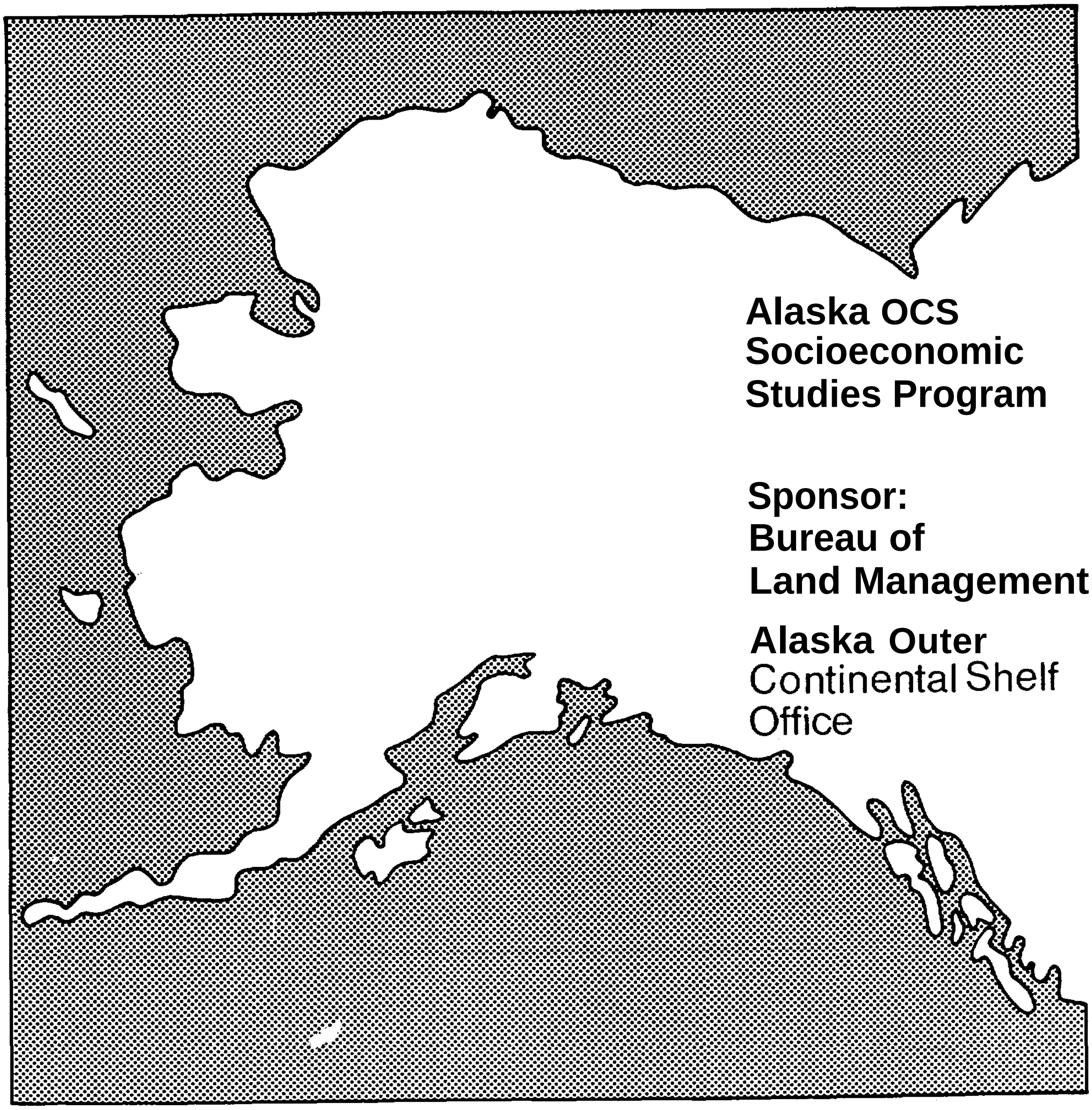
Technical Report
Number 45



Alaska OCS Socioeconomic Studies Program

Sponsor: Bureau of Land Management

Alaska Outer Continental Shelf Office

Lower Cook Inlet Petroleum Development Scenarios Transportation Systems Analysis

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 ❑aking at all governmental levels. In fulfillment of its federal responsibilities and with an awareness of these additional information needs, the BLM has initiated several investigative programs, one of which is the Alaska OCS Socioeconomic Studies Program (SESP).

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

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

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

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

Technical Report No. 45 Contract No. AA550-CT6-61

Alaska OCS Socioeconomic Studies Program

LOWER COOK INLET

PETROLEUM DEVELOPMENT SCENARIOS

TRANSPORTATION SYSTEMS ANALYSIS

Prepared for

Bureau of Land Management

Alaska Outer Continental Shelf Office

Prepared by

Peter Eakland

Raj Joshi

Peter Eakland and Associates

March 1980

Document is available to the public through the
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Springfield, Virginia 22161

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Alaska OCS Socioeconomic Studies Program
Lower Cook Inlet
Transportation Systems Impact Analysis'

Prepared by
Peter Eakland and Associates

March, 1980

TABLE OF CONTENTS

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

APPENDIX : METHODOLOGY

TABLE OF CONTENTS (Cont.)

TABLE OF CONTENTS (Cont.)

LIST OF TABLES

LIST OF TABLES(Continued)

LIST OF TABLES(Continued)

LIST OF FIGURES

LIST OF FIGURES (Continued)

e

1.0 INTRODUCTION

1.1 Purpose

Transportation has been determined by the Bureau of Land Management to be 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 the 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 ofa multidisciplinary effort to analyze potential impacts of oil and gas development resulting from Lease Sale No. 60, which is proposed for Lower Cook Inlet and Shelikof Strait. 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 systerns within the study area. Chapter 3 contains an analysis of the base case, which includes the medium scenario of Lower Cook Inlet Lease Sale No. CI. The low, medium, and high 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 System which will be prepared for Lease Sale No. 60.

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. Two adjacent areas are involved in Lease Sale No. 60--Lower Cook Inlet and Shelikof Strait. Figure 1-1 shows the location of areas selected for development activities in the various scenarios on the basis of geology and economics. In the medium and high scenarios, the principal supply bases are expected to be located at Homer, Nikiski, and Afognak Island. The analysis of local and regional terminals and facilities is limited to Homer, Kenai-Soldotna, and Anchorage. Route analysis extends to the regional and even interstate levels. The data collection area for regional analysis is as shown in Figure 1-2. Anchorage is one of the two regions. The remaining census divisions in the study area make up the Southcentral Region.

1.3 Study Time Horizon

The study will examine OCS-related impacts on transportation systems beginning in 1982 when exploration drilling is expected to commence and extending 20years to 2001. Impacts resulting from OCS activity will occur beyond this date, but peak periods of development and production will be captured.

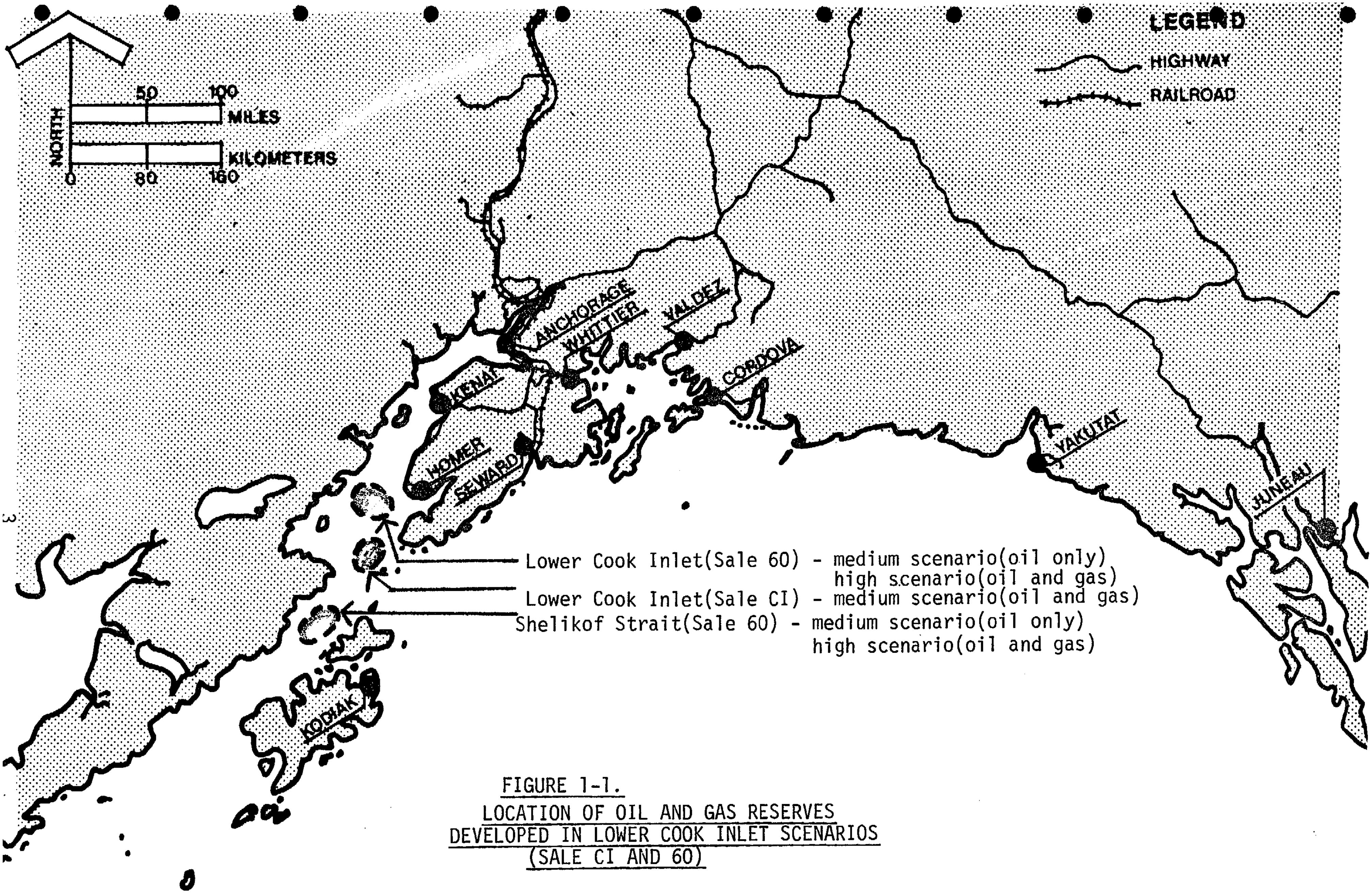
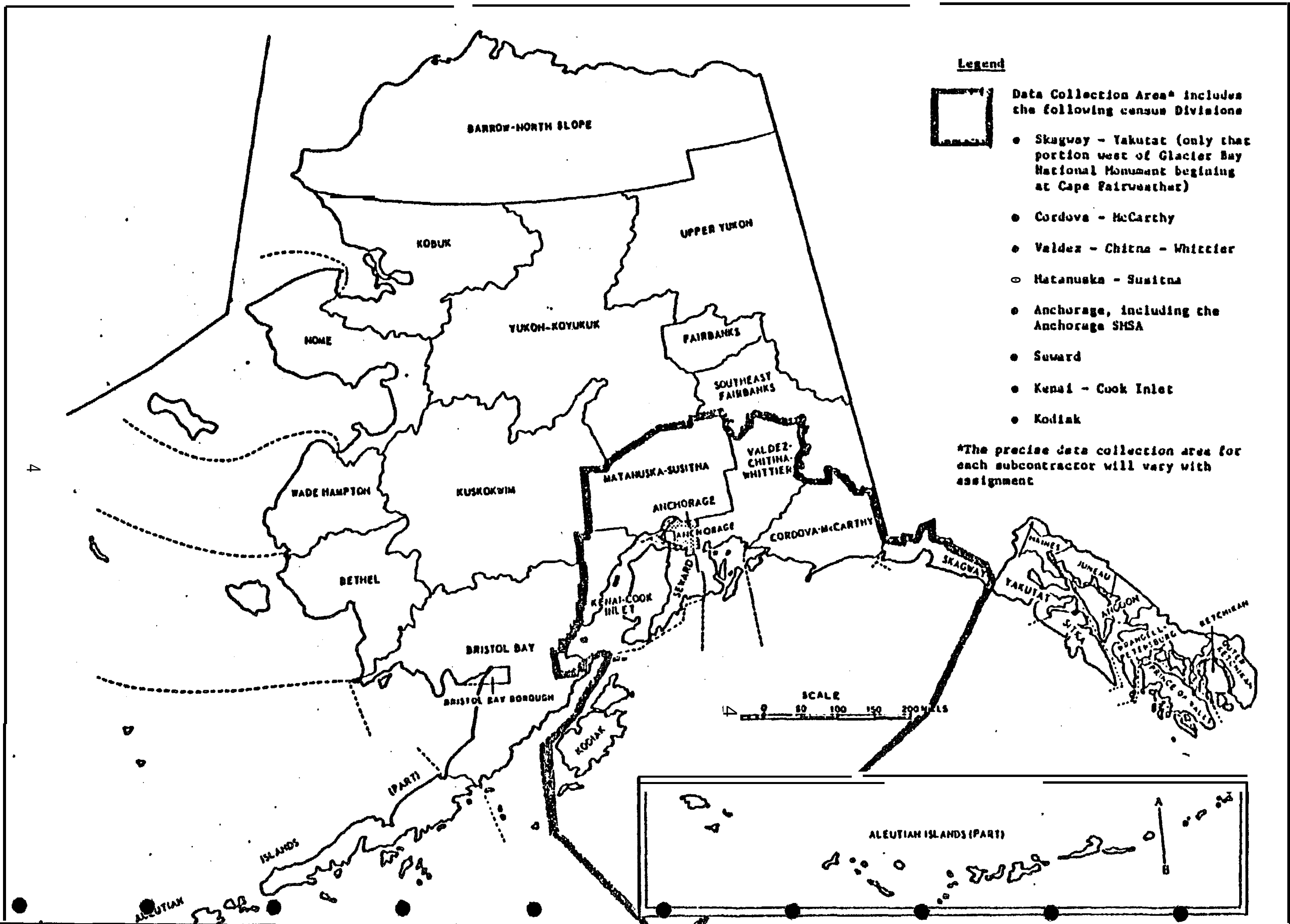


FIGURE 1-1.
LOCATION OF OIL AND GAS RESERVES
DEVELOPED IN LOWER COOK INLET SCENARIOS
(SALE CI AND 60)

Source: Dames and Moore, 1979.

Northern and Western Gulf of Alaska Lease Sales



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 unless they primarily handle movements 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 i 11 ustrate the relationship between these basic transportation terms. Consider a movement of 100 tons of related freight from Seattle to Anchorage, which wi 11 be assumed to be a single generated trip unit. The shipper can utilize several routes. Direct shipment from the Seattle area to Anchorage is available on container or roll-on, roll-off ships. This route would have a single link and two nodes, an origin and a destination. Another possible route would be a rail-barge shipment from Seattle to Whittier followed by movement to Anchorage by raiJ. This intermodal route would involve two links and three nodes.

Each transportation system consists of three disti net aspects--stationary facilities associated with nodes and 1 inks, 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 1 ead 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 rests at one terminal might allow previously marginal facilities to be more competitive. Another method of reducing peak demand on segments of the transportations systems would be to spread out the demand over a longer period of time. This, unfortunately, is unlikely once oil and gas companies enter the development phase. This phase places the greatest demands on the transportation systems. Companies move towards production as fast as possible so that they can begin to recover their significant investments. More important than the feasibility of reducing demands is that of increasing supply. 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 problem of obtaining legislative approval of funding and, thus, generally require a long response time. Projects must be justified and reviewed through the capital budgeting process, and 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 Gulfof 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 limits for paved roads as appropriate to minimize damage to paved surfaces. The ability to irepose load limits proved to be an inadequate control during construction of the trans-Alaska pipeline. Considerable damage occurred to the Richardson Highway, which is the primary route between Valdez and Fairbanks. The State's inability to enforce load limit regulations, particularly for short-hauls used in carrying gravel to work sites, was a major factor contributing to the extent of damage that occurred. Unfortunately, the load limits come at a critical time for construction activities, as contractors wish to have materials at work sites in late spring in order to complete as much outside work as possible during the summer and fall.

Accelerated deterioration is not expected to be a serious problem for OCS-related transportation activities in Lower Cook Inlet. An insignificant amount of oversized 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 in the study area has frozen ground at the foot of dock pilings. Docks that are old and have had necessary improvements deferred could experience accelerated deterioration if OCS activities produce larger and more frequent loadings than would otherwise occur.

1.6.3 INDIRECT TRANSPORTATION IMPACTS

Increased usage of transportation routes can produce socioeconomic impacts beyond those of the transportation system. Such impacts will be studied to the extent that they produce feedback on the transportation systems.

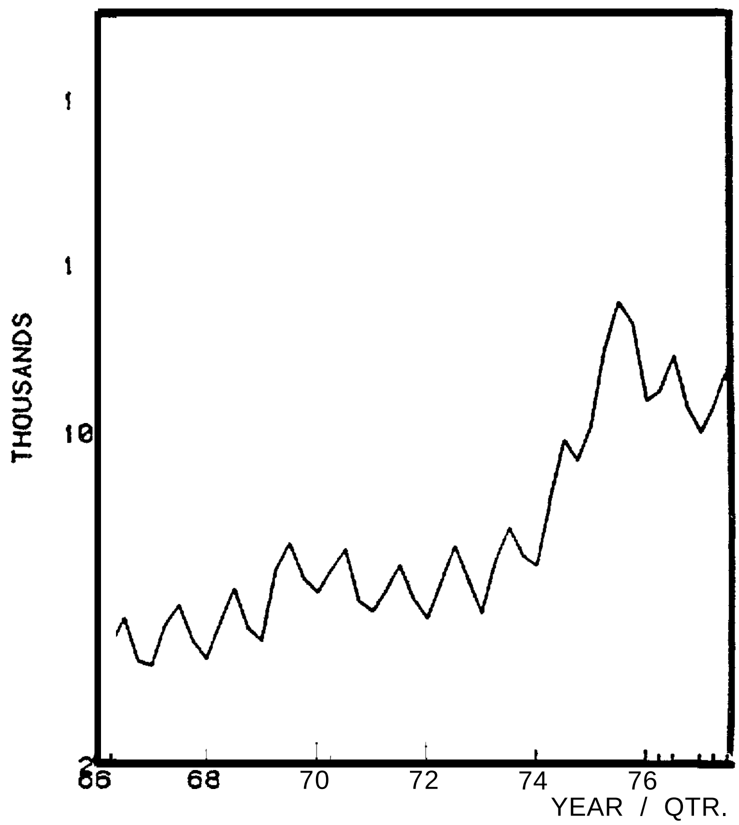
For example, existing marine transportation routes to Gulf of Alaska communities, particularly those segments close to shore, in many cases are prime fishing grounds. The use of large vessels and more frequent sailings could seriously interfere with fishing activities. Such interference produces impacts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

1.7 Peaking of Transportation System Activity

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

Figure 1-3.

TRANSPORTATION EMPLOYMENT



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

*

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 for many bulk items annual demands must be shipped at one time. 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 most likely sale area and port and supply base sites serving OCS activities for Lease Sale No. 60 are ice-free, and freight vessels will be able to operate on an all-year round basis. In rough seas during the winter, tandem barge operations might be less frequent; and shipments of oversized freight--such as drilling platforms or oil terminal modules--would not be scheduled at this time. Otherwise, freight movements would provide shipments on an as-needed basis.

The extent of annual peak demands will depend upon the timing of oil and gas activities in Lower Cook Inlet and Shelikof Strait, 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.

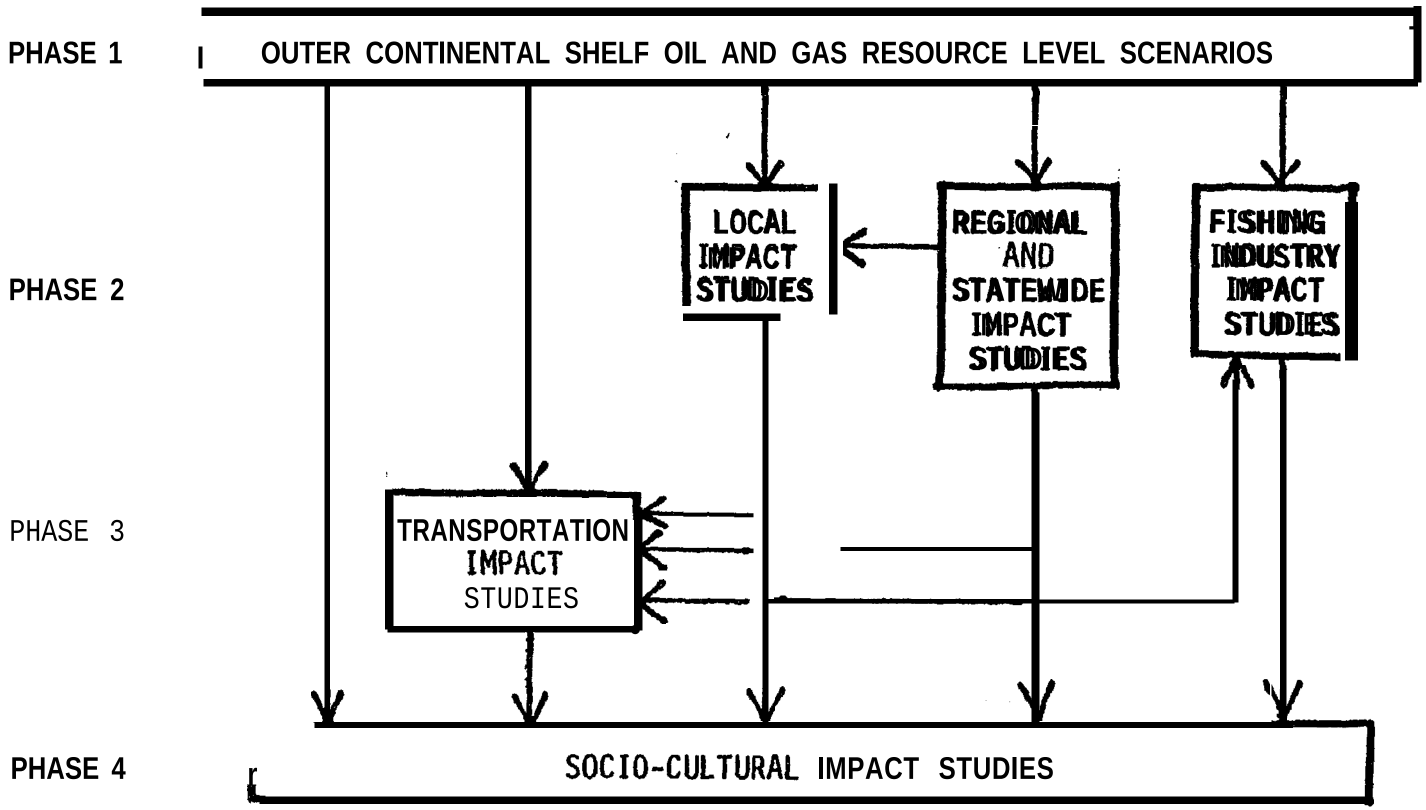
1.8 Relationship to Other Studies

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 levels--first, between the lease sale and preceding lease sales and, second, within the lease sale. Efforts for an individual lease sale must consider impacts of previous lease sales so that cumulative OCS impacts can be assessed. The first lease sale in Lower Cook Inlet, Sale No. CI which took place in October 1977, is the only previous lease sale adjacent to proposed tracts for Lease Sale No. 60; but proposed lease sales in the Beaufort Sea, Northern Gulf of Alaska, and the Western Gulf of Alaska will also cause population and employment increases in the Southcentral and Anchorage region. Sale No. CI occurred before the establishment of the Socioeconomic Studies Program. For the other lease sales, results of previous studies can be carried forward. The base case assumes occurrence of the mean scenario for all previous OCS lease sales.

