2,794	7,436	13,216	21,294	2,749	7,812	13,884	21,696	4	6	80	0.6	2.5
7	2,890	5,094	9,054	17,678	916	2,604	4,628	7,232	2	3	41	0.3	1.3
8	8,036	13,894	24,694	48,214					4	5	73	0.7	2.3
9	10,796	18,526	32,926	64,286					5	7	98	0.9	3.0
10(1990)	9,976	16,906	30,046	58,662	1,380	2,316	4,116	8,036	6	7	101	0.9	3.1
11	4,140	6,948	12,348	24,108	2,760	4,632	8,232	16,072	4	5	61	0.6	1.9
12	690	1,158	2,058	4,018	2,760	4,632	8,232	16,072	2	3	31	0.3	0.9
13					690	1,158	2,058	4,018	1	1	7	0.1	0.2
14													
15(1995'													
16													
17													
18													
19													
20 (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 throughput factors are twice the dry freight and fuel tonnage divided by base year tonnages.

Source: Peter Eakland and Associates, 1979.

Table 4-28

Estimated Barges and Tonnage for Construction Activities - 5% Scenario

Location	Facility	1983	1984	1985	1986	1987	1988	1989
Seward(1)	Inbound Uncoated Pipe & Cement		4	1				
	Outbound Coated Pipe			7	2			
	Total Barges		4	8	2			
	Est. Tonnage at 6,000 Short Tons/Barge		24,000	48,000	12,000			
Kodiak(z)	Construction Camp	5						
	Support Base	3		2				
	LNG Plant - 600 mm cfd	6	10	10				
	Oil Terminal - 384,000 bbls/day				4	6	2	
	Onshore Pipeline			0.1				
	Construction Equipment	3	2					
	Total Barges	17	12	12	4	6	2	
	Est. Tonnage at 6,000 Short Tons/Barge	102,000	72,000	72,000	24,000	24,000	12,000	

Notes: (1) Facilities to be constructed for Northern Gulf of Alaska Scenarios not included.
(2) Includes materials going to Kodiak area directly and those going to Ugak Bay.

Source: Peter Eakland and Associates, 1979.

Table 4-29

Average Monthly Consumable Demands, Western Gulf

High Scenario

Year	Tons[1]		Containers[2]	
	Seward	Kodiak	Seward	Kodiak
1 (1981)	21.9	0	2	0
2	49.8	0	4	0
3	49.8	0	4	7
4 〃	25.4	264.0	2	18
5 (1985)	26.1	297.8	2	20
6	17.9	187.4	2	13
7	14.9	254.1	1	17
8	10.2	175.7	1	12
9	6.9	152.7	1	11
10 (1990)	6.0	155.3	1	11
11	5.0	77.9	1	6
12	5.3	61.4	1	5
13	5.3	48.8	1	4
14	5.3	52.1	1	4
15 (1995)	5.3	55.8	1	4
16	5.3	59.6	1	4
17	5.3	59.6	1	4
18	5.3	59.6	1	4
19	5.3	59.6	1	4
20 (2000)	5.3	59.6	1	4

Notes: (1) Tons = (Offshore onsite + Onshore onsite non-local employment) X (300 lbs./person) ÷ (2,000 lbs./ton).

(2) Containers = Tons/(15 tons/container).

Source: Peter Eakland and Associates, 1979.

Table 4-30
Monthly Supply Boat Round-Trips by Service Base - 5% Resource Level Scenario

Year	Middle Albatross Basin Exploration	Middle Albatross Basin Development	Middle Albatross Basin Production	Tugidak Basin Exploration	Tugidak Basin Development	Tugidak Basin Production	Total Seward Based Trips	Minimum Berth Requirements	Total Kodiak Based Trips	Minimum Berth Requirements
1(1981)	24						24	1		
2	48						48	2		
3	48						48	2		
4	72	24		48			144	3	12	1
5(985)	48	87		48			140	3	44	2
6	24	131		48			138	3	66	2
7		191		48			144	3	96	3
8		227	4				114	3	117	3
		160	12		24		96	3	100	3
1:(990)		120	16		40		85	2	91	3
11		40	24		40		48	1	56	2
12			28		40		30	1	38	1
13			28			4	11		21	
14			28			4	11		21	
15(1995)			28			4	11		21	
16			28			4	11		21	
17			28			4	11		21	
18			28			4	11		21	
19			28			4	11		21	
20(2000)			28			4	11		21	

Source: Peter Eakland and Associates, 1979

Table 4-31

5% Resource Level Scenario - Oil and Gas Production and Transportation

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
oil Production															
Albatross Basin															
Oil Terminal (MMBBL)		14.0	40.3	61.3	70.1	68.7	56.7	44.3	35.5	27.2	17.5	13.3	11.0	8.7	6.9
Tugidak Basin															
Offshore Loading (MMBBL)						9.5	17.8	23.7	23.7	23.7	23.1	18.9	16.3	14.0	12.0
oil Tanker Traffic (1)															
Albatross Basin (Round-trips/year)		16	44	66	76	74	61	48	39	24	19	15	12	10	8
Tugidak Basin (Round-trips/year)						11	20	26	26	26	25	21	18	16	13
Total (Round-trips/year)		16	44	66	76	85	81	74	65	50	44	36	30	26	21
Gas Production															
Albatross Basin															
LNG Terminal (Em	70.1	175.3	210.4	245.4	280.4	280.4	280.4	280.4	280.4	252.4	229.9	198.7	103.4	140.0	113.0
LNG Ship Traffic (2)															
Albatross Basin (Round-trips/year)	25	63	76	88	101	101	101	101	101	91	83	71	37	50	41

Notes: (1) Oil Tanker Round-trips/year = (Total Production/year) /(7.74)(120,000). Assumes average tanker fleet size of 120,000 DWT. 7.74 bbls = 1 long ton.

(2) LNG Ship Round-trips/year = (Total Production/year)/(2.8 BCF), where 2.8 BCF of natural gas is equivalent to 130,000 n?, the capacity of LNG vessels designed for Cook Inlet.

Source : Peter Eakland and Associates, 1979.

Table 4-32

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

Year	Anchorage		Whittier		Kodiak		Seward	
	Dry Bulk	Petroleum	Dry Bulk	Petroleum	Dry Bulk	Petroleum	Dry Bulk	Petroleum
1 (1981)								
2								
3					1.3**	1.4		
4	No Change	No Change	No Change	Military Use	1.4**	1.4	No Change	1.3
5 (1985)					1.5**	1.6		1.3
6					1.5**	1.5		1.3
7					1.6**	1.6		1.4
8					1.6**	1.6		1.5
9					1.6**	1.7		1.6
10 (1990)					1.6**	1.7		1.7
11					1.7**	1.7		1.7
12					1.7**	1.8		1.6
13					1.7**	1.8		
14					1.8**	1.9		
15 (1995)					1.8**	1.9		
16					1.8**	2.0*		
17					1.9**	2.0*		
18					1.9**	2.0*		
19					1.9**	2.0*		
20 (2000)					1.9**	2.1*		
Threshold Value for Low Cap.	1.9	2.2	2.7	No Increase Expected	-	1.6	3.8	3.3
Threshold Value for High Cap.	2.7	3.5	3.9		1.1	3.2	5.4	4.6
Low Value (year)					1.1	1.1		1.1
High Value (year)					1.9	2.0		1.7

Value Exceeding Low Capacity *
Value Exceeding 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 4-33

Weekly Helicopter Round Trips from Service Bases in Western Gulf

High Scenario

Year	Kodiak Total Offshore Average Monthly Employment(1)	Peak Weekly Round Trips(2)	Helicopter Trips er Week(3)
1 (1981)	214	71	5
2	472	157	11
3	472	157	11
4	1,046	469	34
5 (1985)	1,934	645	46
6	1,680	560	40
7	1,994	665	48
8	1,940	647	47
9	1,804	601	43
10 (1990)	1,766	589	43
11	732	244	18
12	483	161	12
13	284	95	7
14	278	93	7
15 (1995)	303	101	8
16	328	110	8
17	328	110	8
18	328	110	8
19	328	110	8
20 (2000)	328	110	8

Notes: (1) Total employment includes offsite plus onsite personnel. 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/me.) X (2.) peak factor) ÷ 4.3 weeks per month.

(3) Based on 14 passengers per trip

Source: Peter Eakland and Associates, 1979.