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

Figure 1-4

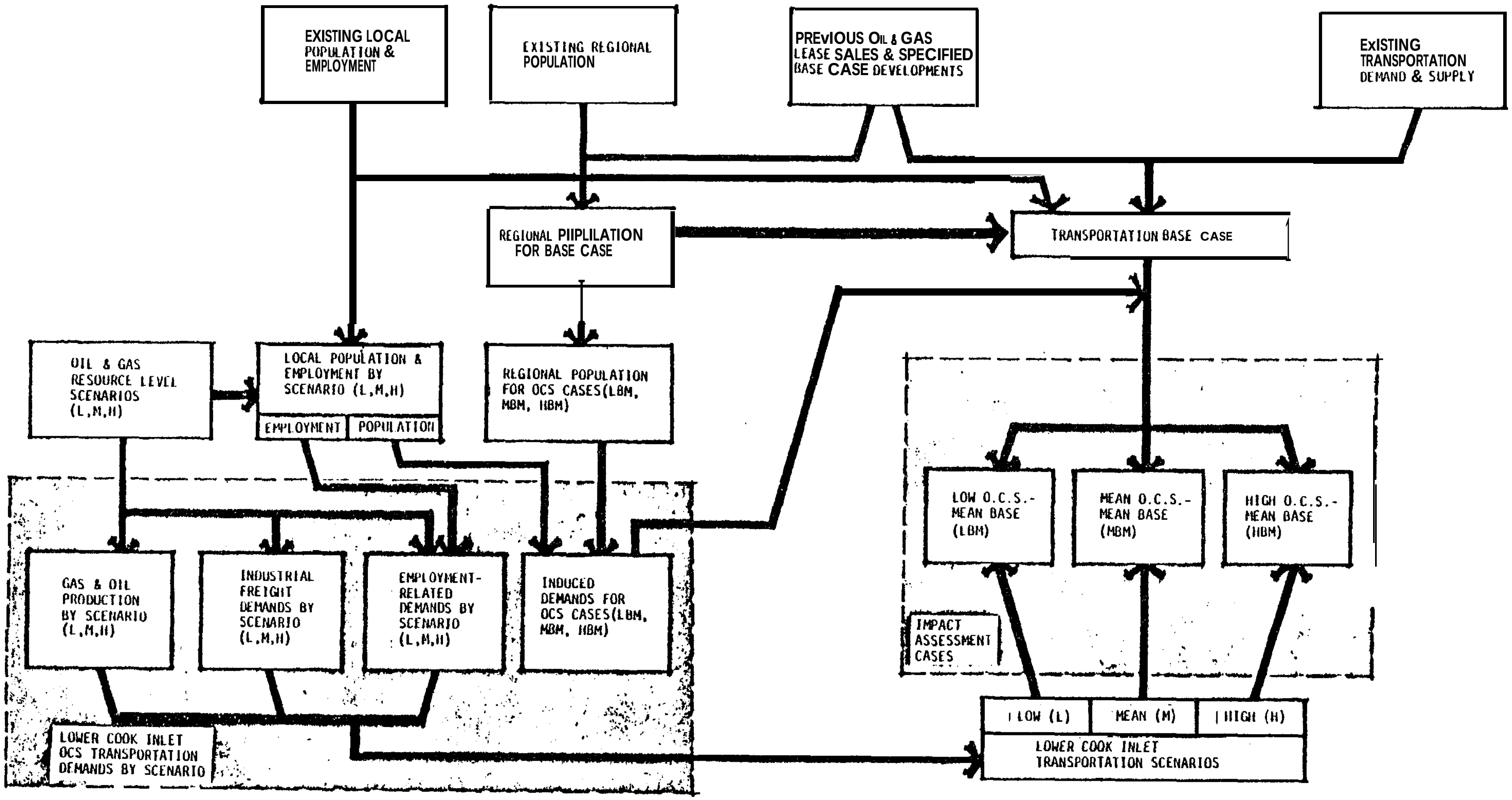
Relationship of Transportation Impact Studies to Other Studies in Socioeconomic Studies Program



Source: Peter Eakland and Associastes, 1979.

FIGURE 1-5.

RELATIONSHIP OF TRANSPORTATION **IMPACT** ASSESSMENT TASKS **FOR** LOWER COOK INLET 0.(2.S. OIL **AND** GAS DEVELOPMENT



SOURCE: PETER EAKLAND IT 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 the lease sale area 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 Lower Cook Inlet and Shelikof Strait. Four cases have been developed for analysis. One represents the most likely base conditions for the next 20 years and includes the cumulative impacts of mean OCS cases in previous lease sales. The remaining three cases represent cumulative transportation demands of the low, medium, and high oil and gas Lower Cook Inlet (Sale No. 60) scenarios when added separately to the mean base case. These OCS cases bracket the range of impacts that might occur. 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 the base case. Scenario demands are independent of conditions in the base cases, whereas induced demands depend upon base conditions and, thus, are interactive in nature.

At the top of Figure 1-5 are the elements that are used to construct the base case which cover the same period as the OCS cases, 1982-2001.

1.8.1 TRANSPORTATION BASE CASE

Three primary inputs are required to produce complete transportation forecasts for the transportation base case: (1) demands related to regional population growth, (2) those related to local population growth, and (3) those related directly to a medium level of development activities. Impacts occurring during the study period (1982-2001), given base case assumptions, provide a benchmark for measuring the incremental and cumulative impacts of different levels of resource discovery and recovery in Lease Sale No. 60.

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 usually is broken down into offshore and onshore loading because of the difference in impacts, but the scenarios developed for Sale No. 60 do not include any offshore loading. 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 each of the OCS cases. Forecasts for induced transportation demands are shown going directly to the OCS cases because of their interactive nature with base case conditions rather than joining with the other three categories of OCS demands.

1.8.3 OCS CASES

The three OCS cases bracket the range of transportation demands and associated impacts that will occur, given the assumptions of the mean base case. A three-letter system is used in this report to identify the cases, even though only one base case is involved. 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 medium base case.

1.9 Comparison of the Transportation Impact Assessment Process and the Standard Transportation Planning Process.

Transportation studies undertaken as part of the Bureau of Land Management's OCS Socioeconomic Studies Program are based on what can be called the transportation impact assessment process (TIAP). This process differs in several important aspects from the standard, or normative, transportation planning process (STPP). Both types of studies currently are being performed in Alaska. A discussion of the differences between the processes, hopefully, will assist those who review this study in several ways. First, readers should gain a better understanding of the reasoning behind the organization and the content of this study. Second, those who either participate in or review non-OCS transportation planning studies having a similar study area will be better able to compare the results of the two processes and to integrate the results of one into the conduct of the other. The results of the TIAP and the STPP, it will be shown, are never fully compatible, nor should they be, since they are designed to serve markedly different purposes. Nevertheless, they should be viewed as complementary.

Table 1-1 shows a generalized methodology for both the STPP and the TIAP with comparable steps placed alongside each other. The most obvious difference between the two processes is that the STPP has two additional steps, namely, the development of transportation alternatives and the selection of a recommended plan and implementation strategy.

The purpose of the STPP is to generate short and long-range recommendations for transportation facilities, services, and policies for all modes that will adequately meet total transportation demands, taking into consideration financial, technical, socioeconomic, and environmental considerations. Its methodology is oriented towards decision-making. The final step (7) is a systems plan and implementation strategy that can be adopted by funding and decision-making agencies. Much of the scope and direction of the STPP is generated internally. Goals and objectives are adopted by local elected officials, usually in cooperation with the general public and state and Federal officials. The TIAP, on the other hand, has a narrower focus from several perspectives. The process stops short of recommending transportation improvements that are not already included

Table 1-1

Comparison of Methodologies for the Standard Transportation Planning Process and the Transportation Impact Assessment Process

Step	Description	Step	Description
1.	Goals and Objectives	1.	OCS Leasing Process
2.	Inventory of Existing Conditions	2.	Inventory of Existing Conditions
3.	Development of Socioeconomic Forecasts	3.	Development of OCS Scenarios, Base Case, and OCS Cases
4.	Forecasting of Transportation Demands	4.	Forecasting of Transportation Demands for Base Case and OCS Cases
5.	Development of Transportation Alternatives		---
6.	Evaluation of Transportation	5.	Assessment of Transportation Impacts
7.	Selection of Recommended Plan and Implementation Strategy		---

Source: Peter Eakland and Associates, 1980

3

in the non-OCS case to serve population-related demands and in the OCS scenarios to serve direct OCS demands. The TIAP does not produce a single product but instead a range of cumulative and incremental transportation impacts. Financial and environmental considerations, which are important to the STPP, are of limited concern in the TIAP. Environmental considerations are treated in a separate OCS program. The Socioeconomic Studies Program, of which the TIAP is one element, is actually a process within a larger process, the OCS leasing program. The scope and direction of the TIAP, thus, is developed externally. The TIAP for the most part analyzes facilities and services separately rather than from a systems perspective, although all relevant elements of local, regional, and statewide transportation systems in the study area are studied. The systems planning methodology used in the STPP can introduce mitigating measures by routing traffic to alternative routes when a certain level of congestion occurs.

The STPP is designed to be a continuing planning process for each study area. Its results are up-dated every three to five years as additional information becomes available. The TIAP, on the other hand, is undertaken only once for a given lease sale, although the direct transportation demands and impacts may extend twenty years or more after the lease sale is made. The same study area will be examined again only if a later lease sale is scheduled in the same place. The continuing aspect of the TIAP is that it sequentially assesses the cumulative and incremental impacts of OCS leases according to the Bureau of Land Management's proposed leasing schedule. Some overlapping of study areas will inevitably result from one study to the next, but otherwise, one study cannot be considered as a continuing effort of a previous study.

Each process contains an inventory as step 2. The focus of the TIAP on OCS-related activities and of the STPP on overall activities requires the use of different considerations in establishing a study area, deciding what information should be gathered, and disaggregating this information.

Choice of the study area for the STPP is heavily influenced by political and administrative boundaries, which is natural because of the process' orientation towards implementation. The TIAP, instead, largely ignores such boundaries and attempts to include all areas potentially impact by a given OCS lease sale. The study area may not be geographically continuous, because of the limited interregional land facilities in Alaska. For example, Anchorage is included in all impact studies, although for some lease sales its adjoining regions may not be.

The STPP inventory focuses on the use of facilities and services falling under the jurisdiction of agencies conducting the process. The TIAP focuses on all facilities and services, both public and private, which are potentially impacted by OCS-related transportation demands.

The emphasis on overall activities in the STPP but on disaggregation into non-OCS, indirect OCS, and direct OCS activities extends into the forecasting of socioeconomic conditions which is step 3 in both processes.

Socioeconomic conditions are disaggregate in the STPP by variables that influence the level and type of trip-making, such as sector employment, household income, and land density. It is difficult, if not impossible, to isolate the effects of individual development activities. Although a range of socioeconomic options is usually generated initially in the STPP, a single set of conditions is usually chosen for detailed analysis. In the TIAP, direct OCS activities and employment are separated from other activities. The OCS scenarios establish the timing, location, and development for a range of economic discoveries of oil and gas. This information is then used in local and regional socioeconomic studies to produce total levels of population and employment by community and region. The construction of base and OCS cases enables cumulative and incremental population and employment figures to be generated.

The information generated in step 3 of each process is used to generate transportation demands by facility and route for each mode. As with the forecast of socioeconomic conditions, the TIAP disaggregate demands into direct OCS and population-related categories while for the STPP disaggregation is by such categories as trip purpose and handling category. The forecasting procedures are less complex for the TIAP since they do not have to take into account the implications of major transportation improvements such as those that will be developed in step 5 of the STPP.

The development of transportation alternatives exists only in the STPP (step 5). The do-nothing alternative represents the lowest level of improvements and includes existing facilities and services and those that have been committed for implementation. In the TIAP, the transportation system in the non-OCS case closely resembles that of the do-nothing alternative. The only additional facilities included in the base case are those specifically included in the medium scenario of previous lease sales. For the OCS cases, additional facilities are limited to those included in the scenarios for the OCS lease sale under consideration.

Step 6 of the STPP is evaluation of transportation alternatives and is comparable to step 5 of the TIAP, which is assessment of transportation impacts. In the STPP, one set of socioeconomic conditions is arrayed against numerous transportation alternatives while for the TIAP one set of transportation conditions is arrayed against a range of OCS development conditions. In both the evaluation and impact assessment steps, the relationship of transportation supply to demand is first explored for each set of socioeconomic and transportation conditions. Then, the differences between the sets are explored. The separate analyses for the TIAP concern cumulative impacts and those for the STPP concern the ability of the transportation alternative to provide for total transportation demands and to meet the study's goals and objectives.

Evaluation in the STPP is a multi-dimensional task, including not only the performance of transportation systems but also financial, socioeconomic, and environmental considerations. Each alternative is treated as equally likely in the evaluation stage. Differences between the evaluation of transportation alternative are used to establish trade-offs. For the TIAP, emphasis in both the cumulative and incremental analyses is placed on the mean OCS case, since it is the most likely. Two types of incremental impact assessments are made. The impacts of the mean OCS case are compared to those of the base case, and the impacts of the other OCS cases are compared against those of the mean OCS case.

In summary, the two processes have some similarities but in many ways are only complementary. Intermediate information and end results of the TIAP can be useful to those pursuing other transportation planning studies. An understanding of the purpose of the Socioeconomic Studies Program and of the assumptions and methodologies used in this study will increase this usefulness.

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

2.1 Purpose

This chapter examines 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 1982-2000 for the base case and the OCS cases. Emphasis is placed on the areas of Homer, Kenai-Soldotna-Ni kiski, and Anchorage. Homer and Nikiski are the probable location of major supply bases, and Anchorage is a collecting point for transportation services to and from the Kenai Peninsula.

For each mode, a separate discussion is provided for facilities and carriers and, as appropriate, routes, rates, technology, and regulations. These elements together provide a basis for assessing how the transportation system will respond to increases n OCS and non-OCS transportation demands. The existing supply and demand of transportation and their relationship is explored for both facilities and carriers. No results can then be used to determine the extent and timing of potential impacts given future transportation demands. The supply side of facilities includes a physical description and a computation of service capacities. The demand side includes traffic levels by origin and destination, by season, and by handling category. The supply side of carriers includes equipment operated, routes operated, seasonal differences in schedules, and capacity of scheduled operations. Carrier demand includes the mix of traffic between carriers, seasonal differences in traffic, and traffic levels by link and route.

Two sets of thresholds evolve from the examination of existing conditions which figure prominately in the impact assessment process. First are the service capacities which establish the level at which impacts occur. Second are the differences between these capacities and the existing level of demand which establish the amount of growth available before impacts begin.

2.2 Water Mode

Three distinct areas of marine transportation have importance within Cook Inlet. First is the shipment of general cargo to Anchorage from the Lower 48. Approximately 75% of all freight reaching Anchorage by surface transportation enters the Port of Anchorage. The remaining 25% enters through Seward and Whittier. Much of the marine freight destined for the Kenai Peninsula first goes to Anchorage and then travels by truck to its destination. Transportation of oil and gas products from Nikiski and Drift River to Lower 48 and foreign ports is another major source of marine traffic. Finally, there is the fishing industry. Processing facilities exist at Kenai and Homer, and major expansion of fishing fleets and facilities will occur if the potential for Alaskan involvement in the bottom fishing industry is realized.

2.2.1 TERMINALS

There are three types of port facilities important to the study area. The first type are the facilities in Homer and Kenai which are centered around the fishing industry, but several also handle small amounts of general cargo. The second are the specialized ports of Nikiski and Drift River Terminal, which were built to collect, process, store, and finally transport Cook Inlet oil and gas products south to the Lower 48.

Anchorage represents the third type of facilities which serves distribution and collection functions. Anchorage port facilities are important to Lower Cook Inlet communities because shipments from the Lower 48 go there first and then are transshipped by motor carriers. Kodiak, Seward, and Whittier are the other entry ports for cargo having a Kenai Peninsula destination but are of secondary importance. Kodiak receives direct shipments from Seattle, some of which are then transshipped to Lower Cook Inlet. Whittier freight entering Whittier bound for Homer or Kenai goes first by rail to Anchorage or Moose Pass and then by truck. From Seward, goods can be picked up directly by trucks or moved first by rail to Moose Pass.

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; (4) tonnage by origin and destination.

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

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

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

- Breakbulk General: loose freight which requires manual manipulation.

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

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

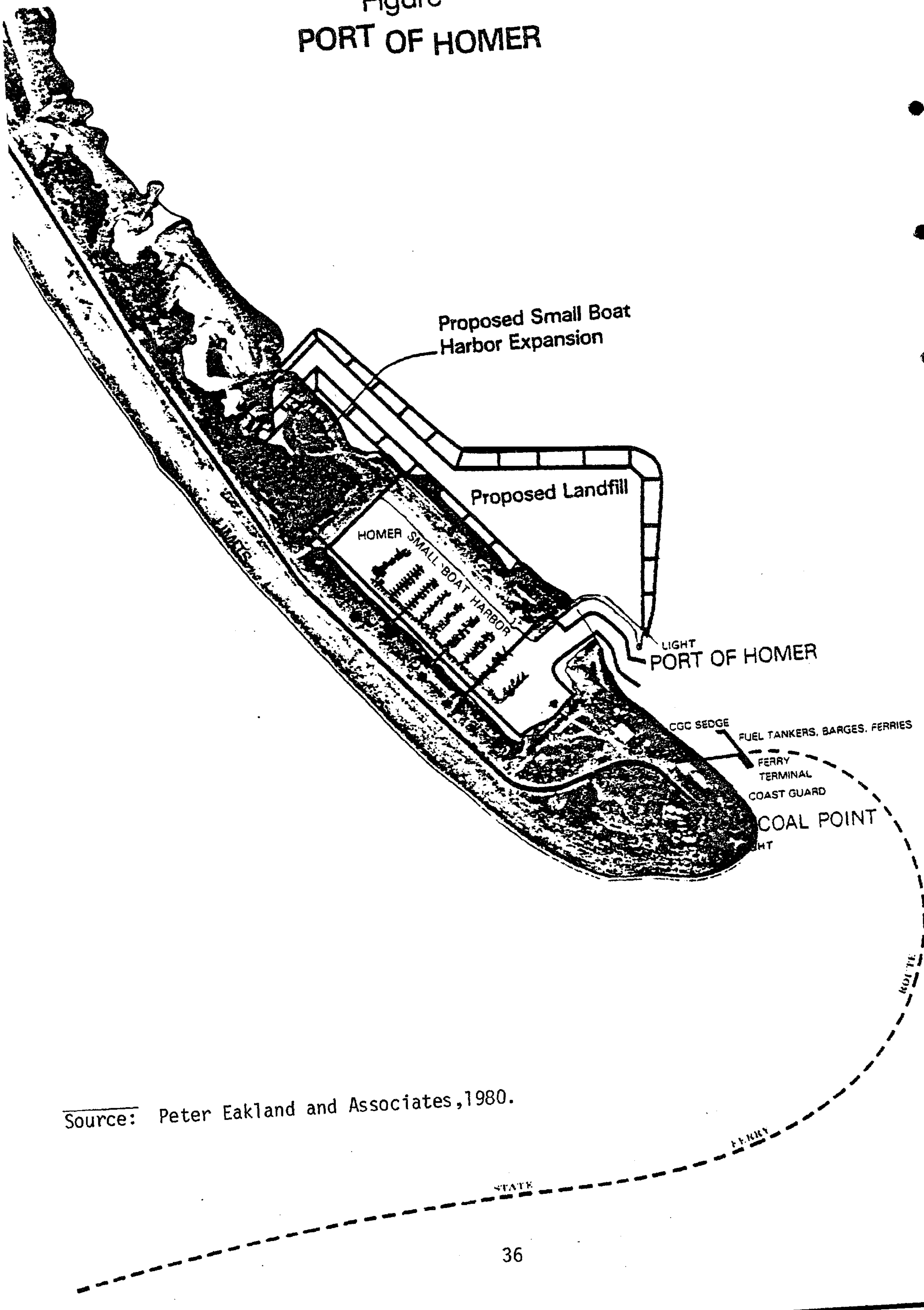
- Dry Bulk: bulks that can be moved by various types of conveyor systems.

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

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

Figure 2-1

PORT OF HOMER



Source: Peter Eakland and Associates,1980.

2.2.1.1 Portof Homer

Facilities. Existing port facilities are located toward the end of the Homer Spit on the Kachemak Bay (north) side, as shown in Figure 2-1. The Homer City pier which extends 140.2 m (460 ft.) out from shore serves deep-draft vessels. It has three docking faces. The largest face is 125 m (410 ft.) long and has water depth alongside of 7.6 m (25 ft.). Its northwest section is 8.8 m (32 ft.) wide and the southwest section 18.3 m (60 ft.) wide. The M.V. Tustumena of the Alaska Marine Highway System has preferential berthing privileges at this facility. It is also used for shipment of fish products, occasional freight barges, and the receipt of petroleum products from the Standard Oil tanker, Alaska Standard. Supply boats serving offshore drilling activities have used the facility to load fuel and water. Water is available at the pier, but diesel fuel and gasoline supplies must be delivered by truck. A truck-mounted crane is available from a local contractor for onloading and offloading heavy cargo.

The northwest face, which is 42.7m (140 ft.) long and 8.8m (32 ft.) wide, is used for mooring the Coast Guard buoy tender, CGC Sedge. It has a 4.0 m (13 ft.) draft. The southeast face, 18.3 m (60 ft.) long, has a draft of 3.7m (12 ft.) and is used principally by fishing boats.

Other facilities are located within the small boat harbor basin, which is reached by an access channel 120 ft. wide with a depth of -4.6 m (-15 ft.) mean lower low water (MLLW).

Facilities within the boat harbor, which has a depth of 4.0 m (13 ft.) on the south and 1.8 m (65 ft.) on the north end, include the following:

- A city dock 30.5m (100 ft.) long.

- A 9.1 m x 85.3m (30 ft. x 280 ft.) boat launching ramp with float.
- A 6.1 m x 42.7m (20 ft. x 140 ft.) repair grid.
- A 12.1 m (40 ft.) gas dock.
- 398 stalls for recreational and commercial small boats.

The access channel receives annual maintenance dredging but no dredging has taken place within the basin since 1964.

The Corps of Engineers has conducted an economic feasibility study of expanding the small boat harbor basin to accommodate a total of 1,525 recreational and commercial boat stalls. A favorable benefit/cost ratio of 3.8 to 1 suggests that the project will proceed once funding can be secured through a combination of Federal, State, and Local sources. The new project is shown on Figure 2-1. Recommended as part of the project for an additional $2.7 million is an enlarged breakwater which would provide 16 acres of storage area and could be the site of future deep-draft dock facilities (Corps of Engineers, 1979).