Table 4-34

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

	Seward-Anchorage				Kodiak-Anchorage				Kodiak-Seattle		Anchorage-Seattle			
Year	Intra (1.0)	Inter (1.0)	Total Weekly Trips	Commuter Plane Equivalent (1)	Intra (1.0)	Inter (.25)	Total Weekly Trips	Jet (2) Plane Equivalent	Total Weekly Trips Inter (.75)	Jet (2) Plane Equivalent	SWD Inter (1.0)	KOD Inter (.25)	Total Weekly Trips	Jet (2) Plane Equivalent
1 (1981)	5	8	13	0.7	11	11	22	0.2	32	0.3	8	11	19	0.2
2	11	20	31	1.7	23	23		0.5	68	0.7	20	23	43	0.4
3	11	20	31	1.7	83	38	1:!	1.1	113	1.1	20	38		0.6
4	25	38	63	3.4	160		258	2.4	292	2.7	38		1;:	1.3
5(1985)	30	34	64	3.4	181	1;:	306	2.8	374	3.4	34	1:;	159	1.5
6	23	16	39	2.1	110		208	1.9	294	2.7	16		114	1.1
7	22	10	32	1.7	142	1;:	264	4.3	366	3.4	10	1;:	132	1.2
8	18	5	23	1.3	110	104	214	2.0	310	2.9	5	104	109	1.0
9	14	2	16	0.9	113	89	202	1.9	265	2.4	2	89	91	0.9
10(1990)	14	1	15	0.8	120	84	204	1.9	250	2.3	1	84	85	0.8
11	11	1	12	0.7	96	24	120	1.1	72	0.7	1	24	25	0.3
12	12	1	13	0.7	82	12	94	0.9	36	0.4	1	12	13	0.2
13	12	1	13	0.7	72	3	75	0.7	9	0.1	1	3	4	0.1
14	12	1	13	0.7	79	1	80	0.8	1	0.1	1	1	2	0.1
15 (1995)	12	1	13	0.7	84	1	85	0.8	1	0.1	1	1	2	0.1
16	12	1	13	0.7	89	1	90	0.9	1	0.1	1	1	2	0.1
17	12	1	13	0.7	89	1	90	0.9	1	0.1	1	1	2	0.1
18	12	1	13	0.7	89	1	90	0.9	1	0.1	1	1	2	0.1
19	12	1	13	0.?	89	1	90	0.9	1	0.1	1	1	2	0.1
20(2000)	12	1	13	0.7	89	1	90	0.9	1	0.1	1	1	2	0.1

Notes: (1) Commuter aircraft assumed to have a capacity of 19 passengers.
(2) Jet aircraft assumed to have a capacity of 110 passengers.

Source: Peter Eakland and Associates, 1979.

Table 4-35
Induced and OCS-Related Weekly Air Travel - High OCS Mean Base (HBM) Case(3, 4, 5)

	Kodiak-Anchorage (1)			Seward-Anchorage				Kodiak-Seattle(1)			Anchorage-Seattle			
Year	High OCS Growth	High W. Gulf OCS	Total Weekly Trips	High OCS Growth	W. High Gulf OCS	Mean Base Devel. (2)	Total Weekly Trips	High OCS Growth	W. High Gulf OCS	Total Weekly Trips	High HBM Growth	W. High Gulf Ocs	Mean Base Devel.(2)	Total Weekly Trips
1(1981)	149	22	171	16	13	?2	41	66	32		1,930	19	957	2,906
2	214	46	260	25	31	18	74	94	68	1:!	3,088	43	1,162	4,293
3	293	121	414	33	31	30		129	113	242	3,822	58	1,535	5,415
4	380	258	638	54	63	34	1;:	167	292	459	3,873	136	1,520	5,529
5(1985)	459	306	765	83	64	112	299	201	374	575	4,323	159	683	5,165
6	521	20B	729	75	39	46	160	228	294	522	4,980	114	778	5,872
7	579	264	843	81	32	22	135	254	366	620	5,842	132	628	6,602
8	696	214	910		23	28	138	305	310	615	6,639	109	897	7,645
9	732	202	934	1!;	16	44	177	321	265	586	7,411	91	1,188	8,690
10(1990)	767	204	971	124	15	24	163	336	250	586	8,170	85	1,019	9,274
11	808	120	928	108	12	10	130	354	72	426	8,762	25	820	9,607
12	B73	94	967	98	13	4	115	383	36	419	9,367	13	722	10,102
13	915	75	990	102	13	4	119	402	9	411	10,049	4	628	10,681
14	960	80	1,040	110	13	4	127	421	1	422	10,769	2	47	10,818
15	1.,004	85	1,089	130	13	4	147	440	1	441	11,593	2	24	11,619
16	1,039	90	1,129	132	13	4	149	456	1	457	12,506	2	8	12,516
17	1,073	90	1,163	143	13	4	160	471	1	478	13,433	2	1	13,436
18	1,098	90	1,188	154	13	4	171	481	1	482	14,410	2	1	14,413
19	1.143	90	1,233	166	13	4	183	501	1	502	15,504	2	1	15,507
20 (2000)	1, 178	90	1,268	17B	13	4	195	517	1	518	16,559	2	1	16,561
Lowest % Induced (year)			59.6%(1984)				32.0% (1985)			35.0% (1985)				66.3% (1981)
Threshold	3 fits/day		794			3 fits/day	80		1.5 fits/day	462		50% service increase		6,433
Values	4 flts/day		1,410			4 fits/day	213		2 flts/day	77o		100% service increase		12,866

Notes:
(1) Kodiak HBM traffic values are also the values for the High OCS - High Base Case.
(2) Mean Base Devel. includes trips forecast for Northern Gulf of Alaska high scenario.
(3) "Growth" traffic is basedon population growth beyond 1977-78.
(4) "Development" traffic is based on non-local employees on development projects.
(5) Threshold values basedon 110 passenger jets for Kodiak routes, 19 passenger planes for Seward, and a mix of jets for Anchorage-Seattle.

Source: Peter Eakland and Associates, 1979

Table 4-36

Seward-Based Supply Boat Berth Requirements - Low Base Case

	N. Gulf - Low Base Case		Low OCS - Low Base Case		
			W. Gulf - Low OCS		
Year	Round Trips/Me.	Berth Req.	Round Trips/Me.	Total Round Trips/Me.	Berth Requirements(1)
1 (1981)	12	1	36	48	2*
2 (1982)	24	1	36	60	2*
3 (1983)	24	1	24	48	2*
4 (1984)	24	1		24	1
5 (1985)					
6 (1986)					
7 (1987)					
8 (1988)					
9 (1989)					
10 (1990)					
11 (1991)					
12 (1992)					
13 (1993)					
14 (1994)					
15 (1995)					
16 (1996)					
17 (1997)					
18 (1998)					
19 (1999)					
20 (2000)					

Note: (1) An asterisk (*) indicates years in which an increase over base case berth requirements is necessary.

Source: Peter Eakland and Associates, 1979.

Anchorage-Seattle Weekly Air Travel - LBL and HBH OCS Cases (1, 2)

Table 4-37

	Low OCS-Low Base Case (LBL)				High OCS-High Base Case (HBH)			
Year	LBL Growth	Low W. Gulf Ocs	Low Base Devel. (3)	Total Weekly Trips	HBH Growth	High W. Gulf Ocs	High Base Devel. (3)	Total Weekly Trips
1	1,827	42	510	2,379	1,879	19	764	2,662
2	2,947	42	748	3,737	2,998	43	1,294	4,335
3	3,616	15	1,220	4,851	3,925	58	2,227	6,2?0
4	3,525		1,061	4,586	4,362	136	2,581	7,079
5	3,835		173	4,008	5,198	159	1,461	6,818
6	4,349		161	4,510	6,035	114	1,251	7,400
7	4,953		243	5,196	6,948	132	744	7,824
8	5,610		388	5,998	7,797	109	1,389	9,295
9					8,544	91	1,541	10,176
10 (1990)					9,097	85	1,360	10,542
11					9,868	25	1,362	11,255
12					10,473	13	1,070	11,556
13					11.193	4	943	12,140
14					11,927	2	112	12,041
15 (1995)					13,574	2	47	13,623
16					14,526	2	14	14,542
17					14,539	2	3	14,544
18					15,555	2	3	15,560
19					16,688	2	3	16,693
20 (2000)					17,768	2	3	17,773
Lowest % Induced (year)				74.5% (1983)				61.6% (1984)
50% service increase				6,433				6,433
100% service increase				12,866				12,866

NOTES :

(1) "Growth" traffic is based on population growth in the Anchorage region beyond 1977

(2) "Development" traffic is based on non-local employees on development projects, including the Northern Gulf of Alaska

SOURCE : Peter Eakland and Associates, 1979.

for Northern and Western Gulf activities will be delivered directly to marine construction work sites or service bases.

Issues. The new issue in the HBM case involves land transportation between Kodiak and Ugak Bay. A major new road will open new lands for development and conflicts could occur between industrial and recreational users.

4.6 Low OCS-Low Base Case (LBL)

4.6.1 REVIEW OF LOW BASE CASE

The low base case includes the impacts of exploration in the three preceding OCS lease sales in Alaska, which are located in Lower Cook Inlet, Beaufort Sea, and the Northern Gulf of Alaska. No direct OCS transportation demands occur after 1984, since exploration activities last only 3-4 years and exploration in the Beaufort Sea and the Northern Gulf of Alaska likely will begin in 1981. The small indirect, or population-related, increases in transportation demand that do take place during the short span of OCS activities quickly recede to non-OCS activities.

Analysis of the low base case did not consider growth in Kodiak for two reasons - (1) a single base case was constructed for the community and was analyzed as the mean base case, and (2) no base case OCS activities are expected to use Kodiak air or marine facilities for support. Seward is one of the ports supplying logistics support for Northern Gulf of

Alaska exploration activities. Whittier and Seward will serve as entry ports for other development projects included in the low base case, including Beaufort Sea OCS exploration activities.

For the marine mode, Anchorage dry freight port facilities are expected to exceed the low capacity threshold in 1997. Fuel will reach the low capacity threshold in 2000. Factors were generated for Kodiak, since Southcentral regional population growth was weighted 30% against 70% for local population growth; but changes from the mean base case occur in only several years. The high capacity threshold value is still exceeded first in 1982. The slight shifts in demand that do occur for the two ports do not change the need for improvements during the study period. At Seward, any potential impacts would be caused by exploration activities in the Northern Gulf of Alaska which would use existing facilities as a support base.

Steady growth in the air mode on airport links out of Seward and Anchorage will cause incremental growth in carrier fleets. A drastic reduction in training operations at Anchorage International Airport will be required to provide adequate runway capacity, but major capital improvements will focus on the passenger terminal and taxiways.

The only impact noted for the land mode was the Seward Highway, particularly the section between Girdwood and the Sterling Highway Junction, which will experience consistent congestion in the late 1980's due to population-related recreational traffic.

4.6.2 FACTORS CAUSING GROWTH

The analysis of the LBL case will consider only those transportation activities that are different from the LBM case and that can be added to activities in the low base case either directly, such as supply boat berth requirements, or through an interactive process, such as population-related demands. No LBL case exists for locally-generated transportation demands, which include air links from Seward and Kodiak and for the most part, Kodiak port facilities. In the case of Kodiak, no low base was constructed. Thus, low scenario impacts are analyzed only in the LBM case. For Seward, the LBM case for the Northern Gulf OCS transportation assessment study was used as the low base case, but the Western Gulf local studies did not carry this case forward. LBL impacts can be assessed only for direct OCS activities. The case is best viewed as an analysis of regional and direct OCS activities.

Differences in regional population for the LBL and BL cases were developed and used to forecast traffic growth at ports with regional market areas and air passenger increases on the Anchorage-Seattle link. As expected, regional population growth in the LBL case is the lowest of any of the cases developed.

4.6.3 WATERM ODE

4.6.3.1 Description of Activities

Industrial Freight. Industrial freight is limited to drilling commodities for three years of exploration in the Western Gulf and four years in the Northern Gulf.

Supply Boat Movements and Berths. Table 4-36 shows the cumulative equivalent supply boat berth requirements at Seward. Two berths are required from 1981-1983, an increase of one each year over the BL case (Table 4-36).

Induced Growth. Changes in regional population are insufficient to cause a 10% change ‘in any year from the BL case in base year throughput tonnage.

4.6.3.2 Summary of Impacts

Terminals. Existing facilities at Seward will be used to support exploration activities. Two berths require a minimum of 122 lineal m (400 ft.) of dock space. Isolated instances of congestion are possible if substantial quantities for other development projects use Seward as an entry port and if a high seasonality of shipments occur. Improvements in Anchorage will be required on the same time schedule as in the BL case.

Carriers. Additional work for contract carriers will develop during exploration activities, but, given adequate lead time by shippers, the necessary equipment can easily be made available. Increased demand to Seward will help Pacific Alaska Lines maintain scheduled service to that community, at least in the early 1980's.

Issues. The principal issue is the level of effort in the exploration phase. In the absence of economic discoveries, there could be a level of effort less than forecast.

4.6.4 AIR MODE

4.6.4.1 Description of Activities

Helicopter operations out of Kodiak are the same as in the LBM case. Those out of Seward remain at a low level since it is not the major terminal for offshore employee movements for activities in either the Northern or Western Gulf. Trips on scheduled carriers from Seward and Kodiak are the same as in the LBM case. Incremental growth from the base case is minor and short-lived.

Table 4-37 shows traffic increases forecast on the Anchorage-Seattle link. The low population increases and short duration of OCS activities result in insignificant changes from the low base case. The largest increase, 55 trips per week, is in 1982 and represents an increase of only 1.5%

over the low base case. Effects then recede, and, after 1988, no low scenario effects remain.

4.6.4.2 Summary of Impacts

No significant changes in impacts on air terminal or air carriers result from the low base case. The extent of service increases required on the Seward-Anchorage and Anchorage-Seattle links remain unchanged, and the need and timing of terminal improvements at Anchorage International Airport will not change. No new issues arise.

4.6.5 LAND MODES

No measurable changes from the low base case are observed either for roads or the Alaska Railroad. Capacity improvements on the northern section of the Seward Highway remain a priority concern, and implementation is required by approximately 1987.

4.6.6 SUMMARY COMPARISON OF LOW OCS-LOW BASE CASE AND LOW BASE CASE

Transportation demands that are regional in origin are virtually identical for the two cases. The slight bulge produced by Western Gulf exploration would not be expected to produce additional problems. The possible exception is the requirement for the equivalent of an additional supply boat berthat Seward from 1981 to 1983. Alternatives exist for moving both OCS and non-OCS freight to destinations should congestion become a problem.

4.7 High OCS-High Base Case (HBH)

4.7.1 REVIEW OF HIGH BASE CASE

The high base case includes high levels of economic discoveries in Lower Cook Inlet, Beaufort Sea, and Northern Gulf OCS lease sale areas. Development-related transportation traffic occurs throughout the study period for all marine and air terminal and carriers except those serving Kodiak.

The only OCS-related construction to occur at cities affected by the Western Gulf is a supply base at Seward. Construction begins in 1985 and includes five supply boat berths, or a minimum of 305 lineal m (1,000 ft.) of dock space. At Anchorage, the low capacity threshold for dry freight is forecast to be exceeded in 1995, while the low capacity threshold for fuel is 1999. As with the LBL case, the 30% weighting of traffic to Southcentral Region population for Kodiak produces some slight changes in several years but no change in the timing of the threshold values. No change is greater than 10% of base year tonnages.

Substantial air passenger increases occur on the Seward-Anchorage and Anchorage-Seattle links. In 1986, on the latter link, a 50% increase over base year traffic is expected. On the former, peaking of demand occurs during Northern Gulf development activities but after 1983 four flights per day appear to be adequate for the remainder of the study period. This level of service represents an additional flight per day over existing conditions.

Consistent congestion on the northern section of the Seward Highway can be expected beginning in 1985. The railroad will carry substantial development-related tonnage from both Seward and Whittier. After themid-1980's, activities in the Beaufort Sea will supply most of this tonnage, although inevitably other developments not included in the base scenario will also emerge.

4.7.2 FACTORS CAUSING GROWTH

Table 4-38 compares base year population factors for the high base (BH) and the HBH case for each year of the study period. As in the LBL case, the HBH case will focus on those impacts that are regional in origin and those categories of direct OCS demands that are different from the case using the mean base case.

For Anchorage, the population factors never exceed 3% of the base year population. A peak of 2.9% is reached in 1987 and a level of 2.4%or above is maintained for the remainder of the study period. Population impacts apparently do not affect the growth rate, as the scenario contributes a relatively constant population figure from year to year in the last half of the study period.

4.7.3 WATER MODE

4.7.3.1 Description of Activities

Industrial Freight. The HBH case adds the high scenario of Western Gulf development (Tables 4-25 and 4-26) to the high scenarios of the three previous OCS lease sales. The analysis developed in the LBM case for Kodiak is unchanged for the LBL case, since only a single base case was developed for the community. At Seward, activities for the Western Gulf are added to those of the Northern Gulf. By 1984, the combined base year throughput tonnage figures for dry freight and fuel, respectively, are 1.7 and 6.7. Induced and base development tonnage add an additional 1.9 and 1.2, respectively, to the dry freight and fuel tonnage factors. The year in which the largest drilling-related tonnage occurs is 1984 for the Western Gulf and 1990 for the Northern Gulf. The peak for the Northern Gulf is 33% higher than that for the Western Gulf. When tonnage for the two lease sales is combined, the peak year occurs in 1990 and produces a 1.7 base year throughput factor for freight and 9.1 for fuel.

Supply Boat Movements and Berths. Peak supply boat requirements of five in the high base case are increased to seven in the HBH case to handle an estimated 364 monthly round-trips in 1988 (Table 4-39). Increases in berth requirements occur soon after exploration begins. In the high base case, the equivalent of two berths is adequate until 1988, but an earlier development schedule for the Western Gulf high scenario makes three berths necessary in 1983. Four berths are required for the following four years.

supply boats serve a variety of purposes other than moving drilling materials to rigs and platforms, which accounts for the difference' in peak years between the analyses for tonnage and supply boat movement.

Induced Growth. Despite the high level of activity in the Western Gulf, regional population growth is insufficient to produce changes ofat least 10% of the base year throughput tonnage in any year at Anchorage, Whittier, or Seward.

4.7.3.2 Summary of Impacts

Terminals. No additional impacts from the high base case are expected at the Ports of Whittier and Anchorage. At Seward, the potential for congestion occurs several years after exploration begins. Even before development begins, resource discoveries result in increased exploration and delineation drilling. To accommodate the forecast supply boat movements, construction of the supply base probably should be moved ahead several years. Impacts of the high scenario in Kodiak are discussed in the HBM case.

Carriers. A high demand for contract carriers will occur in the HBH case but, based on the ability of operators to obtain equipment for the massive Prudhoe Bay sealifts, the lesser requirements for the OCS operations can easily be accommodated. Scheduled carriers will be able to accommodate the forecast incremental traffic increases resulting primarily from increases in population but also including some OCS-related goods.

Issues. The HBH scenario, which anticipates maximum discoveries of economically recoverable oil and gas reserves, is influenced by all steps of the OCS planning process leading up to the lease sale. The call for nominations and subsequent tract selections likely will produce a substantially smaller area than was originally under consideration, decreasing the probability that the high scenario will take place. The other principal issue involves timely construction of a support base at Seward so as to limit the potential for congestion at Seward's existing facilities.

4.7.4 AIR MODE

4.7.4.1 Description of Activities

Helicopter operations remain low at Seward despite the high level of activity becasue offshore employees are rotated through Kodiak for Western Gulf worksites and through Yakutat and Cordova for Northern Gulf worksites. Traffic increases on the Anchorage-Seattle link are a modest 5% in 1990 at the height of development. As explained in the discussion of the HBH case, the links out of Kodiak are expected to experience the largest proportional increases due to the high scenario. This increase can be accommodated by existing carriers, particularly on the Kodiak-Seattle link.