A third area of port activityon the Homer Spit will soon exist. Homer has the potential for becoming the site of major bottomfish processing facilities, and detailed plans have been developed for a privately financed $20 million Homer Fisheries Industrial which would reoriented towards this activity. The Corps of Engineers gave final approval in August, 1979. The project will have a channel 610m (2,000 ft.) long and 102m (334 ft.) wide leading to a main basin 762 m (2,500 ft.) long by 107 m (350 ft.) wide

(Anchorage Times, 1979). Based on expressions of interest, developers hope for cold storage plants, seafood processing facilities, boat repair and servicing facilities, and freight handling facilities. The mean lower low water (MLLW) depth of the basin will be -4.6 m (-15 ft.) for the basin and -1.6 m (-5 ft.) for the channel.

Water Depth and Navigational Characteristics. The 42.7 m (410 ft.) face of the city pier, with its 7.6 m (25 ft.) of water, can handle ocean-going barges and small tankers, but dredging would be required for ships of the size operated by TOTE and Sea-Land into Anchorage to use the facility. Supply boats would be unable to use facilities in the small boat harbor basin because of water depth and inadequate room for turning maneuvers. The new industrial park will primarily serve fishing vessels, as indicated by the design depth of the access channel.

The entrance to Kachemak Bay is rich in seafood resources, and a conflict between marine shipping and fishing interests exists. This area must be crossed by ships picking up and discharging pilots. Increased vessel traffic in Cook Inlet brought a corresponding increase in damage to fishing gear. The Coast Guard cooperated with the pilots and the fishermen in establishing a voluntary vessel separation scheme, which has been in operation since 1976. Lanes from both the north and the south are provided. A move to make the vessel separation scheme permanent has been urged by some fishermen. Crabbers have suggested the use of only a single lane in order to expand their crabbing area. The Coast Guard feels that the voluntary system has worked well and that it is preferable to a permanent system due to its flexibility (Harrell, 1979). During the time when fishing is heavy on the southern leg of the system, a Notice to

Mariners can be put out that states only the north leg will be used.

There is an excellent anchorage about a mile north of Homer Spit Light in ten to fifteen fathoms of water without rocks. The diurnal range of tide is 5.5 m (18.2 ft.) at Homer. Northeast of Homer Spit is Coal Bay which is a shoal area but there are no outlying dangers.

Ice does not present a major problem to vessel operations in the Homer area, but ice floes can interfere with operations at the Homer City Pier from January to March. If the floes are particularly heavy, cargo barges can use a wharf in the small boat harbor.

Tonnages by Handling Category and Commodity . A summary of tonnage handled by the Port of Homer in 1977 is shown in Table 2-1. Liquid bulk in 1977 accounted for about 75% of inbound traffic to Homer. It mainly consists of petroleum products. Outbound, 79% of the reported cargo is in dry bulk, all of which was chemical and allied products. Breakbulk, consisting of lumber, accounted for 79% of outbound goods traffic. The remaining bound traffic is containerizable and consists of fresh fish, food products, machinery, and miscellaneous goods.

The historical figures for throughput tonnages as shown on Table 2-2 for the years 1966 to 1977 show an erratic pattern of tonnage handled. This is because in some years large shipments of a particular product such as sand, gravel, crushed rock, lumber, nitrogenous chemical fertilizer or gasoline dominated the tonnage. The fertilizer did not actually pass across Homer Port facilities but was loaded at Nikiski for delivery to a foreign port. Reporting procedures credit the last port entered with all shipments. In this case, ships took on lumber in Homer after leaving

Table 2-1

Port of Homer - 1977 Tonnage and Capacities (Short Tons)

Handling Category	Inbound	Outbound	Throughput	Berth Occupancy High(1,2) Capacity	Berth Occupancy Low(1,2) Capacity
Container zable	1,[illegible]59	3,124	15,083	-	-
RO/RO	-		-	100,000	-
Special	-	1,760	11,760	-	-
Breakbulk	-	-	-	7,725	3,744
Dry Bulk	-	-(3)	-(3)	-	-
Liquid Bu k	34,396	-	34,396	-	-
Tota	46,355 (76%)	14,884 (24%)	61,239 (100%)		

NOTES (1) Based on 314 available days, one timber pile pier with wooden deck face 30'.
(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) The tonnage for chemical fertilizer (57,331 tons) reported for Homer but ectual y originating at Nikiski has been deleted.

Source: Frederick Harris, 1978.

Table 2-2.

Vessel Trips, Passengers and Throughput Tonnage - Homer

Year	Vessels	Passengers	Metric Tons (Short Tons)
1966	676	2,328	12,529 (13,811)
1968	586	3,123	15,807 (17,424)
1970	2337	5,074	172,136 (189,748)(1)
1972	2871	7,052	154,567 (170,382)(2)
1974	142	10,511	10,831 (11,939)
1975	1217	11,215	35,633 (39,279)(3)
1976	138	10,869	27,906 (30,761)(4)(6)
1977	162	9,559	107,564 (118,570)(5)(6)

Notes:
(1) 150,773 metric tons (166,200 tons) = sand, gravel and crushed rock.
(2) 36,903 metric tons (40,679 tons) = logs; 97,182 metric tons(107,126 rafted logs.
(3) 21,452 metric tons (23,647 tons) = gasoline
(4) 13,564 metric tons (14,952 tons) = nitrogenous chemical fertilizer.
(5) 52,009 metric tons (57,331 tons) = nitrogenous chemical fertilizer? 26,922 metric tons (29,677 tons) = kerosene; 10,587 metric tons(11,76 tons) = logs.
(6) Chemical fertilizer, al though i ncl tided in totals for Homer, orgi nate at Nikiski. Homer is listed because it was the last port-of-call before a vessel sailed to a foreign port.

Source: Department of the Army, Corps of Engineers, 1966-1977.

Nikiski. If these large tonnages of particular products are removed, it is seen that Homer consistently handles 15,000 metric tons (49,200 tons) or less of goods per year through its port.

Tonnages by Origin and Destination. Imports from foreign ports, mainly petroleum products, accounted for 64% of total inbound tonnage in 1977. Valdez shipped 28% of total petroleum and coal products imported. Tonnage from Kodiak to Homer consists of diverse products and accounts for 5% of tonnage imported into Homer. Of the outbound tonnage reported, 97% is shipped to foreign ports and consists mainly of lumber and chemicals and allied products. The remainder of outbound shipments in 1977 had diverse destinations such as Seattle, Kodiak, Sitka, and the Alaska Peninsula.

Homer's port facilities receive shipments of goods for local consumption in addition to petroleum products, but the only carrier providing scheduled service is the Alaska Marine Highway System from Kodiak. Outbound traffic is from local resource industries, specifically fish and fish products and logs. Homer does not serve the role of a transshipment port. Since the road distance from Homer to Kenai-Soldotna--129 km (80 mi .)--is one-half of the Anchorage to Kenai-Soldotna road mileage, an expanded port facility in Homer might feasibly serve both areas.

2.2.1.2 Ports of Kenai-Ni kiski-Drift River

Facilities. Three separate groupings of facilities are discussed in this section--Kenai, Drift River, and Nikiski. Only those in Kenai are available for public use. Geographically, the ports of Kenai-Nikiski and Drift River are separate, but the Corps of Engineers' waterborne commerce statistics treat them as a single reporting unit. Drift River is located north of Kenai on the west side of Cook Inlet and Nikiski is located on the east side, north of Kenai (Figures 2-2and 2-3), Kenai facilities include five wharves on the Kenai River, three of which are owned and operated by seafood companies.

The two facilities on the Kenai River which receive general freight are the City Dock, owned by the City of Kenai, and the Port of Kenai wharf, which is privately owned. The City Dock consists of a single 30.4 m (100 ft.) long bulkhead (concrete wall) which has been backfilled. The draft at this port is only 0.3 m (1 ft.) at low tide which limits its use to barges. Principal products received include drilling mud and other petroleum indistry supplies. Winter ice conditions limit use of the facility to approximately 318 days (Frederic Harris, 1978). The Port of Kenai wharf is located 403 m(550 yds.) from City Dock. It has a 111 m (365 ft.) face and receives construction materials and general cargo.

Nikiski and Drift River are specialized ports serving the oil and gas industry. Nikiski has three deep-draft loading docks and one shallow-draft facility as shown in Figure 2-3. In addition to these, there is the Arness dock which consists of three World War II liberty ships sunk in low water so as to provide a breakwater and mooring surfaces for barges supporting offshore drilling operations.

The rig tender's dock (Port Nikiski) consists of a backfilled concrete bulkhead and is designed primarily to handle barges and small offshore platforms service vessels. It has a 182.9 m (600 ft.) face with a 3.04m (10 ft.) draft alongside. The two side faces of the dock are 137.2 m (450 ft.) long where draft ranges from zero at the shore side to 3.0 m (10 ft.) at the inlet side.

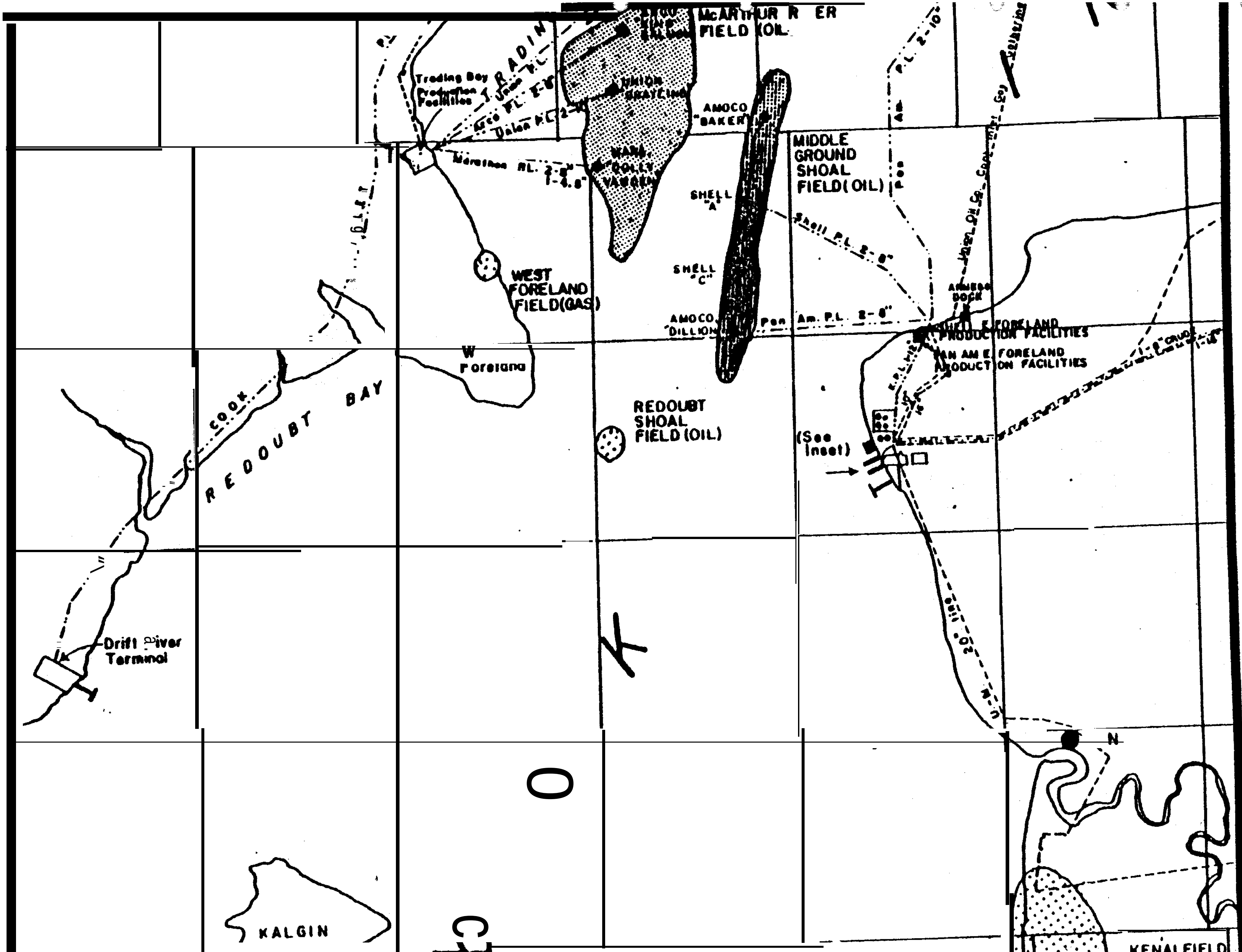
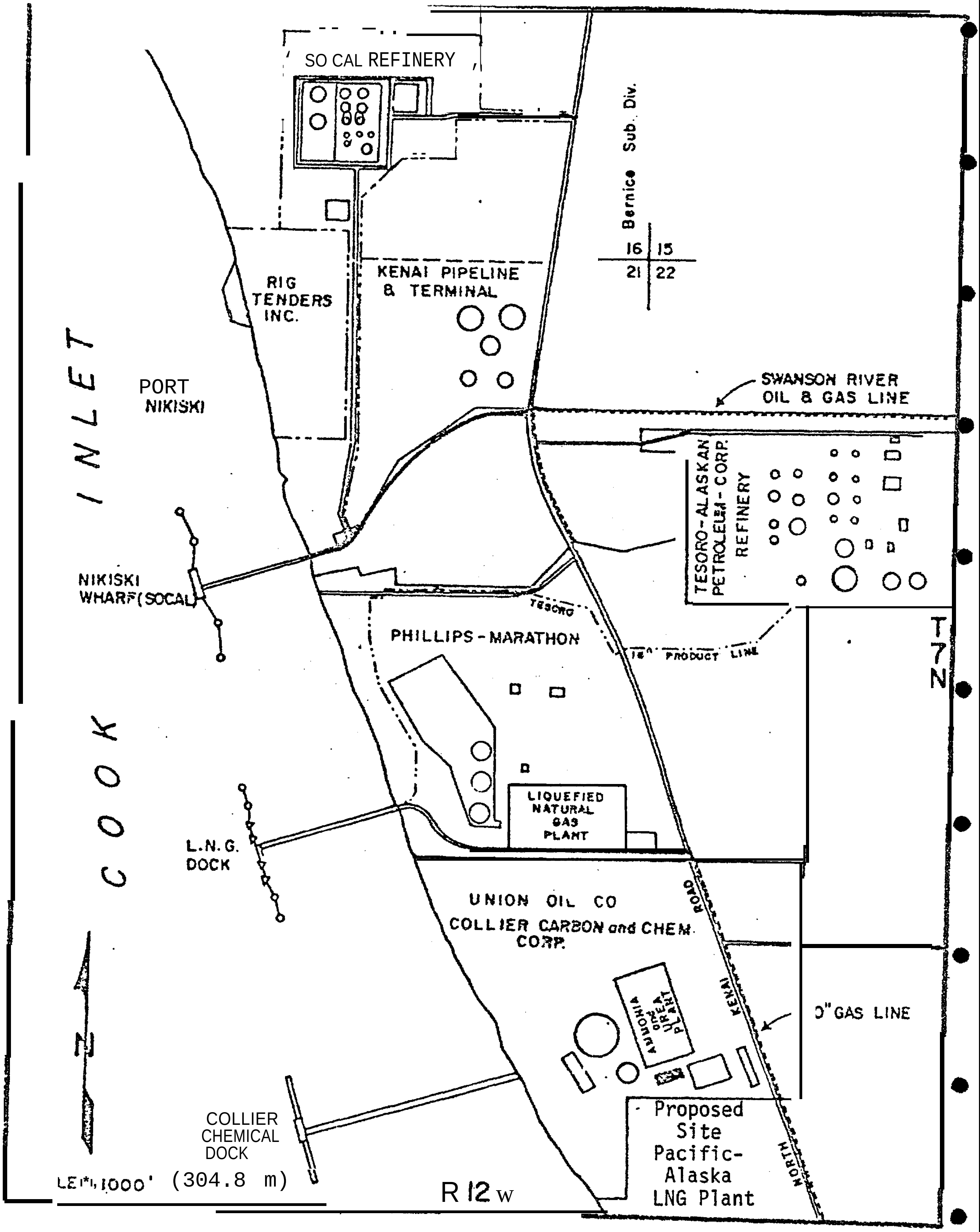


FIGURE 2-2. LOCATION MAP OF NIKISKI/DRIFT RIVER/
KENAI PORT FACILITIES



Source: Alaska Oil and Gas Conservation Commission

Eight acres of landside storage area are available. Shore facilities include crawler cranes with 136 metric ton (150 ton) capacity, storage stations for bulk mud and bulk cement, and machine shops. Also, there are five fuel and water transfer stations designed for use by supply boats. The facility receives inbound barge freight, accommodates loading of supply boats, and is used by Tesoro for the loading of refined petroleum products into barges. The Tesoro traffic has diminished with the construction of the petroleum products pipeline to Anchorage. The rig tender's dock was built by Crowley Maritime for the dedicated use of the oil industry. Conversion to a public use facility would not occur without the concurrence of current users (Waggoner, 1979).

The three offshore loading docks are the Standard Oil of California (also known as Kenai-Pipe Line Company dock), the Phillips-Marathon, and the Collier docks. The Standard dock (Nikiski Wharf) is of steel pile and concrete construction. It has berthing space of 399.1 m (1,310 ft.) with draft alongside of 14.6 m (48 ft.). It is connected to the shore by one 61 cm (24 in.) pipeline to an 800,000 barrel storage facility; one 50.8cm (20 in.) and two 35.6cm (14 in.) pipelines to another 800,000 barrel storage facility; and one 50.8 cm (20 in.) pipeline to 323,000 barrel storage facility. Tankers supplying oil to the Standard Oil and Tesoro refineries dock at this facility.

The Phillips-Marathon dock (L.N.G. Dock) located south of the Standard Oil dock is constructed of sheet piles and concrete and has a length of 320 m (1,050 ft.). It serves ships taking on LNG shipments. The draft alongside this dock is 12.2 m (40 ft.). It is connected to the shore with one 61 cm (24 in.) LNG line to 225,000 barrel storage capacity and one

50.8 cm (20 in.) and one 40.6 cm (16 in.) petroleum line to a 450,000 barrel storage facility.

The Collier Company dock (Collier Chemical Dock) is constructed of steel piles and concrete and the berth has a length of 333.8 m (1 ,095 ft.). The draft alongside the berth is 12.2 m (40 ft.). There is a 113,397 metric ton (125,000 tons) capacity for storing bulk urea. This dock is connected by pipeline (one 30.5 cm (12 in.) connecting to two 15.2 cm (6 in.)) to a facility for storing anhydrous ammonia, whose capacity is 54,431 metric tons (60,000 tons) at-33.3°C (-28°F). Further, there are two pipelines, 25.4 cm (10 in.) and 20.3 cm (8 in.), which feed petroleum to a 171,000 barrel storage facility.

The Drift River Terminal, built in 1966 on the west side of Cook Inlet, has an offshore loading platform equipped with breasting and mooring dolphins. Dolphins are groups of piles, placed to both sides of the end of a pier for either fastening mooring lines or for resting the ship. itself (breasting dolphins). See Figure 2-3 for an example of their placement. Alongside the platform it has a draft of 18.2 m (60 ft.) and is capable of handling tankers up to 149,685 metric dead weight tons (150,000 dead weight tons). There are two 76.2 cm (30 in.) pipelines leading to an onshore tank farm for storing crude oil.

The Arness dock, which has not been used since 1976, has a 914 m (3,000 ft.) mooring space in shallow water created by the beaching of three 1 i berty ships. It is located several miles north of the East Foreland product on facilities as shown on Figure 2-3. Unloading occurs at low

Table 2-3

Ports of Kenai-Nikiski-Drift River - 1977 Tonnages (short tons), Barrels and Capacities

Handling Category	(Short Tons) Inbound	Outbound	Throughput	Berth Occupancy High(1,2) Capacity	V/C(3)	Low(1,2) Capacity	V/C(3)
Containerizable							
RO/RO							
Special	28,553		28,533				
Neobulk	765		765	1,744,200	.04%	1,324,800	.06%
Dry Bulk		-(4)	-(4)	720,000	--	345,600	--
Liquid Bulk		5,527,681	5,527,681	34,948,250	15.8%	19,775,000	28.0%
LNG				16,875,000 (Bbls)	--	8,100,000 (Bbls)	--
Anhydrous Ammonia				12,825,000 (Bbls)	--	6,156,000 (Bbls)	--
Bulk Cement				979,200		806,400	
Total	29,318	5,527,681	5,556,999				

Notes: (1) Based on 318 available days in Kenai and 300 available days at Nikiski-Drift River.
(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 = Volume (total throughput)/Capacity
(4) Chemical fertilizer output reported for Homer but originating in Nikiski is not included

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

tide when barges are beached. Up to four berths can handle neobulk and dry bulk shipments. Barges supporting offshore drilling operations have used the facility in the past, and the liberty ships can be used to store bulk and palletized cement and mud.

Two dock facilities will be constructed as part of the Pacific-Alaska LNG project, which will be located south of the existing Collier property. First, a construction dock will be built with 152.4 m (500 ft.) of berthing area to accommodate large ocean-going barges carrying plant modules. Interest has been expressed by Kenai in later using this facility for receiving general cargo. To serve LNG ships, a pier 671m (2,200 ft.) long will be constructed to a mooring facility consisting of six dolphins (Federal Power Commission, 1976). Some dredging will be required on the south side of the docking area.

Table 2-4 shows the high and low capacity available at the ports of Kenai-Nikiski-Drift River by handling categories. The table also shows 1977 inbound, outbound, and throughput tonnages through these ports. From these figures it can be seen that considerable additional capacity exists for handling oil and gas products at these ports.

Water Depth and Navigational Characteristics. Water depth at the Port of Kenai is only 0.30m (1 ft.) of water at low tide. Water depth at Nikiski and Drift River facilities is sufficient to handle medium-size tankers.

Freezing occurs in the Kenai River from mid-December to the first of April. Because of tidal currents and numerous shoal areas in Cook Inlet, pilots are required for deep draft ships destined for Nikiski as well as other ports north of Homer.

The annual average number of days available for shipping is 300 at Nikiski, Drift River Terminal, and the Arness dock, and 318 on the Kenai River (Frederic Harris, 1978).

An area extending from 40 yards to several hundred yards north of Nikiski dock has rocks. A shoal area about five miles in extent is 3.2 km (two miles) off the dock and is marked by a buoy.

Navigational difficulties and hazards to vessels in the Kenai-Nikiski area are due more to current and ice than storms and water depth. High tidal fluctuations produce strong currents which reach 8-11 knots in Cook Inlet and up to six knots at Nikiski docking areas. Drift River is adequately protected by the West Forelands from ice and current on the ebb tide. Deep water, wide shipping lanes, the required use of pilots on-vessels above 272 gross metric tons (300 gross tons), and the relatively small level of vessel traffic make navigation safe enroute to Nikiski. The principal safety issue relates to vessels approached or moored during the winter at Nikiski facilities, where they are exposed to strong flood tide currents containing heavy ice. Loading delays up to six hours due to such conditions have occurred at the existing LNG dock. Non-continuous ice floes up to 0.8 km (½ mile) in diameter and up to 1.2 m (4 ft.) accumulate on the east shore of Cook Inlet during flood tides. The resulting forces on ships are sufficient to break mooring lines. In such cases, damage can occur to drifting vessels as well as other vessels in the area. The danger, thus, does not relate solely to traffic levels at a given facility but to the extent adjacent facilities are in use at the same time. "The primary hazard is the inability of vessels torn away from their loading berth or executing emergency break away procedures to maneuver in heavy ice so as to prevent collision with other pier facilities or vessels in the area (Adm. Hayes, 1975)." Construction of the proposed Pacific-Alaska LNG dock facility will increase this hazard.