4.7.4.2 Summary of Impacts

No new demands are placed on the air transportation systems that would affect the timing or extent of improvements required in the high base case. Improvements principally relate to passenger terminal improvements at Anchorage International Airport, which have already been programmed for the near future. No new issues arise.

4.7.5 LAND MODES

Population increases are not sufficient to change the timing of congestion on the Seward Highway. The high scenario will bring some additional traffic to the Alaska Railroad but mostof the industrial freight destined for Seward will go there directly.

4.7.6 SUMMARY COMPARISON OF HIGH OCS HIGH BASE CASE AND HIGH BASE CASE

The relatively modest population increases caused by the high scenario will not add any additional impacts to regional transportation systems. Direct OCS transportation demands increase the need for suppy boat berths at Seward beginning in 1982 and raise ultimate berth requirements from five in the base case to seven. Local impacts for Seward and Kodiak are discussed in the HBM case.

Table 4-38

Regional Population Projections: High OCS - High Base Case (HBH) Factors to Produce Incremental Changes from High Base Case (BH) (1)

Year	Statewide	Anchorage	Southcentral	Fairbanks
		Base-Year Populations		
1977	410,660	190,188	58,958	57,700
		Incremental Factors		
1981	0.001	0.001	0.007	
1982	0.002	0.002	0.015	
1983	0.008	0.007	0.020	
1984	0.018	0.015	0.051	
1985	0.027	0.023	0.076	
1986	0.025	0.024	0.058	
1987	0.028	0.029	0.063	
1988	0.028	0.029	0.066	
1989	0.028	0.029	0.071	
1990	0.028	0.029	0.072	
1991	0.027	0.028	0.067	
1992	0.026	0.027	0.065	
1993	0.023	0.026	0.048	
1994	0.022	0.024	0.045	
1995	0.022	0.024	0.051	
1996	0.022	0.024	0.053	
1997	0.023	0.025	0.053	
1998	0.023	0.025	0.053	
1999	0.023	0.026	0.053	
2000	0.024	0.026	0.053	

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; Peter Eakland and Associates, 1979.

Table 4-39

Seward-Based Supply Boat Berth Requirements - High Base Case

Years After Lease Sale	N. Gulf - High OCS		High OCS - High Base Case		
	Round Trips/Me.	Berth Req.	W. Gulf - High OCS Round Trips/Me.	Total Round Trips/Me.	Berth Requirements(1)
1 (1981)	12	1	24	36	1
2	24	1	48	72	2*
3	36	1	48	84	3*
4	48	2	144	192	4*
5 (1985)	48	2	140	188	4*
6	24	1	138	162	4*
7	60	2	144	204	4*
8	250	5	114	364	7*
9	192	4	96	288	5*
10 (1990)	200	4	85	285	5*
11	144	3	48	192	4*
12	64	2	30	94	3*
13	64	2	11	75	2
14	12	1	11	23	1
15 (1995)	12	1	11	23	1
16	12	1	11	23	1
17	12	1	11	23	1
18	12	1	11	23	1
19	12	1	11	23	1
20 (2000)	12	1	11	23"	1

Note: (1) An asterisk (*) indicates years in which an increase over base case berth requirements is necessary.

Source: Peter Eakland and Associates, 1979.

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APPENDIX: METHODOLOGY

1.1 Introduction

The task of assessing the impact on regional and statewide transportation systems of oil and gas development in Western 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 disaggregated 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. Kodiak and Seward, the most likely supply base sites for oil and gas activities in Western Gulf of Alaska, have certain transportation facilities in excess of what would be expected for communities of their size. Kodiak's airport, constructed by the military during World War II, is equipped 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 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 day of operating an offshore pipeline bury barge have been estimated at $150,000 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. Sharing 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 Western Gulf of Alaska depends upon the location and the mode involved. The more important climatic impacts are discussed below:

- Ice Conditions. None of the Western 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.

- Snow Conditions. Snow conditions can affect the efficiency of supply base operations and close an airport for several days at a time. Mean annual snowfall at Kodiak is 2.3 m (90 in.). The airport occasionally is closed for up to 24 hours due to blowing and drifting snow. 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 both Seward and Kodiak, visibility during August is less than 3.2 km (two miles), an average of 11.8% and 12.5%, respectively. Winter percentages are less than during the summer and generally higher in Seward than Kodiak. CAB certificated carriers flying into Anchorage operated at 93.2% reliability, and Kodiak operations trailed at 87% (CAB, 1978). A significantly lower percentage, 63.3%, was recorded for the same period at Kodiak Municipal Airport, which is used exclusively by Kodiak-Western Alaska Airlines. 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 result 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 that are indirect. The detailed methodologies for each are described below.

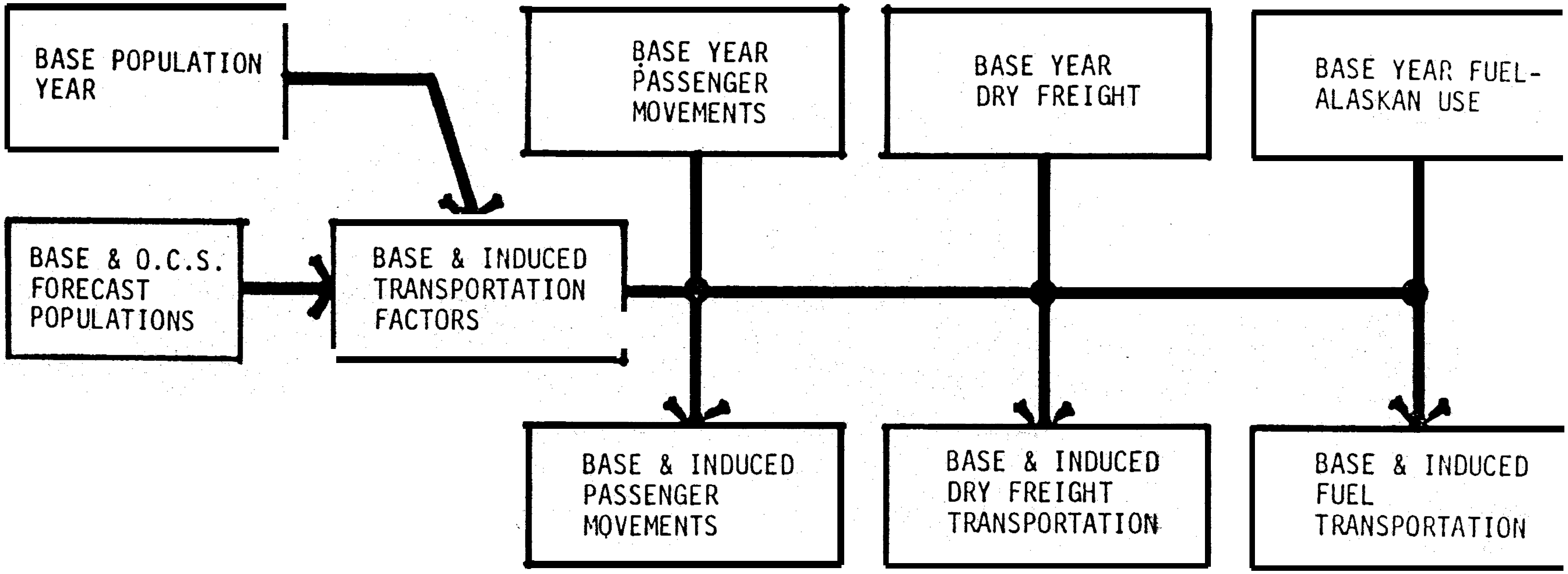
1.6.1 CATEGORIES 1 & 2: INDUCED TRANSPORTATION DEMANDS

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

Flow Charts for Development of Transportation Demand Categories 1, 2, and 3

Category 1 & 2:
BASE CASE TRAFFIC
OCS-INDUCED TRAFFIC

A" PASSENGERS
B " DRY FREIGHT
C. FUEL-ALASKA CONSUMPTION



Category 3:
OCS INDUSTRIAL FREIGHT

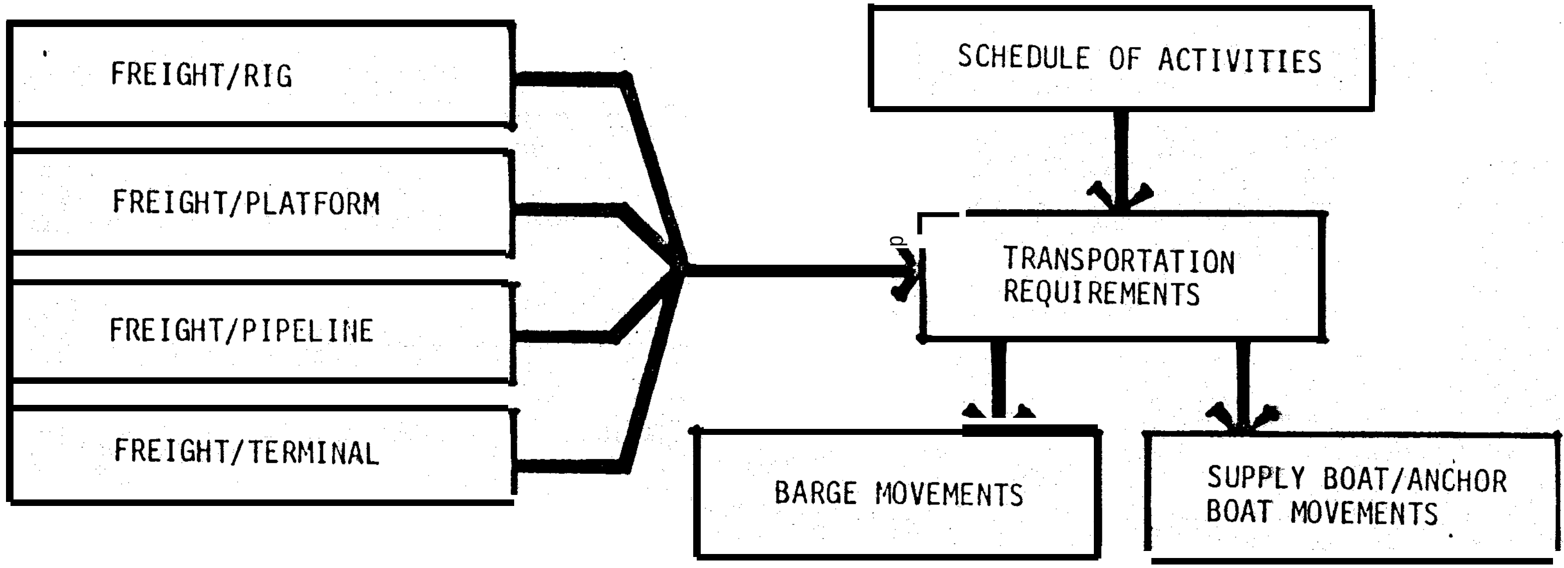
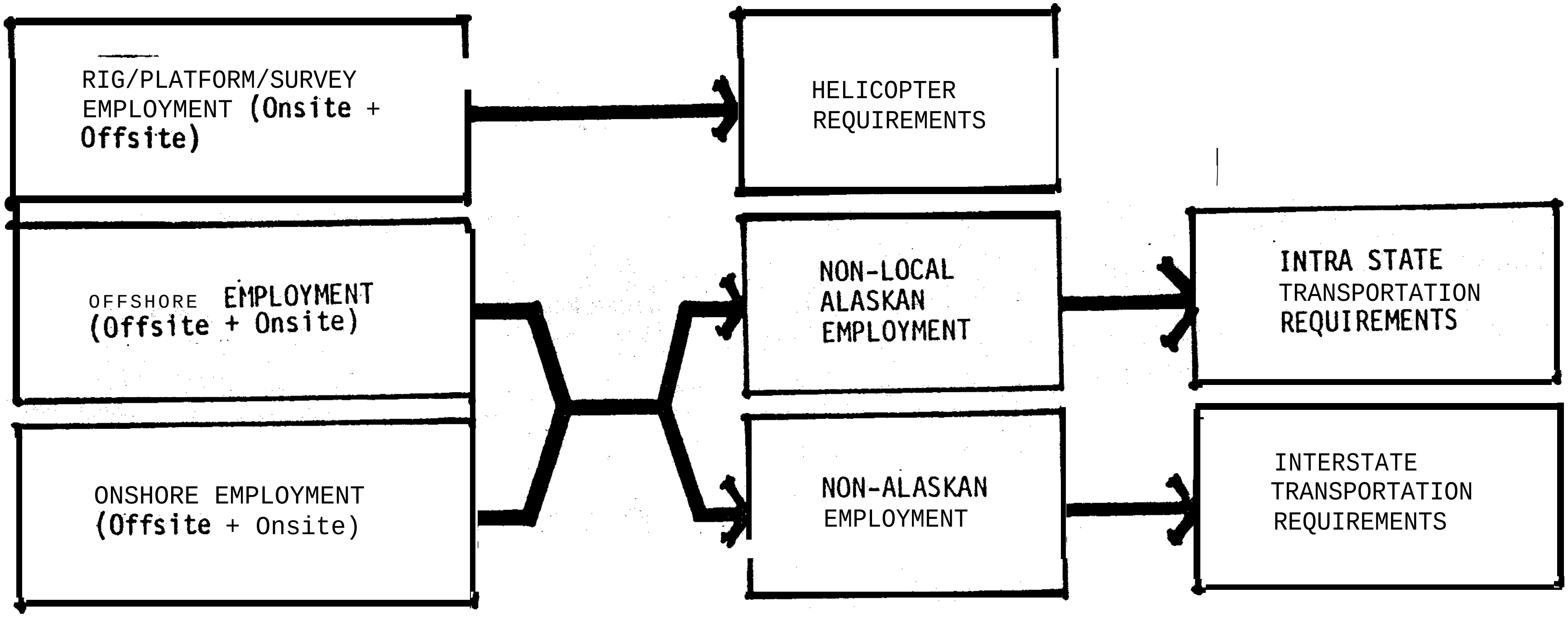


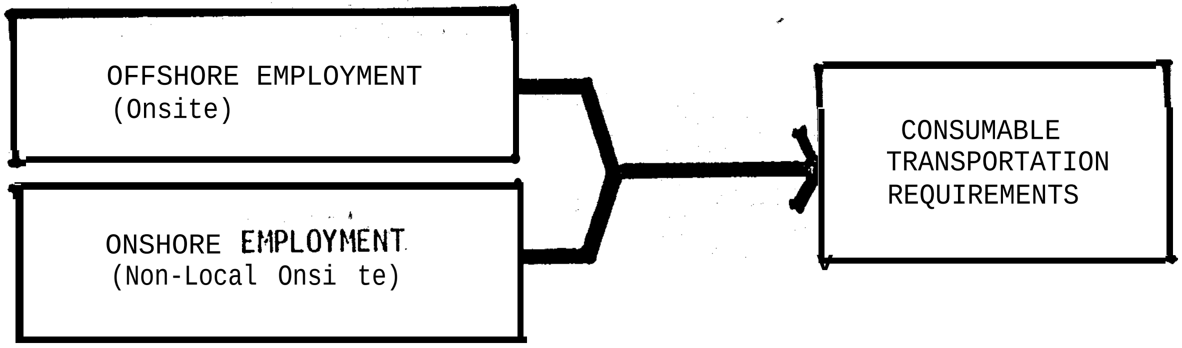
Figure A-1b. Flow' Charts for Development of Transportation Demand Categories 4 and 5

Category 4: OCS PASSENGER MOVEMENTS

A. HELICOPTER OPERATION
B. INTRASTATE MOVEMENTS
C. INTERSTATE MOVEMENTS



Category 5: OCS CONSUMABLES



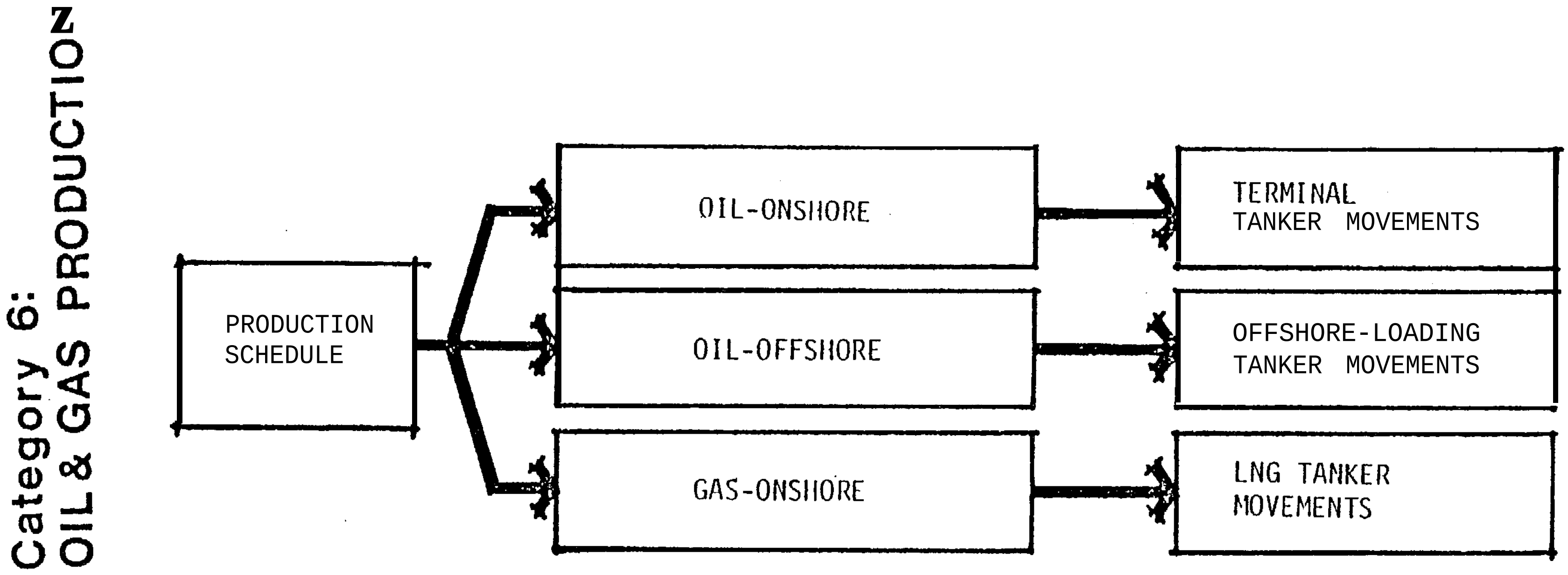


Figure 1-a. Flow Chart for Development of Transportation Demand Category 6

values. A detailed description of the process, first for the marine mode and next for the air mode, is described below.