To reduce the likelihood of damage, the Nikiski Marine Terminal Safety Committee has established voluntary procedures which include the following: mooring with the bow facing flood tides, providing adequate mooring lines, providing necessary engine room and bridge watches, and maintaining the capability to immediately suspend cargo operations and to cast off mooring lines (Federal Power Commission, 1976).

Tonnage by Handling Category and Commodity Type. In 1977, over 99% of the total throughput tonnage handled at Kenai, Nikiski, and Drift River Terminal consisted of petroleum products. Most were exports of crude oil from Nikiski and Drift River Terminal. Inbound, commodities handled were special items (32% of total inbound tonnage), chemical products (16%), lumber products (7%), stone and allied products (4%), and primary metal products (3%). All tonnage is considered to be neobulk or special (Frederic Harris, 1978). The remaining inbound commodity types amounted to one percent or less of the total inbound tonnage. Inbound shipments of liquid bulk are limited because the two local refineries supply most local needs. The Tesoro refinery, which receives the State of Alaska's royalty oil, recently has been unable to operate at design levels because of lower production in Cook Inlet fields. To fill the gap in supply, oil from the Trans-Alaska pipeline is now being shipped to the refinery. The high sulphur content of Prudhoe Bay crude oil limits the percentage that can be used from this source.

Tonnage by Origin and Destination. The major inbound tonnage to these ports in 1977 originated in Kodiak (63%) and Mare Island Strait, California (37%). Total inbound traffic amounted to only 26,597 metric tons (29,318 tons). Twenty-eight percent of exports are to Washington State refineries located in Ferndale and Cherry Point. The remainder (72%) in 1977 was destined for California ports such as Mare Island Strait, Los Angeles, and Long Beach for refining. LNG from the Phillips-Marathon facility is shipped to Japan.

Summary. The ports of Nikiski and Drift River Terminal have adequate capacity to handle additional tanker traffic. Ice conditions and tidal currents are the major limiting factors in the number of days these facilities can be used. Crude oil and other petroleum products account on a percentage basis for virtually all of the traffic.

*

Most of the general marine freight destined for Kenai first goes to Anchorage. Located on the shipping lane to Anchorage, Kenai would provide a convenient intermediate destination on the inbound or outbound voyage for a major shipper if an adequate container or roll-on, roll-off facility could be developed and adequate traffic could be generated.

2.2.1.3 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 serve specialized barge shipments. Figure 2-I is a schematic layout of the port. Capabilities and dimensions of the Municipality's terminals are as follows:

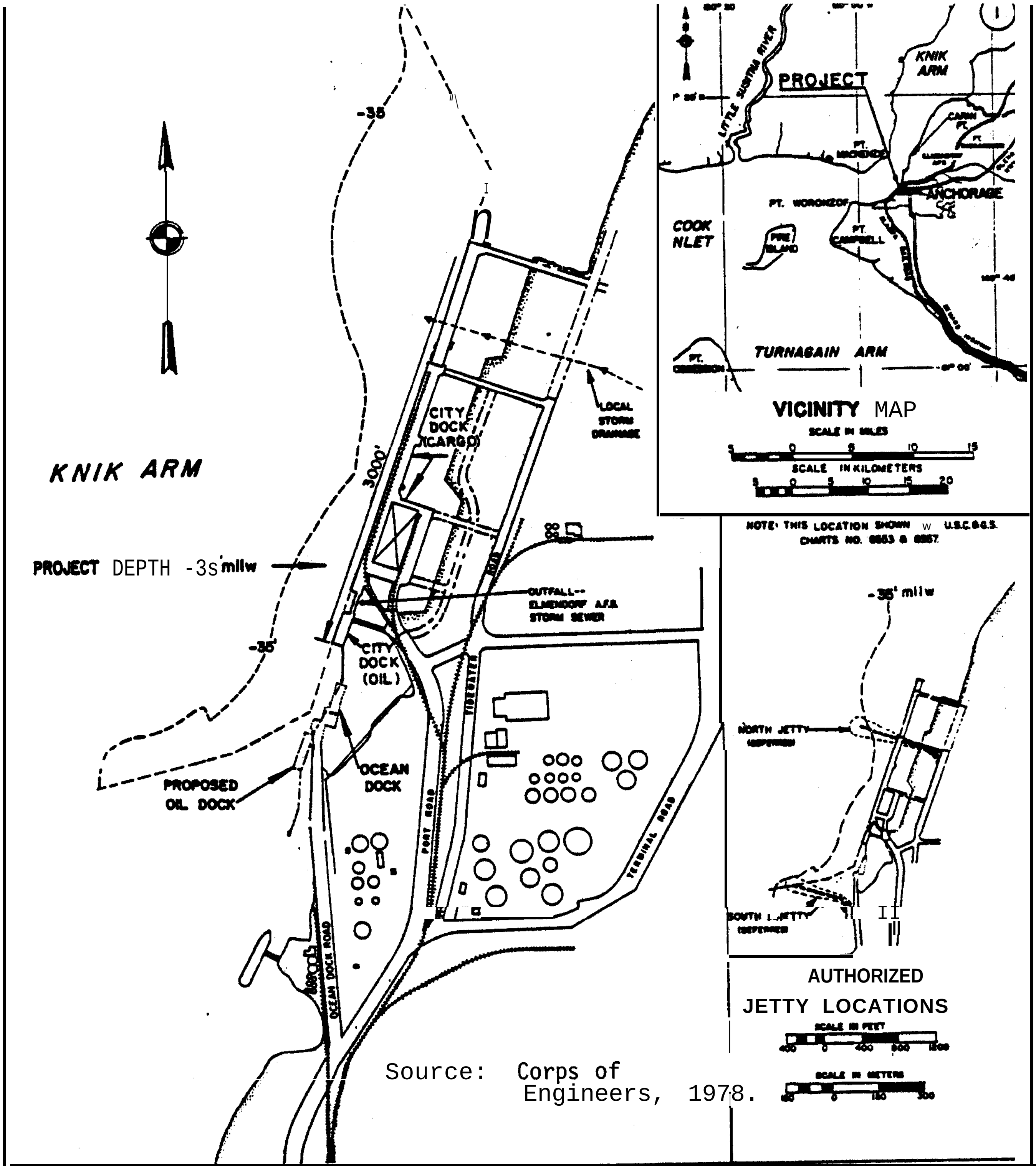
- Terminal No. 1: 183 m (600 foot) wharf, 14.3 m (47 feet) wide, constructed of concrete and steel. It can handle container, roll-on/roll-off, and general cargo ships and also serves as an alternate petroleum dock.

- Terminal No. 2: 186 m (610 foot) wharf, 21 m (69 feet) wide, with the same 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, arid 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.



Source: Corps of Engineers, 1978.

NOTES

NORTH & SOUTH JETTY CONSTRUCTION IS INDEFINITLY DEFERRED.
JETTIES HAVE BEEN 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	716.40
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 2-4

Table 2-4 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, based on 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.

Scheduled for construction in 1980 by York Steel Company on land leased from the Alaska Railroad is a port facility that will provide a transfer dock for rail barges, rail spurs, warehouses for cargo storage, and a repair facility for large boats (Anchorage Times, 1979). The 25.2 ha (63 acre) site is located where Ship Creek enters Cook Inlet. The Corps of Engineers is skeptical of the project's ability to attract shippers because ice conditions make the port unsuitable for barge operations during the winter. As part of the project, a rail-barge facility might also be built north of Nikiski on the Kenai Peninsula.

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

The extreme tidal range of 12.7 m (40.7 ft.) 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 Woronzof near Fire Island and limits the channel width for deep-draft vessels to 610m (2, 000 ft.). 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 ft.) 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 ft.). Despite this problem, approximately 60% of the dry cargo traffic to the port in 1976 and 1977 consisted of vessels having drafts 7.6 m (25 ft.) or greater. Outbound 1976 traffic consisted of 792 vessels, of which 34%, or 271, had drafts greater than 6.1 (20 ft.).

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.

Table 2-4

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 Capacity (1,4)	High V/C (2)	Low Capacity (1,4)	Low V/C
Containerizable	897	101	998	1,530	37%	1,070 (3)	52'%
RO/RO				1,200		839	
Breakbulk							
Neobulk				1,760		1,3:0	i
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	3,128 (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 capacity is not a sum of the individual capacities.

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

Table 2-5

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 (2,932,468)

Source: Corps of Engineers, 1977.

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 from and outbound to other Alaskan ports. Anchorage serves as a distribution center for traffic that completes its journey by truck or rail. TOTE estimates that 80 percent of its total traffic is destined for the immediate Anchorage area, and of the remainder, 15% is for Fairbanks (Westerl in, 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.

2.2.2 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.

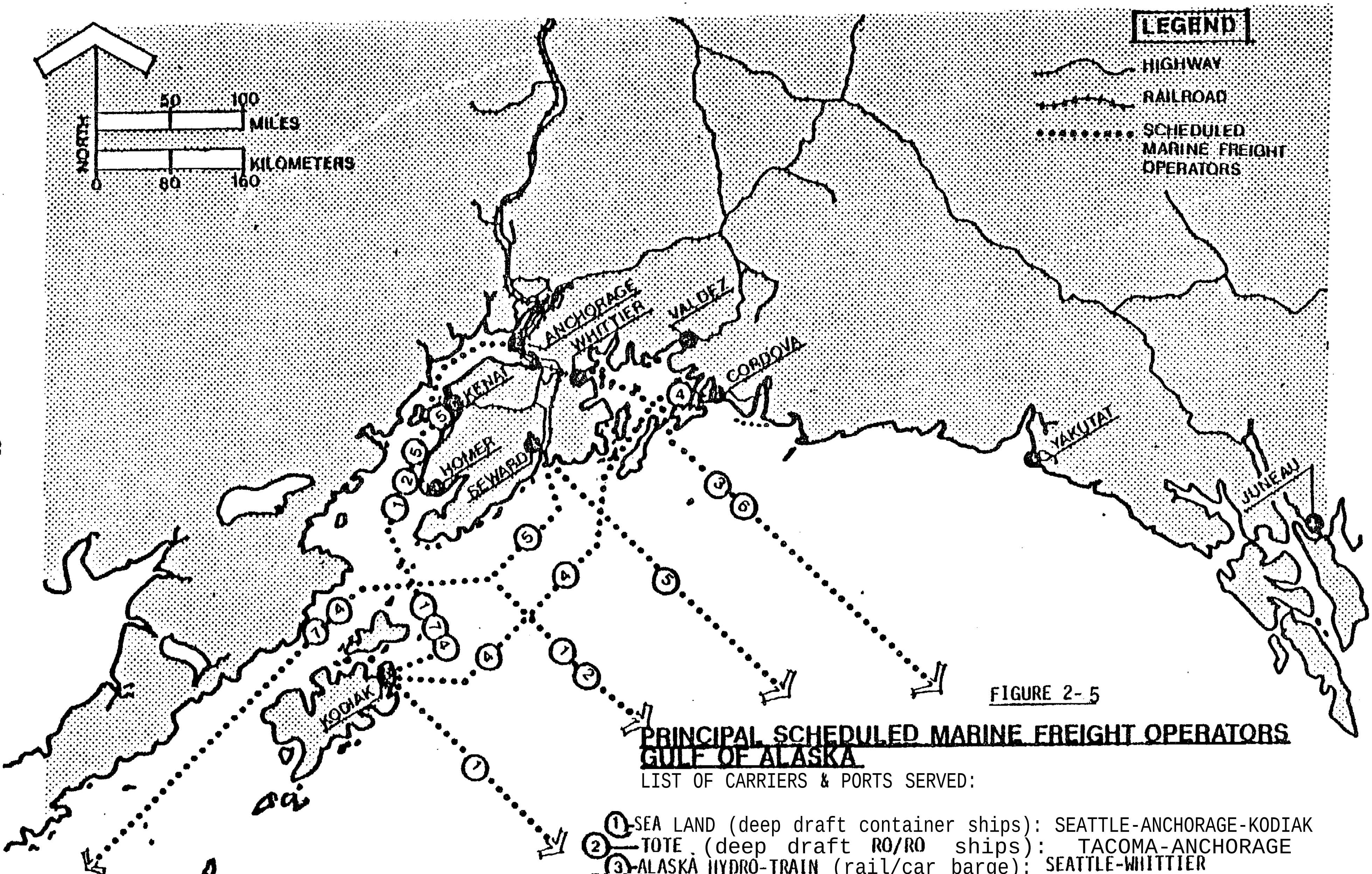


FIGURE 2- 5

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-ALEUT IANS
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

Sea-Land. Sea-Land specializes in the shipment of 10.7 m (35 ft.) 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 ft.), can accommodate 360 containers, and operate at 29.6 km/hr (16 knots). Fully loaded, their draft is 9.8 m (32 ft.). 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, 197'8). 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-bind 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 temperature-controlled containers 10.7 m (35 ft.) in length. 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 ft.) containers. Each ship has a length of 240.8 m (790 ft.), a draft of approximately 9.1 m (30 ft.), and a speed of 44.5 km/hr (24 knots). The travel time of a one-way trip is 2½ days. Because of a very short turn-around time at Anchorage (less than 12 hours), which is accomplished by use of 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 ft. by 100 ft.) 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 ft. by 60 ft.) 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 Upper 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).

Aqua-Train (Canadian National). The Canadian National operates a 21-car rail car barge service between Prince Rupert, B.C. and Whittier approximately once every 10 days. Tonnage for 1977 was 5,370 metric tons (5,919 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 and was the only scheduled service into Seward. Service was discontinued in March, 1979, due to inadequate northbound traffic, and an embargo was placed on the tariff. The 117.3 m (385 ft.) by 29.9 m 85 ft.) enclosed barges delivered freight in both 12.2 m (40 ft.) and 6.1 m (20 ft.) containers to Seward and then traveled to Nikiski 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 was used to carry mobile home units to Seward which cannot be shipped via TOTE or through Whittier because of tunnel clearance problems. PAL service was generally operated twice monthly during the summer and once monthly during the winter.

PAL service offered the advantages of railroad service but for LCL (less than carload) shipments. An estimated 80% of the tonnage delivered to Seward was 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 2-6 shows the characteristics of each vessel. Operationally, the major difference 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 2-7 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 daytime 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, which is located 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

Table 2- 6

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
Stateroom'/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.

Table 2-7

Marine Highway System - Southwest System

Major Links	Direction	Link volumes Passengers	Link volumes Vehicles	Trips	Average Load Factors (1) Passengers	Average Load Factors (1) Vehicles
M.V. Bartlett - July 1976						
Cordova-Valdez	EB	283	105	9	0.18	0.31
Valdez-Cordova	WB	300	101	8	0.22	0.33
Valdez-Whittier	EB	3,332	670	22	0.89	0.80
Whittier-Valdez	WB	3,166	636	22	0.85	0.76
M.V. Bartlett - January 1977						
Cordova-Valdez	EB	161	46	9	0.09	0.13
Valdez-Cordova	WB	242	57	9	0.16	0.3.7
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	66s	61	5	0.67	0.24
Valdez-Cordova	WB	664	71	5	0.66	0.28
Kodiak-Seward	EB	346	107	4	0.43	0.54

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

Source: DOTPF, 1976 and 1977.

weekends, a round trip from Seward to Valdez and Cordova is scheduled. As the number of July 1976 trips indicates, the Kodiak-Homer route is the most heavily traveled. Interestingly, the load factors for summer trips between Cordova and Valdez are significantly higher for the M.V. Tustumena than for the M.V. Bartlett. Apparently, this occurs because the service occurs during the weekend, offers berths, and provides the only ferry connection westward to Seward and Kodiak. Ferry passenger fares for the system are priced somewhat below air fares for the same city pairs.

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 1 eve' s on existing routes.

Table 2-8 shows traffic trends for the Southwest Marine Highway System between 1971 and 1977. A steady increase occurred from 1971 to 1975,

Table 2-8

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%
19?3	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..

but traffic appears to have leveled off despite available capacity on most links. Monthly patronage figures for the system show high peaking characteristic cs. 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 2-7 gives traffic data for the two vessels on major travel links.

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

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

2.2.2.2 Infrequent and Seasonal Carriers

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

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

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

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

2.2.2.3 Contract Carriers

Contract carriers are used by major shippers, such as timber and oil companies, to move specialized and over-sized cargo throughout Alaska as the need develops. The primary companies serving this market in Alaska are Crowley Maritime and Dillingham Maritime, Ocean Division. Worldwide tug and barge operators, they can draw on equipment to meet the needs of any shipper. In serving major points of entry, contract tug and barge carriers are competitive for major shipments except in two situations as noted by Dillingham Maritime, Ocean Division (Osborn, 1979). Where freight can be accommodated on railcars and originates inland of the West Coast, through rates generally 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 because of cheaper handling costs. Contract carriers conceivably could underbid published tariffs but prefer to seek out traffic where larger profit margins would be possible. 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 by scheduled marine carriers reflect the characteristics of traffic to and from a given community, the amount of competition, and the amount of cargo handling and intermodal transfers that must occur. Traffic characteristics include total tonnage, breakdown of tonnage by commodity and handling category, and the relationship between inbound and outbound cargo.

Table 2-9 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 are approximately two-thirds of the northbound rate. This preferential rate is designed to increase low southbound load factors.

TOTE and Sea-Land, the major marine operators serving Anchorage, are highly competitive. The competition has stabilized shipping rates even though both companies lost several million dollars before taxes during the period July 1978 to July 1979 (Anthorage Daily News, 1979). During the first five months of 1979, Sea-Land's traffic dropped off 23% from the same period of the previous year. Table 2-9 shows Sea-Land rates as of August 1979 for a variety of commodity types and shipment sizes for major city pairs. From this information, several general statements can be made regarding marine rates. Prices per 100 pounds can be reduced significantly by shipping in large quantities. On the Anchorage-Seattle route, a 35%

Table 2-9

Typical Marine Freight Rates from Seattle and Anchorage[,2,3]

Transportation Cost per 100 Pounds in Dollars

Origin-Destination	Appliances Shipment Size	Appliances Tariff Type	Appliances Cost	Cement Shipment Size	Cement Tariff Type	Cement Cost	Groceries Shipment Size	Groceries Tariff Type	Groceries Cost
Seattle-Anchorage	2,000#(LTL)	CO	18.78	2,000#(LTL)	CL	10.04	LTL	CO	10.74
	12,000#(TL)	CO	10.01	80,000#(TL)	CO	3.40	24,000#(TL)	CO	6.51
Seattle-Kodiak	LTL	CO	18.94	40,000 #(TL)	CO	3.77	LTL	CO	6.77
	12,000#(TL)	CO	10.16				24,000#(TL)	CO	4.97
Seattle-Seward	12,000#(TL)	CO	13.54	LTL	CL	15.63	LTL	CO	12.44
				40,000#(TL)	CO	5.69	24,000#(TL)	CO	6.93
				80,000#	CO	3.40			
Seattle-Kenai	LTL (no through rate)			LTL	CL	15.63	LTL	CO	12.44
	12,000#(TL)	CO	13.54	40,000#(TL)	CO	5.69	24,000#(TL)	CO	6.93
				80,000#	CO	4.58			
Seattle-Homer	(No through rate)			LTL	CL	16.69	LTL	CO	13.18
				40,000#	CO	6.15	24,000 #(TL)	CO	9.21
Anchorage-Kenai	LTL	CL	10.18	LTL	CL	7.19	LTL	CO	7.67
	18,000#(TL)	CL	3.08	40,000#(TL)	CL	1.54	40,000 #(TL)	CO	1.75
Anchorage-Homer	LTL	CL	13.15	LTL	CL	8.53	LTL	CO	9.34
	18,000#(TL)	CL	4.32	40,000#	CL	2.16	40,000#(TL)	CO	2.47

Table 2-9(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	14.83	LTL	CO	8.07	2,000#(LTL)	CO	14.06
	30,000#(TL)	CO	9.71	32,000#(TL)	CO	4.94	30,000#(TL)	CO	6.20
Seattle-Kodiak	LTL	CO	14.70	LTL	CL	12.81	LTL	CL	12.81
	16,000#(TL)	CO	12.91	30,000#(TL)	CL	4.16	30,000#(TL)	CO	4.51
Seattle-Seward	LTL	CO	16.97	LTL	CL	15.63	LTL	CL	20.16
	20,000#	CO	12.54	32,000#(TL)	CO	6.59	30,000#(TL)	CO	8.02
Seattle-Kenai	LTL	CO	16.97	LTL	CL	15.63	LTL	CL	20.16
	20,000#(TL)	CO	12.54	32,000#(TL)	CO	6.59	30,000#(TL)	CO	8.02
Seattle-Homer	LTL	CO	18.57	LTL	CL	16,69	LTL	CL	21.52
	20,000# (TL)	CO	15.60	32,000#(TL)	CO	6.65	30,000#(TL)	CO	8.50
Anchorage-Kenai	LTL	CO,	15.27[4]	LTL	CL	7.19	LTL	CL	8.82
	30,000#(TL)	CO	2.42[4]	40,000#(TL)	CL	1.54	40,000#(TL)	CL	1.54

Notes: (1) Based on-August 1979 SeaLand tariffs.

(2) LTL = less than truckload shipments; TL = truckload shipments; CL = class tariff; CO = commodity tariff.

(3) 1½% surcharge is in addition to tariffs shown for interstate shipments.

Source: Sea-Land, 1979.

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 66% when going from 0.91 metric ton (2,000 lb.) to 36.3 metric ton (80,000 lb.) lots. Prices from Seattle to Anchorage or Kodiak are approximately the same, since the same Sea-Land vessel stops in both ports and no transfer costs are incurred.

Rates to Kenai Peninsula destinations--Kenai, Homer, and Seward--for freight originating in Seattle are consistently higher than those for similar shipments to either Kodiak or Anchorage. The difference is that all such freight must be trucked south after arriving in Anchorage. In some cases, a through rate exists from Seattle. In other cases, the rate for the Anchorage-Kenai Pen'insula link must be added to the one for the Seattle-Anchorage link. No through rate exists for shipments of appli-antes less than 5.4 metric tons (12,000 lbs.) from Seattle to Kenai. The additional cost of sending such a shipment from Anchorage to Kenai is 54% of the rate for the shipment to go from Seattle to Anchorage. Through rates may not be available when a break in carriers exists or when an Anchorage distributor is involved. For less-than-truckload shipments of groceries to Kenai, a separate Anchorage to Kenai tariff is 71% above the cost of shipping the goods to Anchorage. Where through rates can be utilized, the cost differential is less but still substantial. For LTL shipments from Seattle to Kenai, the increase is 54% for cement, 16% for groceries, and 47% for iron/steel products. The differential drops for larger shipments. The rate increase is only 6% for groceries and 19% for iron/steel products. Generally, rates are the same to Kenai and Seward, and rates to Homer are slightly greater.

Figures 2-6a and 2-6b show major shipping routes in Lower Cook Inlet and Shelikof Strait. Table 2-10 summarizes liquid and dry tonnage and vessels for each of the inbound links in each direction. The date is based on route estimates for 1977 waterborne commerce data (ERCO/Frankel, 1978). Judgmental decisions were required in estimating ship sizes and link assignments. The figures, thus, are not exact but do show the magnitude of shipping on marine links in the study area. 'Link 18 handles the greatest traffic, both in terms of tonnage and the number of laden vessels. The primary route leading to Upper Cook Inlet contains, in order, links 19-18-12 and 10. Data for final links to the ports of Drift River, Nikiski, and Anchorage show that Drift River handles the *most* total and liquid tonnage, Anchorage the most dry tonnage, and Nikiski the largest number of laden vessels. The 1977 traffic in Shelikof Strait consisted primarily of oil tankers carrying crude oil to foreign ports. The recent introduction of service by Sea-Land and American President Lines on Shelikof Strait links will increase its traffic level, although most of the tonnage will be onloaded at Dutch Harbor.

In Cook Inlet, floating navigational aids are available only during the summer months because of winter ice conditions, but Coast Guard officials do not feel that measures beyond the voluntary separation lanes entering and leading Kachemak Bay would be currently justified (Harrell, 1979). Additional marine traffic control measures on any of the links would be justified only because of interference between freight vessel movements and fishing activities or potential interference between oil platform sites and existing navigational lanes. "Under no conditions can the

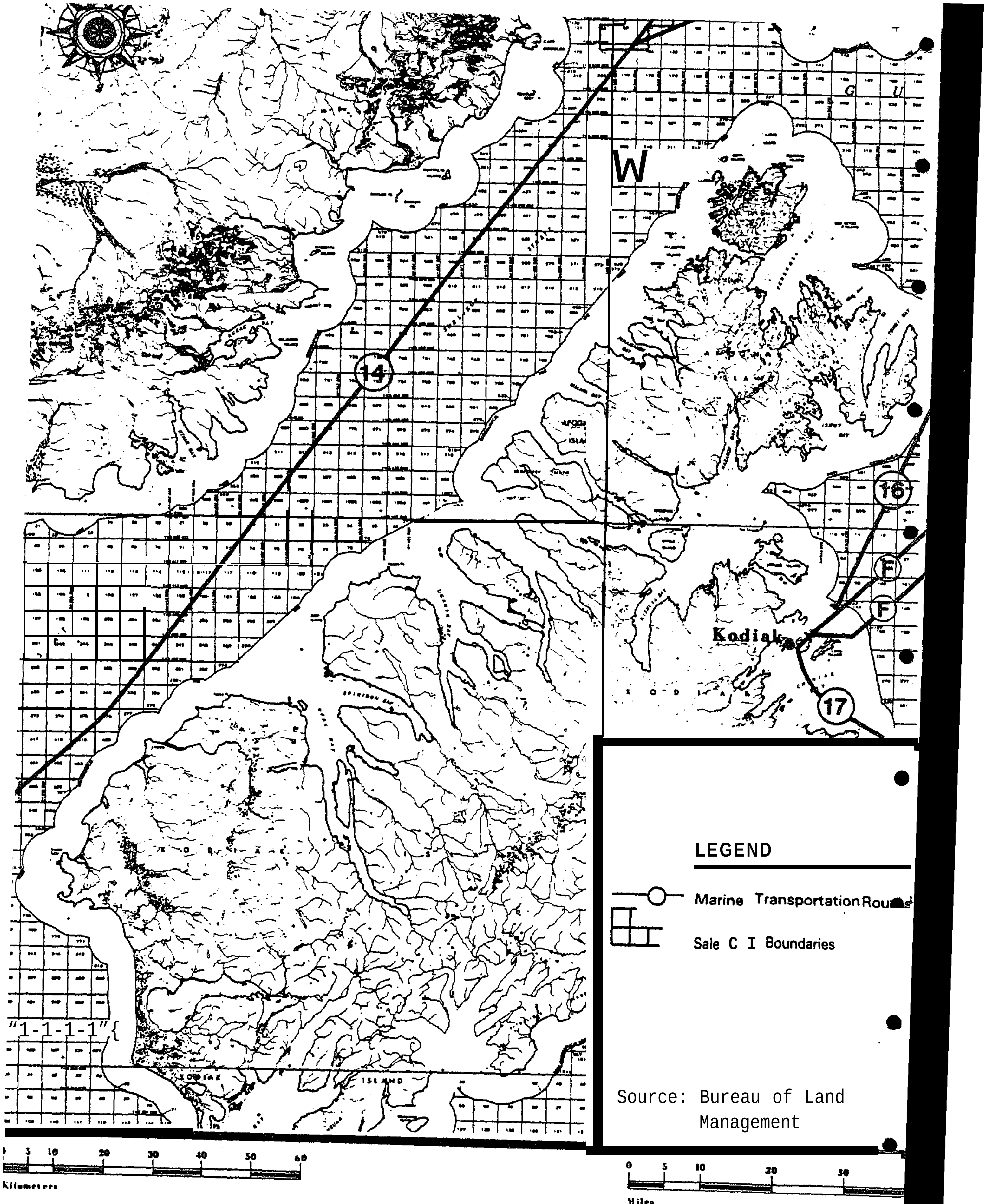


FIGURE 2- 6b. SHELIKOF STRAIT
EXISTING MARINE TRANSPORTATION ROUTES

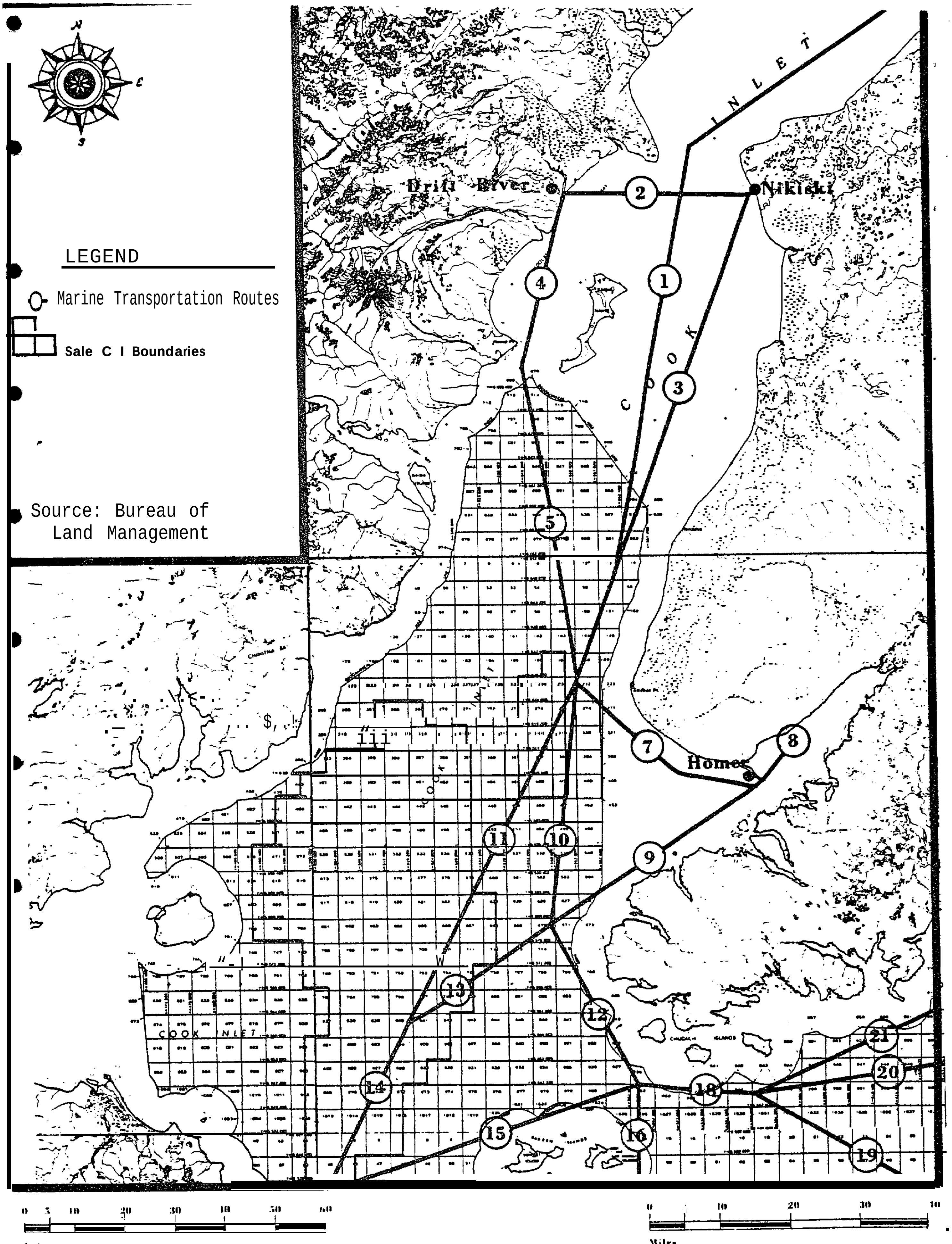


FIGURE 2-6a. LOWER COOK INLET

Table 2-10

Existing Vessel Traffic and Tonnage by Marine Link

		1977 Tonnage (Kilotons)			One-Way Laden	Two-way Vessel
Link	Direction	Total	Liquid	Dry	Vessels	Traffic
1	NB	1,800	800	1,000	275	275
2	EB	800	800		35	35
3	SB	3,650	3,650		253	368
	NB	530	500	30	115	
4	NB	800	800	.		215
	SB	6,000	6,000		1;:	
5	SB	6,000	6,000		180	180
6	NB	2,330	1,300	1,030	390	643
	SB	3,650	3,650		253	
7	NB	580	500	80	130	195
	SB	225	225		65	
8	SB	100		100	10	10
9	NB	500	500		100	160
	SB	300	200	ioo	60	
10	NB	2,630	1,600	1,030	400	743
	SB	9,265	9,265		343	
11	SB	160	160		25	25
12	NB	2,410	1,300	1,110	420	718
	SB	8,240	8,240		298	
.13	WB	1,100	1,000	100	40	40
14	NB	80			8	73
	SB	1,260	1,160	1;:	65	
15	NB	80		80	8	8
16	NB	20		20	25	60
	SB	100	'75	25	35	
17	NB	74	74		15	95
	SB	200		200	80	

Table 2-10 (Continued)

Existing Vessel Traffic and Tonnage by Marine Link

Link	Direction	1977 Tonnage (Kilotons) Total	Liquid	Dry	One-Way Laden Vessels	Two-way Vessel Traffic
18	EB	8,265	8,165	100	316	917
	WB	3,420	2,290	1,130	601	
19	NB	2,630	1,600	1,030	400	630
	SB	8,000	8,000	-	230	
20	WB	500	500	-	100	150
	EB	200	200	-	50	
21	EB	290	190	100	101	101

Source: ERCO/Frankel, 1978.

traffic predicted during this twenty-year period for Cook Inlet and the Gulf of Alaska waters be considered anything but light to moderate. The traffic, and risk of collisions due to congestion, is so slight as to make estimates of traffic capacity almost meaningless despite the present user conflict in Kachemak Bay (ERCO, 1978)."

To help reduce gear losses, the Coast Guard recommends an educational program that informs operators about the timing and location of major fishing resource areas by species and the types of gear for which they should be looking . Maps containing this information for Prince William Sound have been included in the operating manual for that area's vessel traffic service (U.S. Coast Guard, 1977).

2.2.4 REGULATIONS

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

The Jones Act prevents foreign-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 only affects the size of tankers serving Valdez.

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. Next. legislation only affects the size of tankers serving Valdez.

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

2.3.1 TERMINALS

Terminals serving air traffic in the impact 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 crosswinds, 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, taxi-ways, 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 runways--the size and type of aircraft that can be accommodated and the number of operations (take-offs and landings) that can take place. 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 improve capacity. In other cases, the landing aids and facilities may limit operations. Finally, geographical constraints in the form of obstructions or lack of level land for development can be the ultimate constraint.

The Alaska Department of Transportation and Public Facilities 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.

Table 2-11

Lower Cook Inlet Principal Airports - Runways and Ground Facilities

Community	Location	Owner	Runway Heading(1)	Length Meters(ft)	Width Meters(ft)	Surface Type	Heliport(2)	Terminal Building	Hangers	Fuel	Main-tenance
Homer	2½ mi. east of downtown Homer	State of Alaska	3-21 3-21	(7,400) (3,000)	(150) (600)	Asphalt Water	No	Yes	Yes	Yes	Yes
Kenai	½ mi. north of downtown Kenai	city of Kenai	1-19	(7,498)	(150)	Asphalt	No	Yes	Yes	Yes	Yes
Soldotna	2 mi. south of downtown Soldotna	city of Soldotna	7-25	(5,000)	(150)	Asphalt	No	Yes	Yes	Yes	Yes
---	Drift River	Cook Inlet Pipeline Company	5-23	(4,300)	(150)	Gravel	Yes	Yes	Yes	No	No

Notes: (1) Headings are expressed in true compass readings. For example, runway 3-21 has a heading of 30° or 2100 depending upon the direction of a plane when landing or taking off.
(2) Although not all airports listed have designated heliports, each has at least one operator who uses helicopters and who has a private area for operating them from.

Source: FAA, 1977.

International and trunk airports as a general rule have a length of at least l,524m (5,000 ft.), which enables them to handle 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 principal Lower Cook Inlet airports discussed in this report are Homer, Kenai, and Soldotna. Facilities at Drift River and Anchorage are also discussed. Homer and Kenai are trunk terminals and have a service level of AC (Air Carrier) assigned by the Federal Aviation Administration. Soldotna is a secondary terminal with a service level of GA (General Aviation). Drift River is privately owned and has both a gravel runway and heliport. Heliports are located in Nikiski at the rig tender's dock and to the north at the Shell facilities.

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.

Each of the area's facilities will be examined from the point of both facilities and traffic. Tables 2-11 and 2-12 list principal runway and navigational facilities.

Table 2-12

Lower Cook Inlet Principal Airports - Operations and Aids

Community	Service Level(1)	Design Type(2)	Total Operations	Based Aircraft(3)	Scheduled Airlines	Based Air Taxis	Control Tower	Taxiways	Navigation/Landing Aids(4) Runway Heading	Lighting	Radio	Other
Homer	AC	AC	37,198 (1977) 36,760 (1978)	65	2	3	No	Yes	- 3 3/21	MALS VASI	VORTAC DF,FSS, NDB LOC/DME	RCAG
Kenai	Cs	GT	89,965 (1977) 87,425 (1978)	110	2(5)	5	Yes	Yes	- 19 1 1	NALS REIL VAS1	DF,FSS, NDB,VOR/DME GS,LOC	MM,OM
Soldotna	GA	GU	66,000 (1978 est.)	125	1	3	No	Yes	-	VASI	SFO	-
Drift River	Private	Private	Fixed Wing - 750 (1977 est.) Rotary Wing - 1,600 (1977 est.)	3	0	0	No	No	-	Rotating Beacon	-	-

Table 2-12 (Continued)

Notes: (1) Service Level

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

(2) Design Type

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

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

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

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

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

(5) A third carrier, Polar Airlines, was granted an emergency exemption to provide Anchorage-Kenai service for 120 days from May 29 - September 26, 1979.

Source: FAA, 1977, DOTPF, 1978.

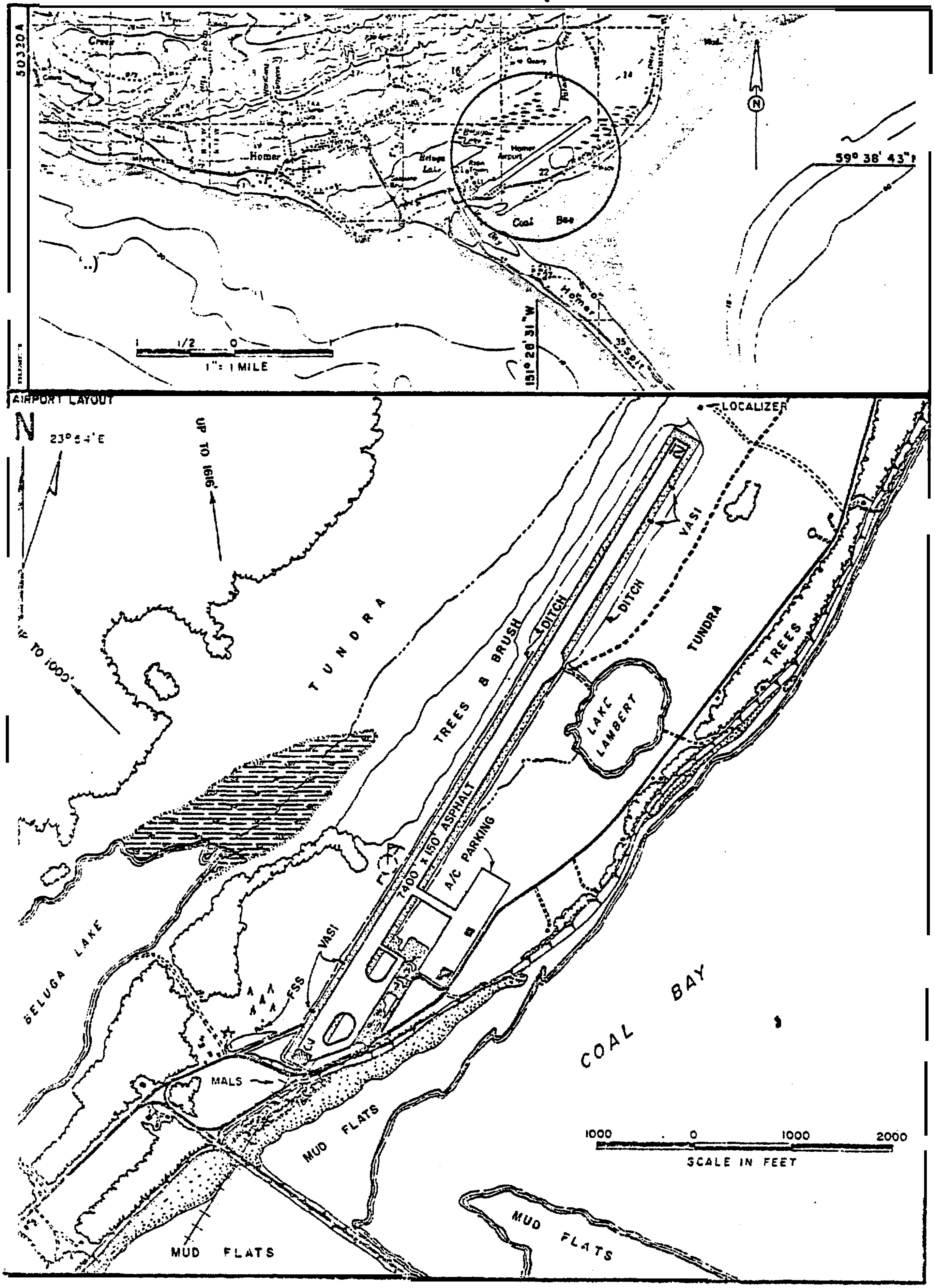


FIGURE 2-7. HOMER AIRPORT LAYOUT Source: Federal Aviation Administration

2.3.1.1 Homer

Homer Airport is located on the bluff just north of the Homer Spit. Its runway, which measures 2,256 m (7,400 ft.) long by 45.7 m (150 ft.) wide, is parallel to the shoreline and being on a slight peninsula, allows over-water approaches from both directions (see Figure 2-7). An adjacent float plane facility at Beluga Lake has a 914 m (3,000 ft.) runway. The airport is owned and operated by the State of Alaska. The Federal Aviation Administration owns adjacent land that would have to be acquired for expansion to take place.

Two scheduled carriers serve Homer. The community is an intermediate stop for Wien's 737 jet flights between Kodiak and Anchorage. During the 12 months ending June 30, 1977, Wien completed only 76.9% of its scheduled flights to Homer. It is also the southernmost destination of AAI's commuter route from Anchorage that serves Soldotna and Kenai. The airport is also served by both fixed-wing and rotary-wing air taxi operators. Several additional rotary-wing operators provide services on contract to offshore oil operators.

The breakdown of 37,198 operations in 1977 for the Homer facility is shown in Table 2-13a.

Table 2-13a

Homer Airport Operations (1977)

Air Carriers	12%
General Aviation	70%
Air Taxi	11%
Military	1%
Training (Touch and Go)	6%
	100%

Source: DOTPF, 1979.

*

The runway length is adequate to serve medium-body jet traffic. The possibility exists that 747 freighters might wish to use Homer to load frozen fish for delivery to Europe. Topography and land uses would present no problems in achieving the required lengthening to 3,048m (10,000 ft.).

The State of Alaska Department of Transportation has forecast a steady 7% annual growth in operations at the facility for the coming 20 years. A draft airport development plan has been prepared to address existing and future problems.

Presently, the terminal facilities and adjacent parking are inadequate, but due to their non-conforming location cannot be expanded at the present location. The terminal is closer to the runway than FAA regulations permit, and height restrictions are also violated. The existing terminal, which is owned by Wien Air Alaska, has seating capacity for only ten persons. These circumstances make it difficult to provide adequate security. Parking is limited to 28 vehicles. The recommended plan is to move the terminal and air carrier operations to the north side of the runway. Facilities on that side would include a perpendicular taxiway to an apron, a heliport for large helicopters, and parking for 50 vehicles.

The south side of the runway would be reserved for general aviation and air taxi facilities. A parallel taxiway is proposed for use of these aircraft. A heliport for small rotary-wing aircraft would also be provialed in this area. For the next ten years, general aviation and air taxi activities would be confined to the area west of Lamport Lake. Transfer of air taxi operations to the southeast end of the runway (east of Lamport Lake) would be accomplished during the following ten years to "accommodate growth of general aviation activities.

The FAA proposes to move its flight service station from the west end of the runway to a location more accessible to the general aviation area.

Homer has adequate navigational and landing aids to meet existing needs. FAA planning documents indicate that the criteria for an air traffic central tower may be needed near the end of the decade.

2.3.1.2 Kenai

Landing facilities at the Kenai Airport consist of asphalt runway 1/19, which is 2,286 m (7,500 ft.) long by 45.7 m (150 ft.) wide and a parallel float plane basin (1L/19R) 762m (2,500 ft.) long. The airport has adequate approach and landing aids to handle foreseeable operations, including a control tower and a glide slope on runway 19. The practical annual capacity of 210,8000perations for the facility compares to a 1976 total of 78,344 operations (TRA/Farr and TAP, Inc., 1978) (Figure 2-8).