1.6.1.1 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 Kodiak	Dry Bulk	0.7			0.3(1)
	Petroleum Bulk	1.0			

Note: (1) This region is used recognizing that it does not include transportation to the Aleutians. Proportions based upon judgment and Frederick Harris Corps of Engineers Report (1978).

Source: Peter Eakland and Associates, 1979.

(2) Development of Freight Distribution Factors, Population data was avialable 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. 46. 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 and Kodiak is assumed to be local in nature. The Port of Anchorage has a market area beyond the Anchorage region, and 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 air passenger movements and local 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.

I.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 flights between Kodiak, Seward, Anchorage, and Seattle. They include Seward-Anchorage, Kodiak-Anchorage, Kodiak-Seattle, and Anchorage-Seattle. The forecasting will concentrate on non-stop travel, and flights in only one direction will be considered. It is assumed that flights in the reverse direction will have approximately the same level of traffic.

(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. August 1978 was used as the base period in order to reflect peak demand. The figures were divided by4.3 to produce weekly trips.

(3) Development of 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 passenger 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 for each link. Second, the ratio between population and traffic between city pairs is expected to remain constant in the future,

Regional and local forecasts as appropriate are used to produce base year factors by dividing each forecast by the 1977 population. These factors are the same as those used in induced marine tonnage forecasting. Local, areawide populations are used for Seward and Kodiak and regional factors for Anchorage. For OCS cases, onshore construction workers are not considered as part of the population. Their movements are forecast separately as a direct transportation demand.

(4) Twenty-year Weekly Passenger Forecasts by Link. Weekly passenger forecasts by link during the peak travel period are simply the product of the base year growth factors and the base level peak monthly traffic.

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 under consideration 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.

1.6.2 CATEGORY 3: INDUSTRIAL FREIGHT

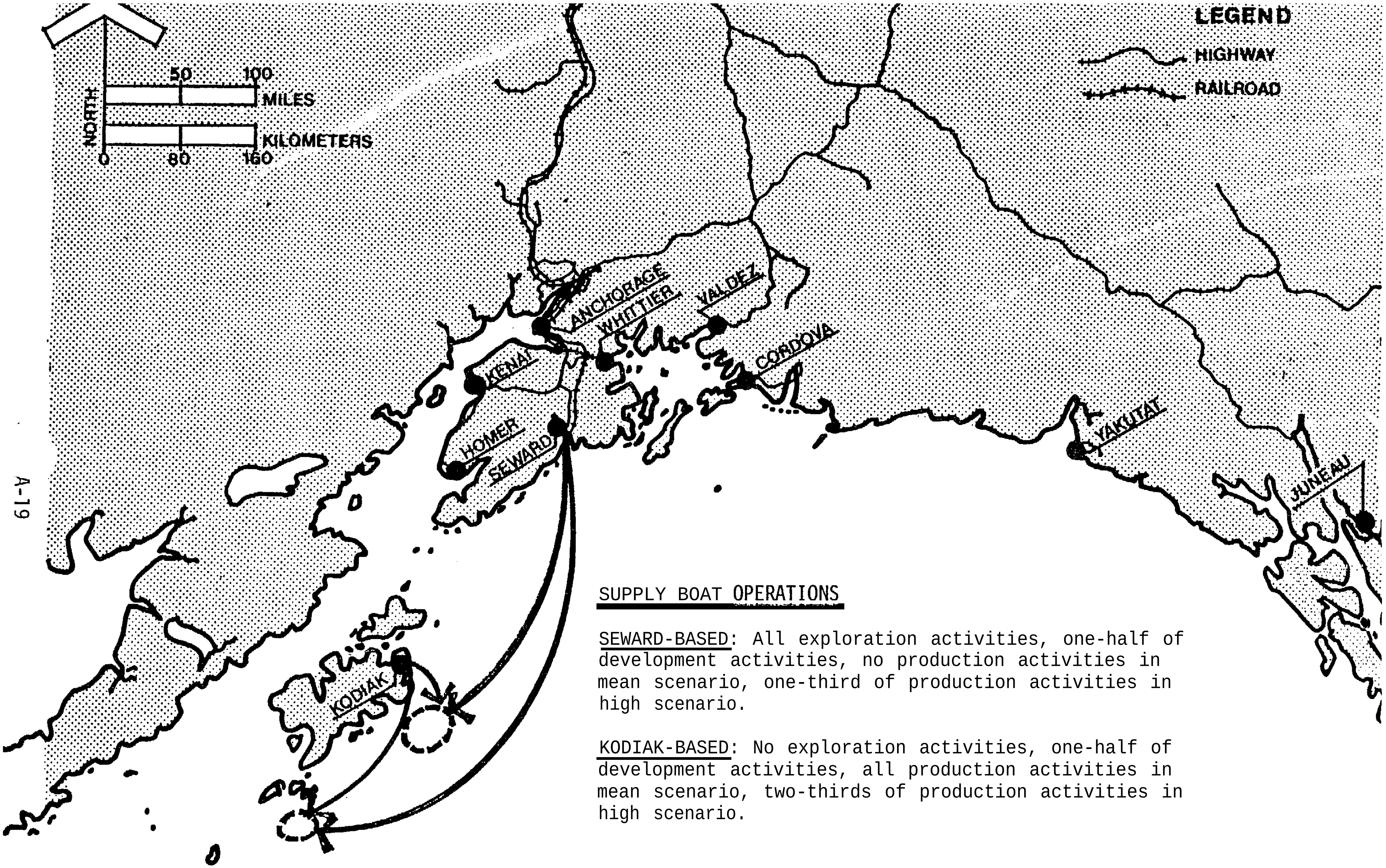
Industrial freight for OCS oil and gas activities supports two general activities--drilling and construction. Quantities for the two activities are not considered to be additive, since different facilities would be used except in rare circumstances.

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.



SUPPLY BOAT OPERATIONS

SEWARD-BASED: All exploration activities, one-half of development activities, no production activities in mean scenario, one-third of production activities in high scenario.

KODIAK-BASED: No exploration activities, one-half of development activities, all production activities in mean scenario, two-thirds of production activities in high scenario.

FIGURE A-z

Source: Peter Eakland & Associates. 1979

- 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.

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 in operating costs for the closer facility would be 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 for all areas within the lease sale will be supplied exclusively from Seward, as shown in Table A-2.

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 change because of the construction of a supply base in Kodiak in both the mean

Table A-2

Distribution of Supply Boat Functions to Supply Bases

Supply Base	Exploration	Development			Product Resupply	
	Well Drilling	Well Drilling	Platform Installation	Offshore Pipeline Construction	Mean	High
Seward	1	1/2	1/2	1/2	0	
Kodiak	0	1/2	1/2	1/2	1	

Source: Alaska Consultants, 1978.

and high scenarios. It will be constructed in time to serve all development activities.

The logistics requirements for development drilling will be shared equally between Kodiak and Seward. In all cases involving development, construction of a support base in Seward as a result of the Northern Gulf of Alaska lease sale will be assumed. The intense level of activity during the development phase will require use of major support bases in both Seward and Kodiak.

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 the pipe-laying barges working in the Middle Albatross Basin. The pipe-coating plant, which is required only for the high scenario in the Western Gulf of Alaska lease sale, will be constructed as part of the mean and high base cases.

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 oil being produced, and distillation facilities can provide the crew’s water requirements.

Logistics roles for supply bases in Kodiak and Seward will differ for mean and high scenario production. Kodiak is assumed to provide all logistics in the mean case because of the low level of development. In the high case, the split is one-third Seward, two-thirds Kodiak.

1.6.2.2 Inbound Drilling Supplies (Barges and Tankers)

Table A-3 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 drill pipe. Tonnages for a 4,267 m (14,000 ft.) well developed for the Alaska Department of Community and Regional Affairs (Alaska Consultants, 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 Environmental 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

Table A-3

Materials Requirements for Gulf of Alaska Drilling Activities

	Oil and Gas Exploration[2] Depth: 13,500 Feet				Oil Development Depth: 7,500 Feet				Gas Development[2,3] Depth: 12,000 Feet			
Material	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]												
36 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			2,800 ft.	95.2			2,800 ft.	95.2		
9-5/8 in.	10,000 ft.	265.0			4,700 ft.	124.6			9,200 ft.	243a		
5" tubing					7,500 ft.	65.5			12,000 ft.	104.8		
		458.2	0.08	0.92		345.0	0.06	0.69		503.2	0.08	1.01
Dry Bulk:												
Bentonite		675		4.56		300		2.03		480		3.24
Cement		2a9		1.26		129		0.56		206		0.90
Berite		33a		1.01		150		0.45		240		0.72
		1,302	0.22	6.83		579	0.10	3.04		926	0.15	4.86
Fuel:		2,314	0.39	5.14		1,029	0.17	2.29		1,646	D.27	3.66
Drill Water:		3,616	N/A	6.03		2,009	N/A	3.35		3.214	N/A	5.36

Notes : (See following page) .

Source: Peter Eakland and Associates, 1979, except as noted.

Table A-3 (Continued)

Notes:

(1) Drill 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%ofmaterials/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 loads are based on average barge capacities of 6,000 short tons.

(7) Minimum supply boat trips are based on commodity capacities contained on page 820f reference cited in Note (2) above.

Table A-4

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 scenarios.

Source: Alaska Consultants, 1976; Peter Eakland and Associates, 1979.