Table 2-13b provides a breakdown of annual operations at the Kenai Airport for 1976. General aviation activities account for 78% of the airport's operations. In this category, three categories--recreation, charter, and training--each account for at least 20% of activities. The high

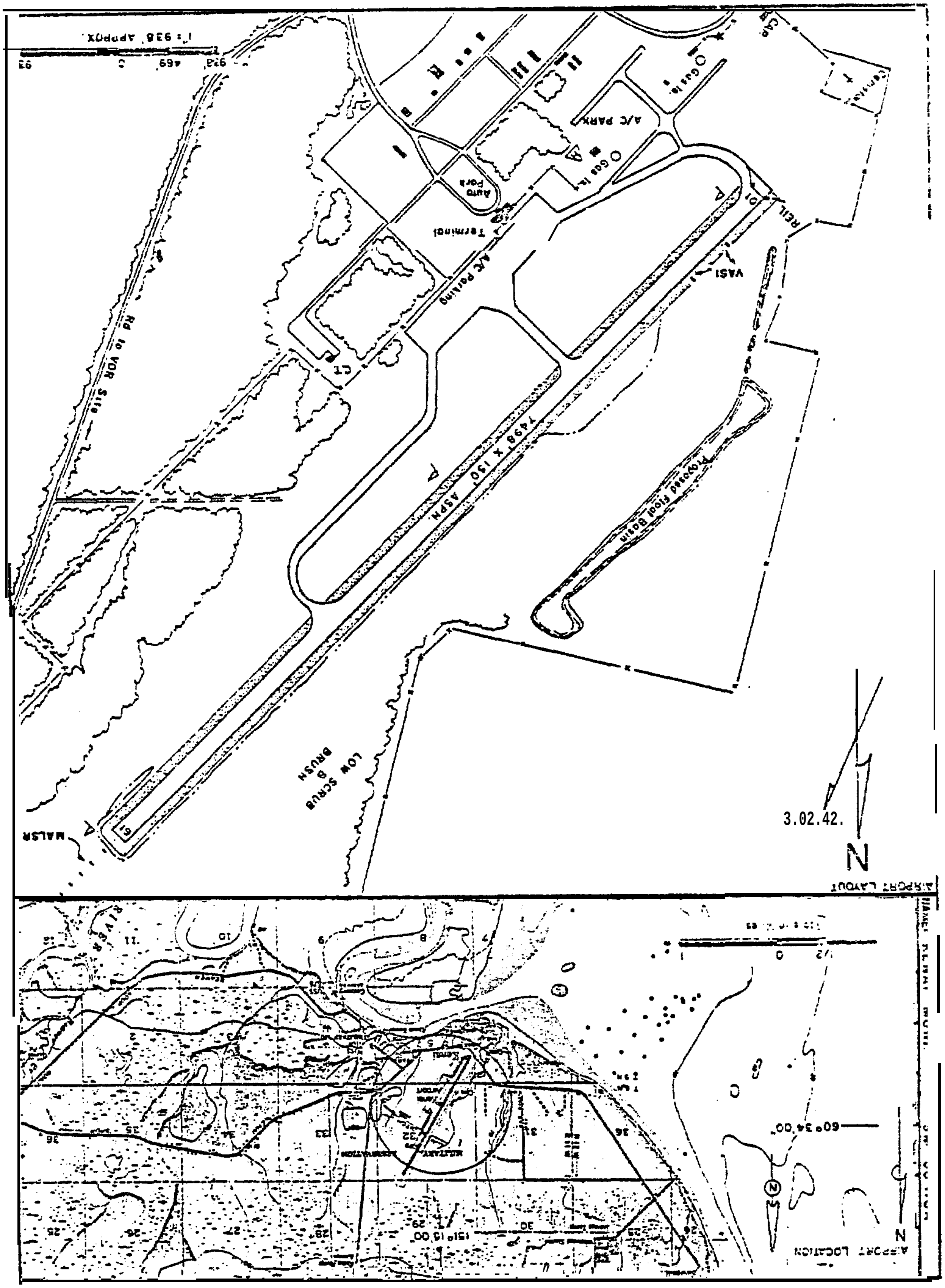


FIGURE 2-8. KENAI AIRPORT LAYOUT

Source: Federal Aviation Administration

Table 2-13b

Kenai Airport Annual Operations (1976)

General Aviation:	
Business	4,713 (6%)
Recreation	15,348 (20%)
Charter	20,592 (26%)
Government (excluding military)	1,460 (2%)
Local (training)	19,278 (25%)
Total	61,391 (78%)
Scheduled Airlines	13,870 (18%)
Military	3,083 (4%)
Total	78,344 (100%)

Source: TRA/Farr and TAP, Inc., 1978.

number of scheduled airline operations despite only one carrier is due to the high frequency of service by AAI. The high percentage of general aviation operations suggests that the percentage increase in total annual operations will closely follow that of the area's population. The use of Kenai as a base for recreational travel creates a seasonal variation in airport activity. During 1976, 57% of the operations occurred from May to September.

The Kenai facility currently receives two scheduled carriers with permanent operating authority, AAI and Wien. AAI is a commuter airline and offered 30 flights per day to Kenai in the summer of 1979, three of which were exclusively for freight. Commuter airline flights have increased from nine in 1971, to 19 in 1976, and finally, to the present schedule. Trunk carriers did not serve Kenai between 1974 and 1979. Western Airlines had CAB operating authority during the 1960's but asked to have it suspended in 1970. Wien Airlines, which at the time operated both jet (737) and prop (FH-227) aircraft, picked up Kenai as an intermediate stop on its Anchorage-Kodiak service until 1974. Two increases in scheduled air carrier activity to Kenai occurred in 1979. Polar Airlines, which has filed an application for authority to operate an Anchorage-Kenai route with the Alaska Transportation Commission has been given emergency authority to operate the route due to road closures on the Seward Highway. Also, Wien received approval for a Kenai-Seattle route from the Civil Aeronautics Board and during the summer of 1979 operated it three times a week.

The available fish processing facilities in Kenai combined with large salmon catches in Western Alaska produced frequent landings of large cargo aircraft in the summer of 1979. FAA received a request from local officials to assist in designing tie-down space for five C-130 aircraft.

. Kenai will remain primarily a market for commuter airline services for the following reasons:

- The short 106 km (66 mi.) journey to Anchorage does not provide jet passengers with a significant time advantage.

- Frequent flights minimize connection difficulties with-transfers in Anchorage.

- Frequent service allows Anchorage and Kenai business travelers to conduct a full day of business in the other city without staying overnight.

- Kenai's economy is based on the oil and gas industry, which has Alaska offices in Anchorage.

Three capacity figures are relevant to planning for capital improvements. The practical annual capacity is 210,800 operations. practical hourly capacities for VFR (visual) operations are 86 and for IFR (instrument) operations are 40 (TRA/Farr and TAP, Inc., 1978). This study will focus on analysis of annual operations, since they are used most often in establishing criteria for new facilities and aids. Estimated annual operations in 1977 (89,000) were 54% of capacity. The Master Plan (TRA/Farr and TAP, Inc., 1978} proposes increases in the VFR practical hourly capacity by 1985 and practical annual capacity by 1995. The former would be accomplished by providing a full parallel taxi-way and the latter by construction of a paral 1 el general utility runway. The Master Pl an calls for three phases of improvements whose cost and timing are as follows: Phase 1 - $7.4 million (1978-80); Phase II - $2.6 million (1980-85); and Phase III - $7.7 million (1985-95). In Phase I, the emphasis is on protecting the existing runway with a 7.6 cm. (3-inch) pavement overlay and expanding the float plane basin. Extension of the existing taxiway is scheduled for Phase II, and Phase III contains additional improvements in taxiways, aprons, and the runway pavement.

Length of the existing runway is considered adequate for all aircraft likely to use Kenai. The terminal building currently contains FAA and City of Kenai offices as well as a cafeteria, cocktail lounge, and passenger loading area fora single gate. The size of the building is adequate but when the need for a second and possibly even a third gate develops, changes in floor space use must occur.

2.3.1.3 Soldotna

Soldotna Airport (Figure 2-9) is located on the southeast corner of the town and designated a general utility airport. It has a 1,524 m (5,000 ft.) by 46 m (150 ft.) asphalt paved runway with an estimated pavement strength of 32,000 kg (70,000 lbs.) gross weight. AAI began service to Soldotna in 1976 and now makes three daily round trips between Soldotna and Anchorage with an intermediate stop in Kenai except for Saturday and Sunday.

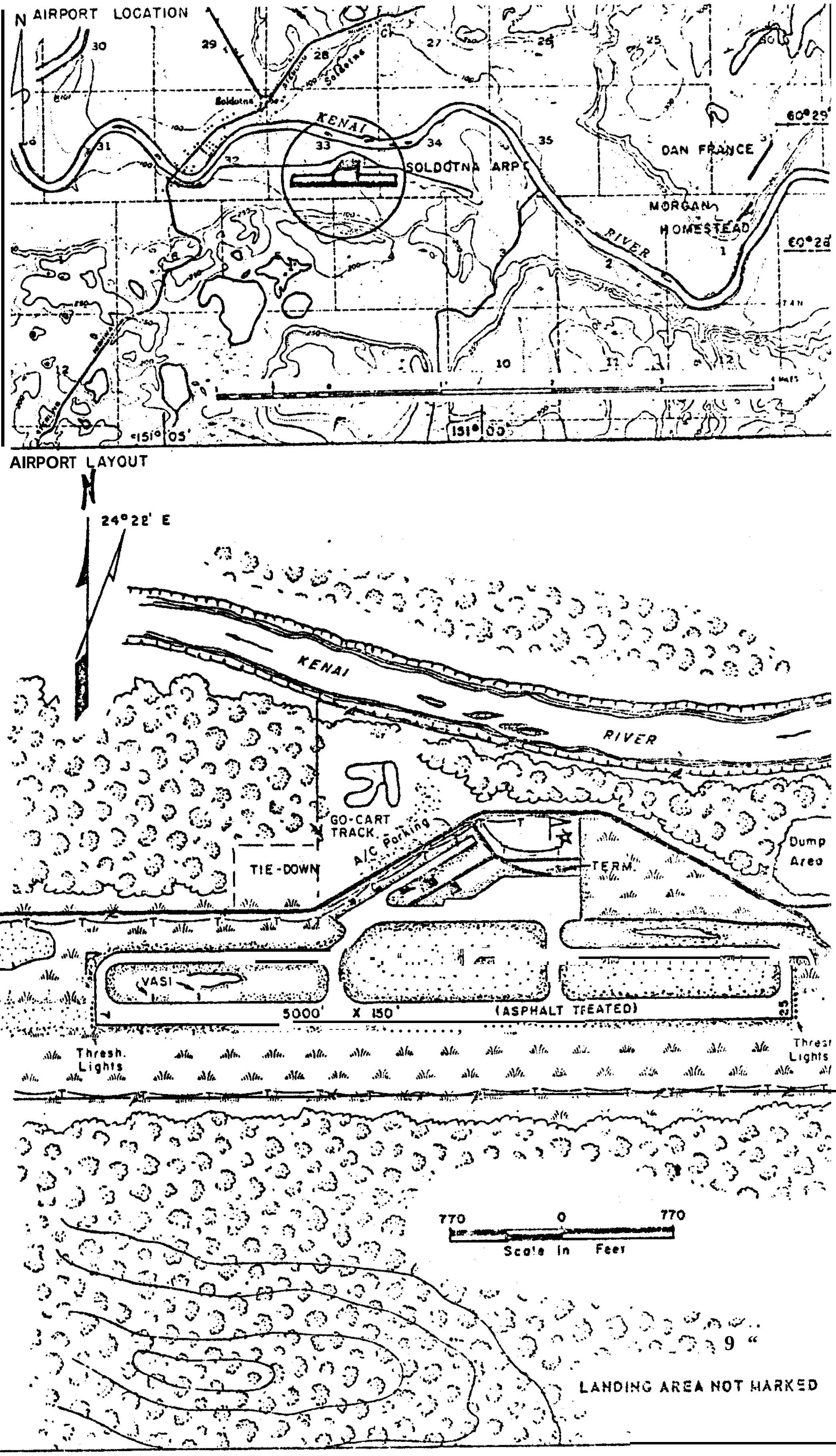


FIGURE 2- 9. SOLDOTNA AIRPORT LAYOUT Source: Federal Aviation Administration

The computed annual capacity of the airport is 150,000 operations compared to a 1978 figure of 66,000 operations. The computed hourly capacity is 110 operations compared to the 1978 figure of 47 (Forsi, 1979). The City of Soldotna records 125 aircraft being based at the airport in 1978 which is a 71% increase from the 73 planes recorded in 1973. During the winter, one runway is left unplowed which allows for the use of planes fitted with skis. During 1978, an estimated 103,546 kg. (228,277 lbs.) of cargo was handled at the airport and an additional 36,511 kg. (80,491 lbs.) of mail.

The estimated pavement strength is 31,751 kg (70,000 lbs.) gross weight, which compares to a gross weight of 70,307 kg (155,000 lbs.) for a Hercules C-130 cargo plane. AAI currently operates its passenger service out of a small trailer, and the need exists for a permanent terminal facility with adequate space for passengers and baggage handling.

The ten-year National Aviation System Plan (FAA, 1977) includes recommendations to:

- Expand and pave existing apron and runway.
- Construct and pave new apron.
- Add new approach aids such as VASI and REIL. "
- Improve existing buildings.

2.3.1.4 Anchorage International Airport

This facility handled 236,000 operations (landings and take-offs) in 1976 which is 77% of the capacity estimated in the 1971 Master Plan (Quinton-Budlong, 1971). The primary purpose of the new north/south runway, which is presently under construction, is to provide a runway capable of accommodating larger jets in cross-wind conditions and to alleviate aircraft noise impact east of the airport by placing the majority of aircraft operations over water. The completed runway will also raise the airport operational capacity to 334,000 operations, a 9% increase. The runway will be used primarily for air carrier arrivals and one of the east-west runways will be used for air carrier departures. The three existing asphalt runways include two that are greater than 3,048 m (10,000 ft.} in 1 ength.

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% of the enplanements, (Moore, 1978). The number of enplaning passengers doubled between 1972 and 1976. In recent years the enplanement growth rate has consistently exceeded the population growth rate of the Municipality of Anchorage.

The facility serves an important role in moving freight and passengers to, from, and within Alaska. In 1976, throughput tonnage of the airport amounted to 107.8 thousand metric tons (118.8 thousand 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).

The Lake Hood complex adjacent to Anchorage International Airport has four water runways and caters to general aviation and air taxi operators. These groups also heavily use Merrill Field, located adjacent to downtown Anchorage. Present usage of Lake Hood runways is 75,000 operations compared to a theoretical capacity of 88,000 operations.

A pressing need exists in the Anchorage area for increased capacity to handle general aviation activities, particularly training. The designation by the FAA of Birwood Airport in Chugiak as one of 86 satellite airports in the country eligible for special funds to upgrade their navigational aids and runways will likely generate the needed financial assistance (Anchorage Times, 1979).

2.3.2 CARRIERS

The Alaska Transportation Commission (ATC) regulates all common air carriers operating solely within the State of Alaska and with the Civil Aeronautics Board (CAB) jointly regulates those carriers that operate interstate routes as well as two intrastate carriers, Munz Northern Airlines and Kodiak-Western Alaska Airlines. 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.

Table 2-15 shows the level of service by each carrier for the three scheduled carriers serving Lower Cook Inlet communities, and Table 2-16 shows usage on these routes by link for August 1978. Data on these tables are summarized by city pairs on Table 2-17.

Table 2-15

Passenger Service Provided by Scheduled Carriers

Scheduled Carrier	Route	Minimum Required Service(1)	Sumner 1978 Service	Winter 78-79 Service
AAI	Anchorage - Kenai	3 fits/day (exe Sunday)	30 fits/day exc Sa. Su. (3 freight only)	24 fits/day exc Sa. Su. (3 freight only)
	Anchorage - Homer	(unspecified)	8 fits/day exc Sa. Su. (1 freight only)	7 fits/day exc Sa. Su. (1 freight only)
	Kenai - Homer	6 fits/week	4 fits/day exc Sa. Su. (1 freight only)	6 fits/day exc Sa. Su. (1 freight only)
	Anchorage - Soldotna	(unspecified)	1 fit/day exc Sa. Su.	3 fits/day exc Sa. Su.
	Kenai - Soldotna	(unspecified)	3 fits/day exc Sa. Su.	3 fits/day exc Sa. Su.
Polar	Anchorage - Kenai(3)	(Emergency Authority to Operate 120 days, June 29 - Sept. 26, 1979)	6 fits/day exc Su.	
Wi en	Anchorage - Homer	(unspecified)	1 flt/Th. Su.	1 flt/Th. Su.
	Anchorage - Kodiak	(unspecified)	2 flts/day + 1 flt/Th. Su	2 fits/day
	Anchorage-Seattle(*)	(unspecified)	1 fit/day non-stop (1979)	
	Kodiak-Seattle(2)	(unspecified)	1 flt/Mo. We. Fr. Su. (1979) -	
	Kenai-Seattle(2)	(unspecified)	1 flt/Tu. Th. Sa. (1979)	

Note: (1) As listed in the Alaska Transportation Commission's Scope of Operating Rights, May, 1978.
(2) Route added in 1979.
(3) Emergency authority extended unti 1 Seward Highway opented to through traffic between Anchorage and the Kenai Peninsula 24 hours a day.

Source: Alaska Transportation Commission, 1979 and carriers.

Table 2-16

Summary of Passenger Data by Travel Link and Carrier

Link(Carrier)	Flight Termini	Origin - Destination	Flights	Passengers[2]	Load Factor
Kenai-Anchorage (AAI)	Kenai-Anchorage	Kenai-Anchorge	610	6,049	0.52
		Soldotna-Anchorage	78	197	0.13
		Total	610	6,246	0.54
	Homer-Anchorage	Kenai-Anchorage	112	1,122	0.53
		Homer-Anchorage	112	705[3]	0.33
		Total	112	1,827	0.86
	Total		722	8,073	0.59
Homer-Anchorage (AAI)	Homer-Anchorage	Homer-Anchorage	111	1,410[3]	0.67
Kodiak-Homer (Wien)	Kodiak-Anchorage	Kodiak-Homer	9	198	0.57
		Kodiak-Anchorage	9	75	0.22
		Total	9	273	0.79
Homer-Anchorage (Wien)	Kodiak-Anchorage	Homer-Anchorage	9	125	0.36[1]
		Kodiak-Anchorage	9	75	0.22[1]
		Total	9	200	0.58
Homer-Kenai (AAI)	Homer-Anchorage	Homer-Kenai	112	105	0.05
		Homer-Anchorage	112	705[3]	0.33
		Total	112	810	0.38

Notes: (1) Based on a composite seating capacity of 38.6 seats/flight, as derived from Civil Aeronautics Board data.

(2) An equal number of passengers are assumed in each direction on a link.

(3) It is assumed that two-thirds of Homer-Anchorage commuter airline passengers travel on non-stop flights.

(4) For Kenai-Anchorage trips, passengers are assumed to be able to equally choose flights originating in Homer and Kenai.

Source: Peter Eakland and Associates, 1979.

Table 2-17

Lower Cook Inlet Scheduled Airlines Origin-Destination Data

Existing Conditions - August, 1978[1]

Origin-Destination	Passengers	Seats	Overall Load Factor	Number of Flights/Week
Homer-Anchorage	2,240	3,143	0.71	53 commuter flights/week (26 non-stop) 2 F27 flights/week
Homer-Kenai	105	186	0.56	27 commuter flights/week
Kenai-Anchorage	6,895[2]	12,953	0.53	182 commuter flights/week
Kenai-Seattle	710[3]	1,420	0.50[3]	3 Jet flights/week
* Anchorage-Seattle	54,850[2]	16,083	0.77	125 Jet flights/week

Notes: (1) Kenai-Seattle service was introduced in 1979. Polar Airlines flights during summer of 1979 between Kenai and Anchorage not considered.
(2) It is assumed that two-thirds of new Kenai-Seattle service is derived from existing Kenai-Anchorage service. Soldotna-Anchorage passengers are included in the Kenai-Anchorage figures.
(3) A load factor of 0.50 assumed.

Source: Peter Eakland and Associates, 1979.

2.3.2.1 Air Taxi Operators

Air taxi carriers operate from fixed bases of operation specified in their operating rights. Although most operate aircraft with certified gross take-off weights less than 5,670 kg (12,500 lbs.), the ATC has authority to grant air taxi certificates to operators having larger aircraft. The only carriers with such authority within the study area have Anchorage bases. The other major division is between fixed-wing and rotary-wing (helicopter) operations. Table 2-14 lists by community the air taxi operators having bases of operation within the study area. In some cases, the same operator has rights in an area for both fixed-wing and rotary-wing operations. Operators must provide "safe, adequate, efficient, and continuous service from and maintain bases of operation at listed locations (in their 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 19 persons.

Air taxi operators specialize in serving remote locations inaccessible by highway. Passenger flights serve established villages, canneries, and logging camps as well as recreation and mineral exploration sites.

Air taxi serv ces compete successfully with commuter airlines on trips between Anchorage and the Kenai Peninsula. Fares are competitive if several passengers fly together. It is estimated that of the 500-600 persons flying daily into Kenai during the summer of 1979, air taxis are

Table 2-14

Study Area Air Taxi Operators

Number of Operators

Base of Operations	Fixed Wing: Less than 5,670 kg (12,500 lbs.)	Fixed Wing: Greater than 5,670 kg (12,500 lbs.)	Rotary Wing: Less than 5,670 kg (12,500 lbs.)	Rotary Wing: Greater than 5,670 kg (12,500 lbs.)	Selected List of Operators
Anchorage	40	4	1	6	
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	Dick's Flying Service Soldotna Air Service Twin City Airways
Kenai/Nikiski	5	0			ERA Helicopters Kenai Air Service Kenai Aviation Gene's Bush Flights Andy's Flying Service Arctic Aviation
Homer	3	0	1	0	Cook Inlet Aviation Homer Air Kachemak Air Service Totem Helicopters
Seldovia	1	0	0	0	Cook Inlet Aviation

Source: Alaska Transportation Commission, 1978.

able to attract a significant share of the market, although less than half. Andy's Flying Service has requested authority from the Alaska Transportation Commission to fly a scheduled Kenai-Anchorage route. Air taxi utilization will fluctuate more than scheduled service and, in fact, helps absorb passenger traffic during periods of peak demand.

2.3.2.2 Contract Carriers

Contract carriers generally are not restricted by location in their operating authorities. Principal contract carriers within the Stateof 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 w th a maximum capacity of 22,680 kg 50,000 1 bs.). 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, Ketohikan, 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 2-10 shows routes for carriers that operate jet and prop service.