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 loads of fuel and each development well 0.23. Drilling will occur year-round which will require a steady flow of barge traffic. Greater 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 enlosed 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 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. For Lower Cook Inlet offshore activities, it is assumed that fuel Mull be supplied from refineries in Nikiski.

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. 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 Railroad 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 levels 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 varietyof 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-4. The peak summer period is used for computing the number of monthly supply boat round-trips that will use each supply base. Once round-trips have been developed for the Albatross and Tugidak Fields separately and then totaled, percentage breakdowns for Seward and Kodiak as shown in Table A-2 and discussed in Section 1.6.2.1 are applied.

1.6.3 CATEGORY 4: PASSENGER MOVEMENTS

1.6.3.1 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-5. 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 offsite (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).

Table A-5

Characteristics of OCS Employment Trip-Making by Taak

Employment Sectors For Petroleum Operations	Development	Rotation Factor (1)	Duration (2)	Residency (3)	Round-Trips per Month (4)	Estimated Share of Employment to Alaskan Residents (SEAR) 1979-84	1985-89	1990 +
ONSHORE								
1. Service Base	Exploration	1	P	L	NA	1.0	1.0	1.0
	Development	1		L	NA	1.0	1.0	1.0
	Production	1		L	NA	1.0	1.0	1.0
2. Helicopter Service	Exploration	2	P	NL	0.717	.5	.525	.578
	Development	1.5		NL	0.717	.5	.525	.578
	Production	1		L	NA	1.0	1.0	1.0
3. Service Base Const. .	Development	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.		1.11	T	NL	0.430	.2	.21	.231
6. Oil Terminal Conat.		1.11	T	NL	0.430	.5	.525	.578
7. LNO Plant Const.		1.11	T	NL	0.430	.5	.525	.578
8. Concrete Plat. Const.								
9. Oil Terminal Operation	Production	1	P	L	NA	1.0	1.0	1.0
10. LNO Plant Operations		1	P	L	NA	1.0	1.0	1.0
OFFSNORE								
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. Offshore 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	.88	.968
	Production	1.5	P	0.10L/0.90NL	0.717	.8	.08	.968

Notes: (See following page.)

Table A-5 (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 weeks/month) / (weeks onsite + 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.

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 likelihood that all employees would be allowed offsite time prompted the use of a single factor for offshore employment despite the use of 1.0 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 assumed to be based out of Kodiak.

1.6.3.3 Air Carrier Passenger Movements

This category of transportation demand includes trips between service bases and residences. 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-6 and graphically on Figure A-3. Non-local Alaskans are expected to live primarily in Anchorage. For non-Alaskans, Seattle is assumed to be the final destination, although many will continue trips to the southor east. Kodiak-based non-Alaskan workers are presumed to prefer south-bound flights from Kodiak because of the shorter distance involved. Approximately 25% are assumed to be attracted to Anchorage because of greater frequency of service.

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. 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.

Figure A-4 is a flowchart showing the steps in the developmentof 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

Table A -6

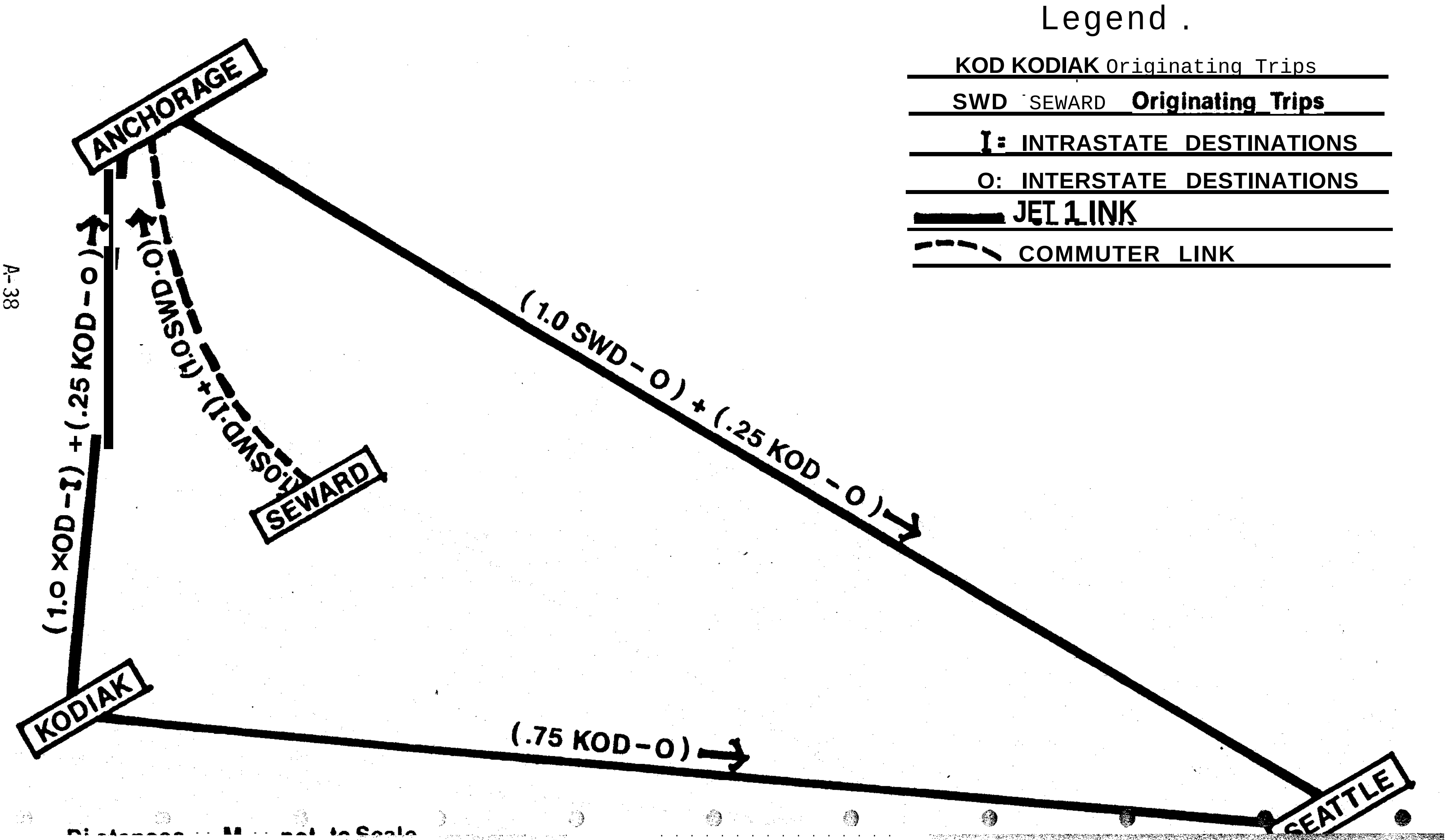
Intrastate and Interstate Trip Distribution Factors

Airlinks	Seward		Kodiak	
	Intra	Inter	Intra	Inter
SWD-ANC	1.00	1.00		
KOD-ANC			1.00	.25
KOD-SEA				.75
ANC-SEA		1.00		

Source: Peter Eakland and Associates, 1979.

Figure A-3

Assignment to Air Links of Outbound Intrastate and Interstate Travel Western Gulf Petroleum Scenarios