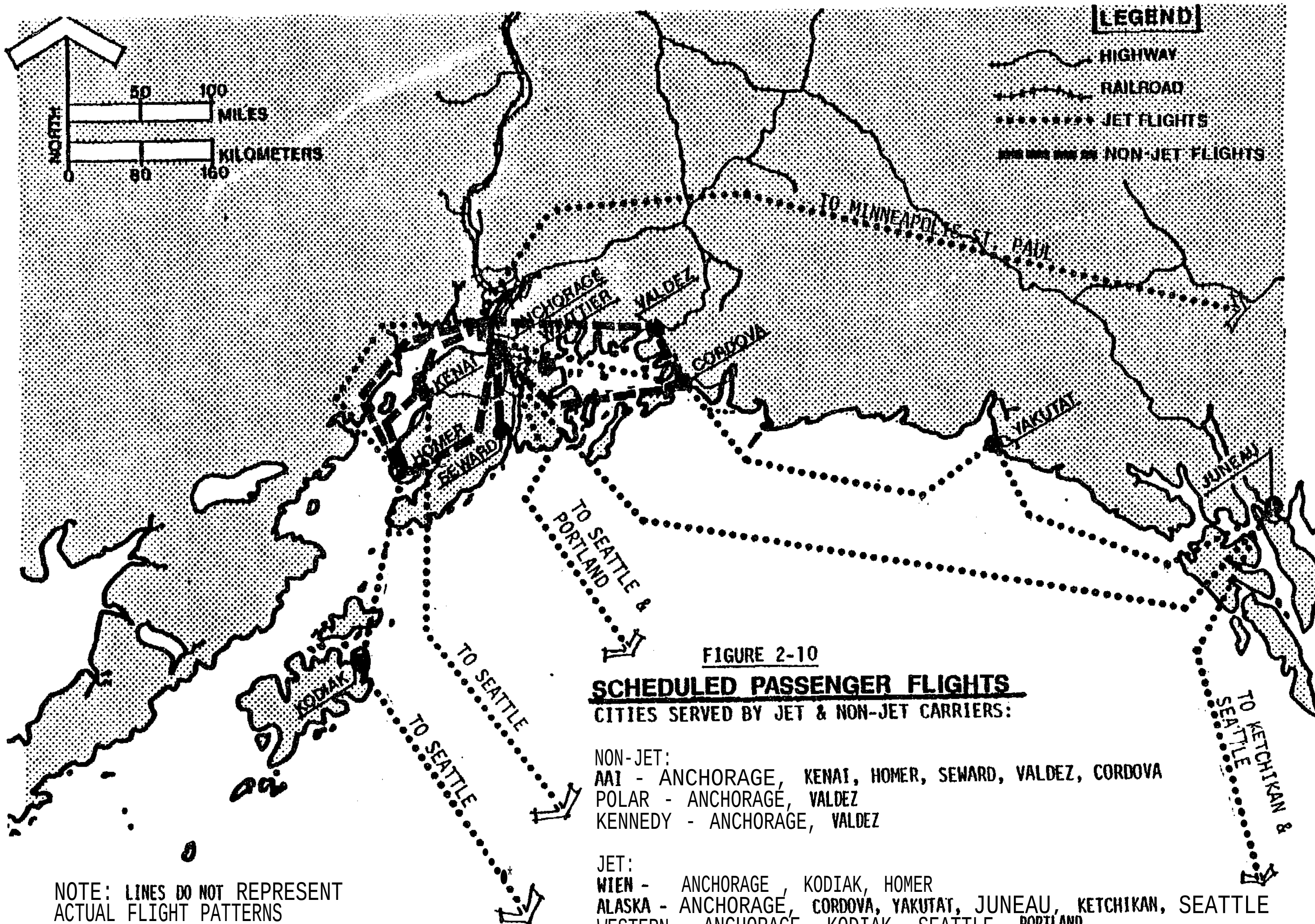


FIGURE 2-10

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
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

2.3.2.3.1 Trunk Airlines

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 few years. 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 in 1979 which was not protected by an existing carrier and chose Kodiak-Seattle. 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 service investigations that were in progress before deregulation have been issued by the CAB in 1979. One or more carriers servicing Alaska were granted increases in authority to serve Southeast Alaska, West Coast, Northwest, and Denver markets.

- Alaska Airlines. Alaska Airlines concentrates on routes linking Anchorage and Seattle but also has non-stop flights to Fairbanks from Seattle and Anchorage and to Portland and San Francisco from Seattle. Current non-stop frequency between Seattle and Anchorage in the winter is five flights per day except Sunday and six flights during the summer. Three round trips per day serve Southeastern Alaska's major communities during the winter and four during the summer.

The monthly fluctuation of revenue for Alaska's Southeast service as shown on Figure 2-11 is similar for other interstate air carrier services serving Alaska and greater than for domestic truck carriers on the average.

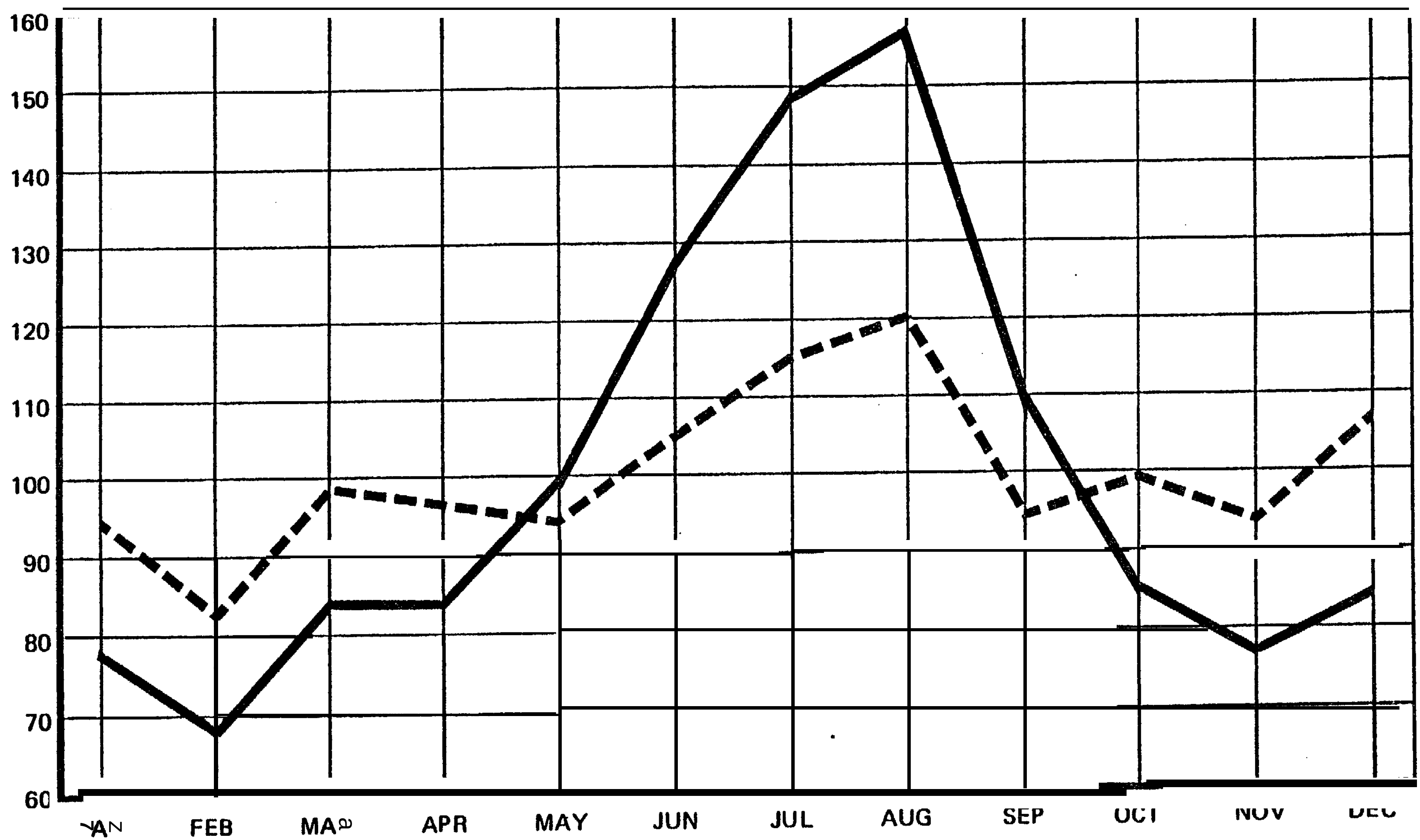
Alaska became an all-jet airlines in 1976 and has a fleet of 727-100 and 727-200 aircraft. It currently has two 727-200, each with a seating capacity of 136 passengers, and has plans to purchase at least one more.

The carrier initiated service to San Francisco in 1979 and also received authority to initiate service between Alaska and two areas--Denver and northern U.S. cities now served by Northwest.

- 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 1979, service south of Anchorage--its other area--was limited to the communities of Homer and Kodiak. The CAB awarded Wien major new operating authorities on interstate routes in 1979, and Wien initiated service on many of them. The CAB allowed carriers in 1979 to initiate service on one route left unprotected by other carriers. Wien chose Kodiak-Seattle and began service in April 1979. Wien also initiated, soon thereafter, non-stop service from Anchorage to Seattle as a result of the CAB's West Coast Service Investigation and from Anchorage to

FIGURE 2-11

INDEX OF MONTHLY REVENUE PASSENGER MILES [1]



Alaska Airlines - Southeast

Domestic Trunks

1) Data for calendar year 1977

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

Seattle via Juneau and Ketchikan as a result of the Southeast Service Investigation. Finally, a Kenai-Seattle route providing flights three times a week began in the summer of 1979. Wien also received authority to serve Chicago and several East Coast cities but has not announced plans to initiate service.

The carrier operates 737 jet aircraft in both all-passenger and mixed passenger-cargo modes depending upon traffic demand. Wien provides only twice weekly service to Homer and during August 1978 carried only 125 passengers from Homer to Anchorage compared to 2,115 for AAI. Now that it no longer operates prop planes on the Kodiak-Homer-Anchorage route, Wien concentrates its service on long routes where jets can operate most efficiently.

- Northwest Orient Airlines. Service levels to Anchorage by Northwest Orient Airlines are shown on Table 2-15. 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 non-stop 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. Western previously operated in Southeast Alaska but its authority was suspended in 1971. The carrier did not exercise its Southeast operating rights in 1979.

On the 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.

In 1976, Western trailed only Northwest Orient in the movement of air freight to Anchorage International Airport, handling 26.9% of the tonnage (Moore, 1978).

2.3.2.3.2 Scheduled Freight Airlines

The CAB's first action in deregulating the air carrier industry was to completely deregulate air freight movements nationwide. Both Wien and Flying Tiger Airlines initiated all-freight service between Seattle and Anchorage as a result of this action. The entry of Flying Tigers has greatly increased air freight capacity into Anchorage, and the carrier has become a major competitor of Western and Northwest for inbound and outbound Alaskan freight. The carrier operates both 747 and stretched DC-8 aircraft. Anchorage is a stop on flights between the United States and Tokyo, and a separate service also exists between Seattle and

Anchorage. Inbound shipments of approximately 1,814 kg (4,000 lbs.) a day consists of a variety of commodities, including groceries and clothing for department stores (Anchorage Times, 1979).

2.3.2.4. Commuter Airlines

Two commuter airlines operating out of Anchorage currently serve Kenai Peninsula destinations--Alaska Aeronautical Industries and Polar Airlines. The communities that are served--Seward, Homer, Kenai, and Soldotna--are all within 193 air km (120 air miles) of Anchorage and are all reached by non-stop flights although some flights require a maximum of two intermediate stops. Only one of these communities, Homer, is currently served by trunk carriers, and that service never exceeds one flight per day in each direction. Commuter carriers operating aircraft with 5-19 passenger seats can offer greater frequency than trunk carriers at comparable rates for a given demand. Only through the use of commuter carriers are persons able to make a round trip to or from Anchorage and one of the communities listed above on the same day.

- Alaska Aeronautical Industries (AAI). Alaska Aeronautical Industries offers two routes connecting Anchorage to Kenai Peninsula communities. Both use 19-passenger DHC-6 (Twin Otter) aircraft. One route serves Seward. The other serves three communities on the west side of the Kenai Peninsula--Kenai, Soldotna, and Homer. AAI's frequency of service to Kenai in the summer of 1978 was 30 flights per week, which is almost four times that of the frequency to any other communities (Table 2-15). A limited number of daily non-stop flights are available to Homer and Soldotna. On AAI's flight to Homer, it competes with Wien Alaska but provides greater frequency. During August 1978, it offered 111 flights to Anchorage from Homer compared to nine for Wien.

AAI's operations focus on the Kenai market. Flights per day from the Kenai area to Anchorage reach a high of 30 during the summer and fall to 24 during the winter. During August 1978, 722 flights were recorded on the northbound link compared to 111 northbound from Homer. AAI operates three flights per day from Kenai to Anchorage that handle only freight. Kenai Peninsula residents depend on air freight for small shipments.

As of July 1979, AAI's tariffs called for a minimum cost of $8.50 and per pound costs of $0.15 to Kenai/Soldotna and $0.18 to Homer.

- Polar Airlines. Polar Airlines, whose primary service is between Anchorage and Valdez, has requested authority for an Anchorage to Kenai route. Due to travel restrictions on the Seward Highway caused by construction activities, the Alaska Transportation Commission originally granted the carrier an emergency 120-day authority which was scheduled to end on September 26, 1979. The authority has been extended until the Seward Highway is open 24 hours a day. Six flights in each direction are offered Monday through Saturday with 9-passenger

Piper Navaho Chieftains. Polar currently operates from Anchorage International Airport but for most of 1979 operated outof Merrill Field.

2.3.2.5 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, which both served Yakutat during OCS exploration activities in 1976 and 1977. They are among six air taxi operators who have authority to operate rotary-wing aircraft with gross weights above 5,670 kg (12,500 lbs.). The others are Alaska Helicopters, Air Logistics, Trans-Alaska Helicopters, and Arctic Air Service. Air Logistics and ERA currently are providing contract services for Lower Cook Inlet exploration activities out of Homer. ERA has authority to perform air taxi operations from Nikiski. Twin-engine helicopters such as the Sikorsky 61, which has a seating capacity of 22, are favored for offshore operations because of the safety factor.

2.3.3 REGULATIONS

The Federal Aviation Administration within the U. S. Department of Transportation through its flight standards program "promotes safety of flight of civil aircraft in air commerce by assuring the airworthiness of aircraft, the competence of airmen, the accuracy of navigational 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, including Homer. Of those terminal facilities analyzed in this report, Kenai and Soldotna are locally owned. Private facilities related to offshore oil and gas operations include a gravel runway at Drift River, and heliports at Drift River and Nikiski (Rig Tenders' and Shell).

Fares and routes fall under the jurisdiction of the Civil Aeronautics Board for certificated air carriers and of the Alaska Transportation Commission for intrastate carriers. The CAB's policy of deregulation is designed to increase service yet at the same time maintain acceptable profits for the carriers.

Guidelines are being established which will 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 consists of twelve regional centers, of which Kodiak is the only one on routes serving Homer or Kenai.

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

2.3.4 TECHNOLOGY

Table 2-18 shows the service characteristics of scheduled carriers serving the study area. The data shows the impact that technology has on the level of service as distance increases. For the Anchorage-Homer link, Wien flying Boeing 737 jets charges 13.7 cents per kilometer compared to AAI's charge of 15.7 cents per kilometer. As distance increases, unit distance costs drop markedly for jet aircraft.

Northwest Orient's fare to Chicago from Anchorage represents a cost of 4.7 cents/km (7.5 cents/mi.) which is approximately a third of that for Wien Airlines' Anchorage-Kodiak 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 using all-jet fleets will continue for carriers that primarily serve links greater than 402 km (250 miles).

Table 2-18

Service Characteristics for Scheduled Service in Lower Cook Inlet

Link	Carrier	Kilometers	(Miles)	One-way Coach Fare	Cost ¢/km	(¢/mi.)	Elapsed Time (Hrs.-Min.)	Avg. Speed km/hr.	(mph)
Anchorage - Kenai	AAI	97	(60)	$19.50	20.1	(32.5)	0:30	194	(120)
Anchorage - Homer	AAI	190	(1 8)	$29.75	15.7	(25.2)	⊙5⊙	228	(142)
Kenai - Homer	AAI	106	(≤≤)	$19.50	18.4	(29.5)	0:30	212	(˙32)
Anchorage - Soldotna	AAI	97	(60)	$19.50	20.1	(32.5)	0:30	194	(120)
Kenai - Soldotna	AAI	13	(8)	$ 8.00	6˙.5	(100.0)	0:10	78	(48)
Anchorage - Kenai	Polar	97	(60)	$19.00	19.6	(31.7)	0:30	194	(120)
Anchorage - Homer	Wien	190	(1 8)	$25.95	13.7	(22.0)	0:40	285	(177)
Anchorage - Kodiak	Wien	399	(248)	$47.70	11.9	(19.2)	0:50	480	(298)
Kenai-Seattle	Wien	2,363	1,468	$129.14	5.5	(8.8)	3:10	746	464

Source: Peter Eakland and Associates. 1979. Fares and mileage obtained from carr˙ers.

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

Technological 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 Mode

2.4.1 HIGHWAYS

2.4.1.1 Facilities

2.4.1 .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 .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 2-12). The two highways have both been designated Federal-aid Primary routes. The Sterling Highway is F-21 and the Seward Highway F-31. Road mileage from Anchorage to Kenai and Homer is 241 km (150 mi.) and 364 km (226 mi.), respectively. 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 land 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 2-19 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.

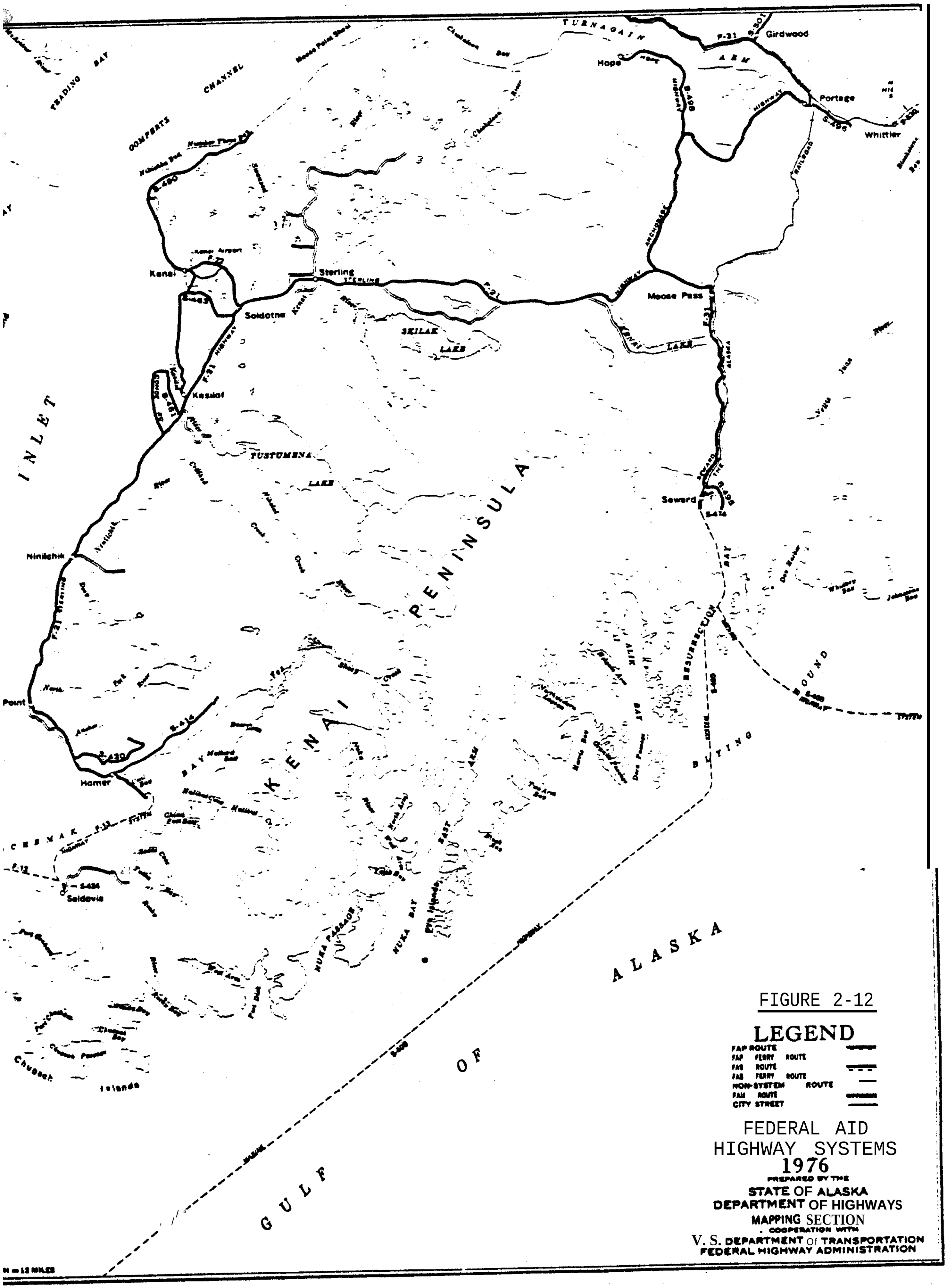


FIGURE 2-12

FEDERAL AID HIGHWAY SYSTEMS 1976

PREPARED BY THE STATE OF ALASKA DEPARTMENT OF HIGHWAYS MAPPING SECTION
COOPERATION WITH V. S. DEPARTMENT Of TRANSPORTATION FEDERAL HIGHWAY ADMINISTRATION

Table 2-19

Traffic Conditions for Kenai Peninsula Primary Routes

Highway	Route Segment	Distance km (mi.)	Capacity (Vehicles/Hour) (2)	1977 Traffic (1)			
				AADT (3)	30th Highest Hour	Peak-Hr. Factor (4)	Volume/ Capacity (5)
Seward Highway (FAB-31)	Seward (Bear Lake Rd.) - Sterling Hwy. Jct.	47.6 (29.6)	398	808	149	0.18	0.37
	Sterling Hwy. 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. Jet.	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; Peter Eakland and Associates.

Table 2-20 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 has accounted for some of the traffic growth. In addition, the census districts of Kenai and Seward have shown steady growth, although less than that of Anchorage during the 1970-1976 period. No clear relationship between changes in AADT and population is evident. Other factors such as tourism from outside of Southcentral Alaska, summer weather conditions, and availability of berths in small boat harbors are likely contributors to the annual average daily traffic figures. Generally, from 1972-1974, annual traffic growth exceeded population growth while figures for 1975 and 1976 show a reverse situation. The leveling off of demand at the Silvertip traffic recording station suggests more traffic is being generated within the Kenai Peninsula.

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

Road condition information was obtained from surveys performed in 1972, 1975, and 1976 by the Department of Highways. For each year, ratings for individual route segments were weighted to produce an overall rating and the percentage of deficient miles was computed. This information is shown on Table 2-21.

Table 2-20

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)	&	Anchorage	% Change	Kenai	X Change	Seward	% Change
1970	169	-	550	-	924	-	126,333		14,250	-	2,336	-
1971	614	-0. 7%	548	-0.4%	977	5.7%	?35,171	7.5%	14,289	0.3;	?,593	11.0%
1 912	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%	I ,222	12.3%	149,440	3.6%	13,808	-0.8%	2,446	. 2.52
1914	,095	27.2%	613	11.1%	1,422	16.4%	153,112	2.5%	13,962	1.1%	2,683	9. 7%
1975	,179	7.7%	693	13.1%	1 ,594	12.1%	177,814	16.1%	15,621	11.9%	3,149	11.4S
1976	,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%		5.8s		9.0%		6.6s		.. 2.7%		6.4x

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

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

Table 2-21

Results of Condition Surveys for Kenai Peninsula Primary Routes

Highway	Route Segment	1972[1] Deficiency/ Par Rating (2)	1972 Weighted Factor (3)	1972 % Defi- ient Miles	1975[1] Par Ratiny	1975 Weighted Factor (3)	1975 % Defi- ient Miles	1976[1] Deficiency/ Par Rating (2)	1976 Weighted Factor (3)	1976 % Defi- ient Miles
eward Highway (FAP-31)	Seward (Bear Lake Rd.)-Sterling Hwy. Jet.	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	72%	17/25	16.3	723
iterling 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	1008	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; Peter Eakland and Associates.

The Sterling Highway from Homer to Ninilchik does not present problems either because of capacity or condition. The 30th highest hour is only 35% of the practical capacity and no deficient miles occurred for either 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. No deficient mile existed in 1975 or 1976, but in 1972 58% of the mileage was found deficient.

The route segment from Soldotna to the Sterling Highway Junction has limitations related to both capacity and condition. The volume-to-capacity ratio was 0.65 and deficient miles in 1976 stood at 70%.