Distances [illegible] Map not to Scale

Employment Related Intrastate & Interstate Tripmaking

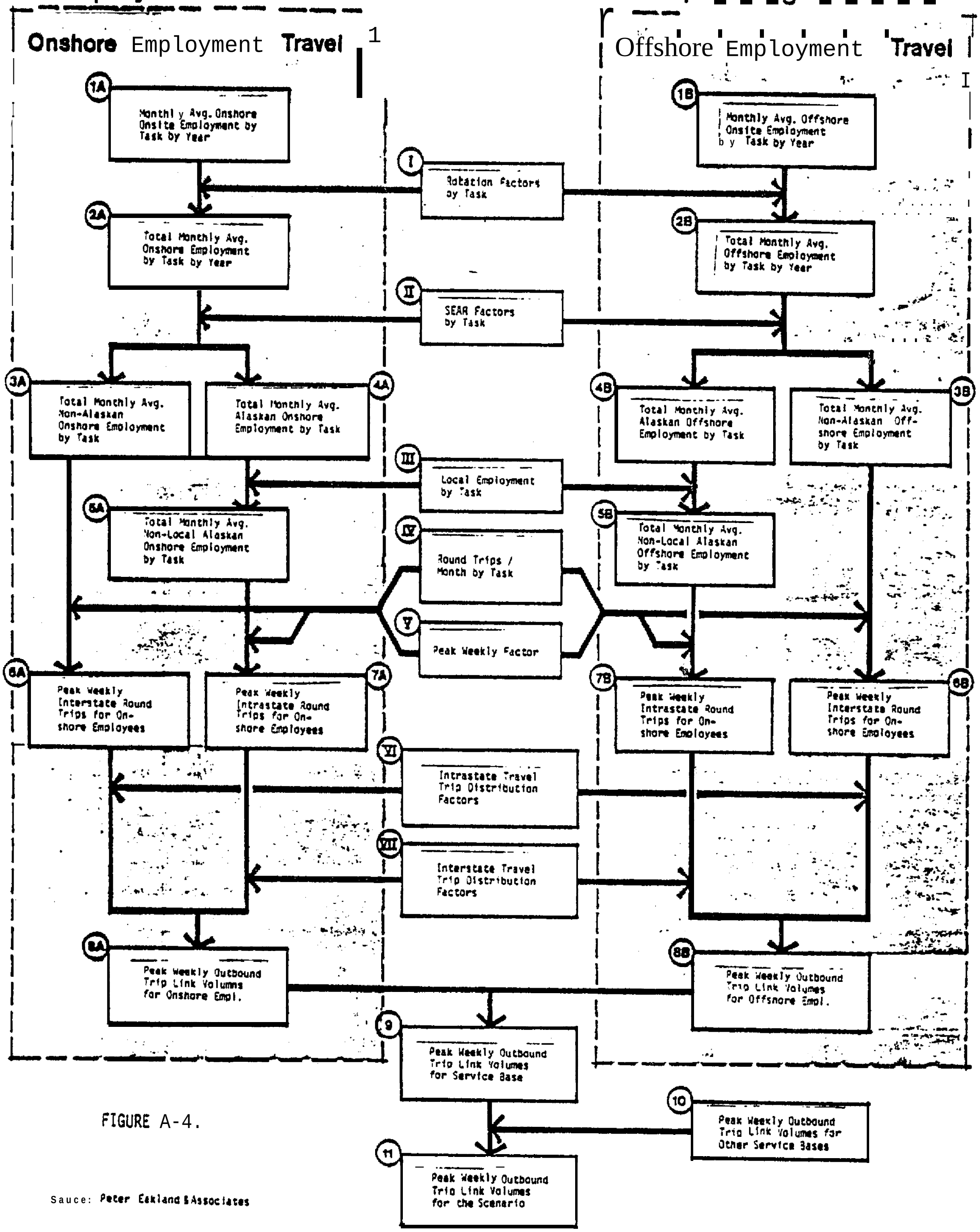


FIGURE A-4.

Sauce: Peter Eakland & Associates

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. 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 down 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/ninth).

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.

1.6.4 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, 36, 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.

1.6.5 CATEGORY 6: OIL AND GAS PRODUCTION

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 (Lease Sale No. CI) and lease sales are scheduled for the Beaufort Sea in 1979 and the Northern Gulf of Alaska in 1980 (Lease Sale No. 55). For the Western Gulf of Alaska lease sale, impacts of these previous lease sales will not be considered because different onshore facilities and shipping lanes will be used.

Oil production in the moderate resource level scenario is limited to offshore loading in the Albatross Basin. In the high scenario, an on-shore terminal becomes economic in the Albatross Basin, and offshore loading occurs in the Tugidak Basin. The only economic gas reserves occur in the Albatross Basin during the high scenario.

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 impact methodologies are discussed by mode

1.7.1 CATEGORIES 1 & 2: INDUCED TRANSPORTATION THRESHOLD

1.7.1.1 Water Mode

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 figureof 22.68 metric tons (25 tons) compares with an actual five-year average of 50.3 tons (55.4 tons). For Anchorage, the capacityof 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 were chosen. The trend toward 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, Cordova, and Kodiak, 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-7 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 of key assumptions used in their development will be considered in assessing impacts. Containerized freight, because it can be handled most effi-

Table A-7

Development Of Threshold Growth factors for 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'" (Metric Tons (Tons))	Base Year Volume/Capacity(5)		Threshold Growth Factors(6)	
						High Capacity	Low Capacity	High Capacity	Low Capacity
Pore of Anchorage	Containerizable	100%	905,366 (988,000)	2,476,600 (2,730, 000)	1,731, 800 (1,909,000)	0.37	0.52	2.70	1.92
	Liquid Bulk	100%	1,639,728 (1, 807, 500) (3)	5,002,756 (6,396,477)	3,670,883 [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 (362,6001	229.720 (253,2241	0.18	0.26	5.41	3.70
	Liquid Bulk	20%	19,760 (21.182)	91,625 (101, 000)	64,410 (71,000)	0.22	0.31	4.64	3.26
Port of Whittier	Railroad Cars	1009	305,051 (336,264)	1,190,104 (1,311,872)	836,289 (921,8S6)	0.26	0.36	3.90	2.74
	Liquid Bulk(8)	100%	40,939 (45,128)	No capacities computed			Noincrease● qmcted		
Port Of Kodiak	Containerizable	1001	304,380 (335.523)	346,996 (362. 500)	167,37 (185,500)	0.88	1.82	1.14	—
	Liquid Bulk	802	93. 888 (103,494)	302,635 (333,600)	145,149 (160,000)	0.31	0.65	3.22	1.55

Notes:(See following page.)

Source: Peter Eakland and Associates, 1979; Frederic Harris, 1978.

Table A- 7

Development of Threshold Growth Factors for WesternGulf of Alaska Port Facilities (Cent'd.)

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 for dock facilities.

(4) High and low capacities given are those computed by Frederic Harris. Weighted capacities are given or dry freight at ports of Seward, As noted, the Anchorage liquid bulk facilities include the capacity of the Nikiski pipeline, which is 1,693,231 metric tons (1,866,477 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 of the volume/capacity figures.

(7) Seward is expected to remain an entry port for breakbulk cargo and this 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.

(9) Port analyzed in Western Gulf of Alaska impact assessment.

ciently, 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 and, to a more limited extent, in Kodiak.

1.7.1 .1.2 OCS Oil and Gas Transportation

For tanker traffic thesholds for increasing numbers of berths have been established (Eakland and Dooley,1978). Table A-8 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.

The length ofa 152,408 metric ton (150,000 DWT) tanker, 298.7 m (980 ft.0 will be used to assess berthing length requirements. Assumed depth re-

Table A-8

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.

quirement will be6.4m (21 ft.) which is 1.05 the draft of a 254,012 metric ton (250,000 DWT) tanker, estimated as the largest oil tanker that could be accommodated onshore in Ugak 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 set up 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-9 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 .).

The traffic separation which is one component of the Prince William Sound Vessel Traffic Service, extends from Hinchinbrook Entrance to Rocky Point

Table A-9

Comparison of Navigation Conditions for Sizing of Vessel Fairways

Basis for Comparison	Gulf of Mexico	Puget Sound	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

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[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.

[d] During the ice season floating aids to navigation are removed from Cook Inlet and other ice areas.

[e] 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.

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).

Major commercial fishing grounds for salmon, halibut, and scallops are located in the vicinity of the proposed lease sale. The establishment of fairways would help minimize damage to fishing gear.

1.7.1 .1.4 Supply Boats and Service Base Berths

Berth thresholds of 30 arrivals per month have been suggested for supply boats (Alaska Consultants, 1976; DCRA, 1978). 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-10 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- 10

Relationship Between Supply Boat Round-trips and Berth Requirements

Round Trips/ Month	Required Berths (1)	Berth Occupancy
o- 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 (210 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 world have been established for the number of supply boats required for different activities (Dames & Moore, 1979). Exploratory drilling rigs require two supply/anchor boats, one of which is on standby status. Installation 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.

1.7.1.2 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. Theshold values relate to the need for and extent of additional service. For primary routes serving Kodiak and Seward, estimates were made of available seats for one, two, and three additional round-trip flights per day based on summer 1977 load factors. The results are shown in Table A-11. Available seats were estimated to be 20% of weekly seating capacity, representing an increase of the load factor from 0.60 to 0.80 on the Seward route and from 0.80 to 1.00 on the Kodiak route. Thresholds were estimated for the existing schedule of three flights per day and for a fourth flight. Jet service was assumed on flights from Kodiak to Anchorage and Seattle. Jet service is not considered to be feasible between Anchorage and Seward because of the marginal landing conditions in Seward and the proximity of Seward to Anchorage by road.

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 five non-stop links. These figures, in the form of peak monthly weekly ridership, are then combined since it is assumed that all interstate travel related to movements of OCS employees

Table A-n

Additional Passenger Threshold Values - Peak Service Season

Link	Direction	Passenger/ Week	Existing Service Level	Estimated Load Factor	Aditional Passenger Threshold Values
Kodiak-Anchorage	NB	1,054	18 flights/week (1)	0.60	21 Jet flights/week, LF of 0.80 = 794 (2)
					28 Jet flights/week, LF of 0.80 = 1,410 (2)
Kodiak-Seattle	SB	462	1 flight/day	0.60	1 flight/day, LF of 0.80 = 154 (2)
					1.5 flights/day, LF of 0.80 = 462 (2)
					2 flights/day, LF of 0.80 = 770 (2)
Seward-Anchorage	NB"	240	3 flights/day	0.60	3 flights/day, LF of 0.80= 80 (3)
					4 flights/day, LFof 0.80 = 213 (3)
					5 flights/day, LFof 0.80= 292 (3)
Anchorage-Seattle	NB	12,866	18 flights/day	0.80	50% increase in seats = 6,433 (4)
					100% increase in seats = 12,866 (4)

Notes: (1) Includes flights stopping at Homer.

(2) Assumes all jet aircraft with seating capacity of 110 passengers. In the past, prop planes have been used on Anchorage-Homer-Kodiak route. LF - load factor.

(3) Assumes commuter aircraft having 19 seats.

(4) A variety of aircraft is used on this route. Due to likely increase in use of wide-body jets as patronage increases, increase in seats rather than planes is used.

Source: Peter Eakland and Associates, 1979.

will be on scheduled carriers. The passenger totals are then compared to the threshold values for additional flights.

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 approached are possible.

The Alaska Region of the Federal Aviation Administration has established guidelines for improvements at air facilities. For example, the criteria for upgrading a flight service center to a control tower is 50,000 operations for general aviation airports and 24,000 itinerant (training) operations for certificated air carrier airports (FAA, 1979). Of the major airport facilities--Anchorage, Seward, and Kodiak--only Seward does not have a central tower.

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.