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 reduces 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 the lowest capacity of any of the route segments studied but also the lowest 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 has the greatest deficiencies. Its volume in percentage terms is the closest to capacity and its weighted condition rating in 1976 was second lowest.

Traffic growth has leveled off on all of the routes except the one between Soldotna and the Seward Highway Junction, which had a 17% increase from 1976 to 1977. This figure is partially the result of the fixed recorder's proximity to Soldotna (9.7 km/6.0 miles). The segment on the Seward Highway north of the Junction experienced a decrease in traffic from 1976 to 1977.

2.4.1.2 Carriers

2.4.1 .2.1 Common Motor Carriers

Table 2-22 relates principal cities within the study area to the operating zones used by the Alaska Transportation Commission.

Table 2-22

Operating Zone	Name	Representative Cities
3	Kenai Peninsula	Kenai, Soldotna, Homer
5B	Anchorage Subzone	Anchorage
8	Kodiak-Afognak	Kodiak

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

Common motor carriers authorized to carry general freight between Anchorage and the Kenai Peninsula include the following: 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 get out of the trucking business.

Excess capacity in the trucking industry has existed in the aftermath of the Trans-Alaska Pipeline boom period. An estimated 1,000 trucks, however, left the state 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.

2.4.1.2.2 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. Transportation Services has authority to operate routes serving Anchorage and the cities of Valdez, Seward, and Homer. Service to Homer currently is not being operated. Westours Motor Coaches offers sightseeing and tour services from Anchorage to Valdez and Seward, but the two services serve different clientele.

2.4.1.2.3 Tonnage by Origin and Destination

The State of Alaska operates a truck scalehouse 9.7 km (6.0 mi.) west of Soldotna. Data is collected on the origin, destination, weight, and commodity type of truck shipments but not on a continuous basis. Table 2-23 shows 1977 tonnages recorded by origin and destination. A breakdown by major commodity movements are listed on Table 2-24 by origin and destination. Although providing insights into the role of truck transportation in meeting Kenai Peninsula transportation needs, the data have several

Table 2-23

Tonnage by Origin and Destination for 1977 Sterling Scalehouse Data (1,2,4)

Tons (3) (Trucks)

Destination / Origin	Anchorage	Kenai	Homer	Seward	Moose Pass	Fairbanks	Mat-Su	Other	Origin Totals	% by Tonnage
Anchorage	83 (8)	6,898 (712)	851 (122)	24 (3)	1	-	-	-	7,856 (845)	49x
Kenai	1,733 (365)	1,065 (231)	68 (6)	.926 (90)	196 (18)	593 (85)	105 (11)	105 (9)	6,791 (815)	42%
Homer	373 (62)	10 (4)	0 (1)	130 (14)	-	24 (13)	0 (1))	0 ((1))	537 (96)	3%
Seward		373 (67)	70 (12)	-	-		-	-	443 (79)	3%
Moose Pass		171 (21)	-	0 (2)			-	-	171 (23)	1%
Fairbanks		96 (12)	5 (2)	-	-	-	-	-	101 (14)	1%
Mat-Su	o (1)	21 (7)	o (1)	-	-	-			2? (9)	
Other	,15 (1)	99 (11)	28 (2)	-	-	-	-	-	142 (14)	1%
Destination Totals	1,204 (437)	8,733 (1,065)	1,022 (140)	1,080 (107)	196 (18)	617 (98)	105 (12)	105 (10)	16,062 (1,895)	100%
% by Tonnage	26%	54%	6%	7%	1%	4%	1%	1%	100%	

Notes: (1) Sterling Scalehouse is located 9.7 km (6.0 mi.) east of Soldotna on the Sterling Highway.
(2) The Sterling Scalehouse was open at least sometime during the 1977 months of April-December. Given the assumption of random openings of the scalehouse during these months and a similar number of hours/month that each scalehouse is opened (except Tok), John Grey of ISER estimates a factor of 9.2 to produce annual totals for this scalehouse. The actual figure will vary between commodities and origin-destination city pairs. The data given has not been expanded.
(3) Tons can be converted to metric tons using a factor of 0.90718.
(4) Census districts are used as origins and destinations.

Source: State of Alaska Department of Transportation and Public Facilities 1977 scalehouse data, as compiled by ISER.

Table 2-24
Major Truck Traffic Tonnage by Commodity[1]

Sterling Scalehouse - 1977[2,3] Tons[4] (Trucks)

Destination-Origin[5]		Chemicals	Refined Petroleum Products	Ores and Minerals	Stone, Glass and Concrete	Primary and Fabricated Metals	Machinery and Transportation Equipment	Logs, Wood Chips, Fuel	Forest Products	Pulp and Paper	Fish, Food, Farm Products
Anchorage	- Kenai	682 (39)	820 (42)	50 (4)	74 (5)	127 (16)	280 (33)		164 (14)		1,014 (81)
	- Homer	70 (28)						28 (2)	89 (8)		174 (18)
Fairbanks	- Kenai						64 (5)				
Kenai	- Anchorage	266 (21)	881 (51)	171 (12)	990 (62)	521 (56)	521 (59)	133 (lo)	603 (60)	49 (lo)	1,385 (146)
	- Fairbanks						48 (5)				
		93 (5)	277 (38)	55 (68)		116 (25)	244 (32)		152 (10)		26 (6)
	- Seward					125 (9)	33 (4)				108 (23)
	- Moose Pass					87 (11)			34 (2)		
	- Midwest					29 (2)					
Seward	- Kenai	44 (2)	520 (26)	103 (6)					33 (3)		82 (31)
	- Homer										113 (11)
Homer	- Anchorage	32 (2)	66 (4)		55 (5)		136 (17)		52 (11)		260 (30)
	- Seward								26 (2)		
	- Kenai		35 (1)						26 2)		
	- Yukon Terr.								28 [2)		
Moose Pass	- Kenai		117 (9)			49 (3)					
Mat-Su	- Kenai		89 (6)								

Notes: (1) Al 1 categories 1 is ted for which a minimum of 25 tons was recorded.
(2) Sterling Scalehouse is located 9.7 km (6.0 mi.) east of Soldotna on the Sterling Highway.
(3) The Sterling Scalehouse was open at least sometime during the 1977 months of April-December. Given the assumption of random openings of the scalehouse during these months and a similar number of hours/month that each scalehouse is opened (except Tok), John Grey of ISER estimates a factor of 9.2 to produce annual totals for this scalehouse. The actual figure will vary between commodities and origin-destination city pairs. The data given has not been expanded.
(4) Tons can be converted to metric tons using a factor of 0.90718.
(5) Census districts are used as origins and destinations.

Source: State of Alaska Department of Transportation and Public Facilities 1977 scalehouse data, as compiled by ISER.

important limitations which must be kept in mind. The figures understate the amount of truck traffic since they are not based on a 100% sample. It has been estimated that a factor of 9.2 should be applied to the figures to produce total tonnages (Gray, 1979). Thus, total tonnage passing the Sterling scalehouse for the year 1977 is estimated at 134,054 metric tons (147,770 tons). Also, truck shipments on the Kenai Peninsula which do not pass the Sterling scalehouse will go unreported. This is particularly true for truck traffic between Kenai and Homer. Finally, a single origin and destination is reported for each shipment, which creates reporting problems for shipments having multiple origins and/or destinations.

Of the 16,062 tons recorded at the scalehouse, 90% or 13,117 metric tons (14,459 tons), had either an origin or destination at Kenai. Excluding trucking within the Kenai census district, 57% of the figure are inbound shipments and 43% outbound. The outbound tonnages do not involve trans-shipment but are for the most part seafood products and petroleum products originating in Kenai. In trade with Anchorage, 65% is inbound compared with 35% outbound. The major export from Kenai is seafood products; and major imports are food, chemicals, and petroleum products. A close balance exists in traffic between Kenai and Moose Pass, which is the closest point to Kenai where freight can be transferred between trucks and the Alaska Railroad. Approximately 167 metric tons (185 tons) were recorded in each direction in 1977. The rail link could be between Moose Pass and Seward, Whittier, or Anchorage. Whittier has the advantage of a rail car transfer facility. Seward is Kenai's second-leading trade partner based on the recorded data. In 1977, "81% of the tonnage recorded between the two cities, 840 metric tons (926 tons), was to Seward. Slightly more than half of this figure consisted of petroleum products. The data does not adequately reflect the amount of trade between Kenai and Homer due to the location of the scalehouse.

Trading patterns for Homer are similar to those of Kenai but on a smaller scale. Anchorage to Homer trucking traffic in 1977 was recorded at 772 metric tons (851 tons) and represented 70% of the two-way traffic. Shipments to Seward exceeded those from Seward. A major percentage of the outbound freight to Seward was seafood products.

2.4.1.2.4 Tonnage by Commodity

Table 2-24 shows annual commodity shipments greater than 23 metric tons (25 tons) between a given origin and destination. Ten commodity categories produced a figure of at least 100 tons and were led by fish, food, and farm products with two totals of at least 907 metric tons (1,000 tons) and refined petroleum products with two totals of at least 726 metric tons (800 tons). All refined petroleum products originated at either Anchorage or Kenai.

2.4.2 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 capacity of 36,000 barrels/day and is currently operating at about 22,000 barrels/day. Standard Oil, which also has a refinery at Nikiski, recently signed a contract with Tesoro and is now shipping its Anchorage-bound petroleum products by pipeline, also.

2.4.3 ALASKA RAILROAD

The Alaska Railroad does not play a major role in serving the communities of Homer and Kenai, although occasionally railcar shipments entering Alaska at Whittier and having a Kenai Peninsula destination will be off-loaded onto trucks at Moose Pass. No advantages exist in transferring shipments at Moose Pass that have entered at Seward. Since no railcar transfer facilities exist at Seward, an additional freight transfer operation is involved. Instead, trucks will drive the extra distance from Moose Pass to Seward. The scalehouse figures for 1977 are consistent with such a strategy, showing Kenai shipments of 840 metric tons (926 tons) to Seward compared to only 178 metric tons (196 tons) to Moose Pass.

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. Existing marine facilities at Anchorage, Kenai, and Homer must be viewed from different perspectives, since presently they serve different purposes. The Port of Anchorage, which is a combination of private and municipal dock facilities, is the major port of entry for freight to southcentral Alaska and has available equipment for efficiently handling containerized and roll-on, roll-off cargo. Facilities at Drift River and Nikiski exclusively serve the specialized requirements of the oil and gas industry, including the export of refined and crude oil, gas products (liquified natural gas, urea, and anyhrous ammonia), and the support of offshore activities. None of these facilities handles cargo for general community needs. Several facilities on the Kenai River handle small barges of general cargo in addition to freight related to seafood processing, but water depth limits the development there of modern, deep-draft facilities. Homer's City Dock is able to handle medium-draft ships; but numerous users and the absence of efficient cargo-handling equipment limits its potential for dramatically expanding the level of existing traffic.

The only Lower Cook Inlet communities served by the Marine Highway System are Homer and Seldovia. Most general cargo destined for Kenai Peninsula communities arrives first in Anchorage by the marine mode and then is transshipped by truck, which-increases tariffs 25% or more those charged for the marine trip to Anchorage.

The air mode plays an important role within the study area for the movement of both passengers and freight. Runways generally are adequate to handle the existing number of aircraft operations and the weight of aircraft handled, but improvements in passenger terminals are needed at Homer and Anchorage. Non-stop flights to Seattle are offered from both Kenai and Seattle. Only two scheduled carriers have permanent authority to operate to either Homer or Kenai. Homer is an intermediate stop on some of Wien's jet (737) flights between Kodiak and Anchorage. Alaska Aeronautical Industries serves routes connecting Anchorage, Kenai, Soldotna, and Homer with commuter-type (19 passenger) aircraft. Land facilities on the Kenai Peninsula include highway connections to Anchorage from Seward, Homer and Kenai, and an Alaska Railroad route from Seward to Anchorage. Freight movements to Homer and Kenai by land predominately move by highway to and from Anchorage. A cargo transfer facility for rail shipments from Seward to Whittier exists at Moose Pass but is not used extensively. Weekend recreational traffic places the greatest demands on the Seward and Sterling highways. From Girdwood south to the Sterling Highway Junction, the traffic levels have reached 73% of the capacity figure for the design level of service.

No major changes in transportation facilities and services to Homer and Kenai have occurred recently. Increases in industrial activity, recreational traffic, and high freight rates are creating the demand for a regional deep-draft port facility and more competitive scheduled air services in both directions from Homer and Kenai.

3.0 BASE CASE

3.1 Introduction

Development and analysis of the transportation base case is an important facet of the impact assessment process. This case establishes the foundation to which transportation demands and impacts OCS Lease Sale No. 60 are added in Chapter 4. The base case represents the socioeconomic conditions that are most likely to occur in the absence of oil and gas activities resulting from Sale No. 60 in Lower Cook Inlet and Shelikof Strait. It is not a non-OCS case, since it includes the effects indirect and direct OCS activities forecast for the medium scenario of previous lease sales. Of particular interest in this report are those for the medium scenario of Sale No. CI. The purpose of this chapter is to develop a set of base case conditions for transportation systems within the impact study area during the period 1982 to 2001. This period begins with the first year after Lease Sale No. 60 and extends for twenty years. Three major tasks are required to achieve this purpose, as follows: (1) development of major transportation facilities to be constructed during the study; (2) development of transportation demands on facilities and services throughout the study period, and (3) assessment of cumulative and incremental impacts of the three OCS cases on local, regional, and statewide transportation systems.

Considered as part of the base case in addition to existing facilities are those that are presently committed for implementation. Existing facilities serving the oil and gas industry are expected to be adequate for Sale No. CI activities. A conservative approach to the implementation of new facilities essentially means that no new facilities are produced during the last 10 years of the study period. This approach is necessary because of the Socioeconomic Studies Program's mandate to only assess impacts and not to make specific facility recommendations for improving transportation systems or for mitigating impacts. Existing projects in the feasibility and discussion stages are discussed as issues, but in no instance as constructed projects.

OCS and population-related transportation demands are computed separately. The assignment to routes and facilities occurs as part of the demand forecasting. Consistent with the approach regarding facilities, routes and services are considered to be a logical extension of those currently existing. A determination is then made as to which facilities and services will handle only one or both categories of demands. For the most part, the marine mode will handle OCS and population-related freight separate, and those for the air mode will handle both. Exceptions do occur, however. Port, facilities in Homer, due to the low level of OCS-related traffic there will handle both, and helicopter facilities exist in the Drift River-Nikiski area that are used solely for OCS activities.

The impact assessment task considers only cumulative impacts of total transportation demands. Incremental impact assessments for OCS activities have occurred in studies of previous OCS lease sales.

The base case as well as the OCS cases examine statewide, regional, and local transportation systems. Anchorage, which serves as the major entry port for interstate movement of passengers and freight, will be the focus of statewide systems. Anchorage will also be examined from the regional perspective, since a significant proportion of passengers and goods with origins or destinations in the Kenai Peninsula passes through Anchorage. The Kenai Peninsula to the extent possible will be examined in a regional context; but the Southcentral region, as used in the socioeconomic studies program, extends from Palmer to Yakutat to Kodiak and, thus, cannot be used to isolate activities in this area. Homer and Kenai will be examined primarily from a local perspective, since they do not serve as transshipment points.

3.2 Factors Causing Growth

Transportation growth in transportation systems impacted by Lease Sale No. 60 will result from three influences: (1) direct transportation demands from development activities, including but not limited previous OCS lease sale activities; (2) indirect transportation demands of development activities which result from regional and local population growth; and (3) structural changes in the operation and management of transportation systems in the study area.

Direct transportation demands consist of the moderate scenario of development activities. Included is construction of the Pacific-Alaska LNG plant in North Kenai which will only impact Kenai. Of the previous lease sales, only Sale No. CI will impact the Lower Cook Inlet area. For Anchorage, lease sale activities for the Beaufort Sea, Northern Gulf (No. 55), and Western Gulf (No. 46) will be considered as well as Sale No. CI, but direct impacts will be limited to employee movements. For all of these sales, activities derived from the moderate level of resource recovery will be used.

Indirect, or induced, transportation demands are those that can be assumed to be related to population growth. These demands include personal and business travel, except that which is related to non-local employees of development activities, and goods needed to satisfy local infrastructure and consumer demands. Both tourism and fishing activities have become important elements of the Kenai Peninsula's economy. In this report, they are treated as indirect rather than direct transportation demands.

In other words, transportation demands resulting from these activities are expected to be related to population forecasts. Areas of concern will be identified which might result from tourism and bottomfishing but only in a qualitative manner. Adequate data does not exist to forecast them separately.

Regional and local population forecasts are shown in Tables 3-2 and 3-3, respectively. Growth rate factors are shown for each year. They represent percentage growth over the population for the base year, which is provided in the first line of each table. At the regional level, Anchorage shows steady growth during the study period. From 1982 to 2000, the total increase in population is 51% of the base year figure, or 92,538. No annual increase exceeds 4% of the base year figure. At the local level, steady growth is also the rule, but several large annual changes occur as well as occasional annual decreases in population. The timing of the changes is the same in both communities, but the percentage differences vary. The commencement of intense development activity in 1986 causes population increases in Homer and Kenai of 13% and 6%, respectively. A slight drop in population occurs from 1988 to 1989 as development ends and production begins. A more significant drop occurs from 1998 to 1999 as production ends. For Kenai, the drop is 7% and for Homer only 2%.

The third area that is expected to change transportation systems in the study area is structural change resulting from construction of new facilities and shifts in regulatory and funding policies at the Federal, State, and local levels. Forecasting for the base case does not assume that such changes will occur, since their timing and impact are uncertain.

Nevertheless, some major changes can be expected, if the changes that have occurred within the past year are any indication. The cities of Seward and Homer have each commissioned port development studies, and major projects in both communities are at or near the construction phase. For Homer, it is a bottomfishing harbor complex and for Seward a ship repair and construction facility. Deregulation of air carriers at the Federal level has led to direct Kenai-Seattle jet service, and competition for commuter airline service between Kenai and Anchorage has occurred during construction work on the Seward Highway and might be approved on a permanent basis. Structural changes will not greatly increase total transportation demand but could cause shifts in routing and market shores for carriers.

3.3 Water Mode

3.3.1 DESCRIPTION OF ACTIVITIES

For the water mode, activities will be a continuation of existing roles and an expansion of activities caused by development projects. It is important to distinguish between activities that will require specialized or dedicated services and facilities that are already in place or will be constructed and those that will compete with other users for services and facilities available for public use. It is assumed that the area for Sale No. CI contains two-thirds of the oil and gas in the Lower Cook Inlet fields. Activities related to transportation demands are shown in Table 3-1. Exploration activities end in 1982, and steel platforms are installed from 1982-1984. During the development phase, 104 wells are drilled between 1983 and 1987, and pipeline laying occurs from 1985 to

1987. Oil production begins in 1986 and continues to 1998, and for gas the production period is 1987 to 1995. No additional onshore processing facilities are assumed, either for gas or oil. Logistics activity for Sale No. CI will center in Kenai because of its existing industrial infrastructure and relative proximity to the lease sale area. Homer will serve as a forward supply base. Waterborne activities can be divided into inbound industrial freight, outbound shipments on supply boats, and transportation of oil and gas.

3.3.1.1 Industrial Freight (Sale No. CI)

Industrial freight consists of requirements for drilling and construction of offshore and onshore pipelines. A discussion of consumables is also being included in this section. Drilling supplies include drill pipe, dry bulk, fuel, and drill water. Pipeline construction requires pipe and cement for offshore pipelines. No additional landside facilities are considered necessary to handle logistics or processing of oil and gas.

Table 3-4 shows the inbound tonnages to be handled by Nikiski and Homer. It is assumed that Nikiski will handle all pipe, and that it will handle two-thirds of dry bulk and fuel. Drilling activities peak in 1985 when an estimated 25,765 metric tons (28,401 tons) will be received by Nikiski. Based on the use of 5,443 metric ton (6,000 ton) barges, this quantity can be handled by five barges during the year. At Nikiski, it is assumed that the local refineries will meet fuel requirements for drilling. Operations at Homer peak during the same period, requiring two barges and three tankers in 1985.

For pipeline construction, Nikiski will handle all logistics requirements. Barges will carry inbound pipe for offshore pipelines and for onshore pipelines on the east side of Cook Inlet. Tonnage is based on offshore pipeline arriving a year before it is needed. Concrete coating of pipe significantly increases tonnage, as can be seen in Table 3-5. Throughput tonnage at Nikiski for pipeline activities peaks in 1986 at 78,532 metric tons (86,567 tons) and will be handled during the summer months as opposed to the steady flow of drilling supplies. Consumables are required to support employees who are working away from home either in construction camps or at offshore work sites. Homer will handle most of the logistics for consumables due to its proximity to work sites. The peak demand is in 1986 when 78 metric tons (86 tons) are estimated, a small figure compared to other industrial shipments (Table 3-6).

3.3.1.2 Supply Boat Movements and Berths

Supply boat movements for all Lower Cook Inlet activities have been generated using the schedule of activities and the listing of supply boat round-trips per month per activity, as found in Table A-5. From 1984 to 1986, over 100 trips per month are required. These movements then have been split between Nikiski and Homer according to percentages established in Table A-3. The figures relate to peak monthly activity which occurs during the summer. Peak activity occurs in 1986 when Nikiski has an estimated 86 round-trips per month and Homer 41, which converts to three and two dedicated supply boat berths, respectively. Homer's role ends in 1987 when the development phase ends. All production support by the water mode is assumed to come from Nikiski. At low levels of demand, it is inefficient to maintain two separate supply bases.

3.3.1.3 Induced Growth

At both the regional and local levels, population growth is steady and produces the largest figures at the end of the study period. Base year growth factors in 2000 are 2.14 for Homer and 1.60 for Anchorage (Table 3-3). Kenai's peak occurs in 1998 when the base year growth factor is 1.77. The population increases are assumed to create corresponding increases in demand for waterborne freight. For Homer and Kenai, the inbound freight might be substantially more than the growth factors would indicate because shifts from the truck mode to the water mode could occur if adequate frequency of marine service and efficient handling facilities could be developed.

3.3.1.4 Transportation of Oil and Gas

A summary of oil and gas production and transportation for the base case is provided in Table 3-8. Production in existing offshore oil fields in Upper Cook Inlet is slowly declining. Production for the Sale No. CI fields begins in 1986 for oil and peaks in 1989, when total production will be 79.5 mmbbl. Total production falls below the existing capacity of Nikiski refineries in 1984 and 1985 but not again until 1994. Annual oil tanker traffic during peak production in 1989 is estimated at 66 tankers from Nikiski and 174 from Drift River for a total of 240.

For Nikiski, construction of the Pacific-Alaska LNG facility and more frequent oil tanker sailings will increase safety problems during the winter months when ice floes are present in Cook Inlet. Hazards already exist at Nikiski due to ice forces that can cause vessels to break loose from moorings during ebb currents. Drifting vessels could collide with ships moored to the north or run aground. Procedures have been established to reduce the likelihood of such incidents, but on the other hand increased traffic will tend to keep concern at a high level.

For induced growth, the population growth factors during the period for Homer and Anchorage are less than the threshold values (Table A-8). By the end of the study period, Anchorage's population has produced a growth factor of 1.60 compared to low capacity threshold values of 1.92 and 2.24, respectively, for dry bulk and fuel. Homer's growth factor in 2000 of 2.14, likewise, is less than the respective dry bulk and fuel values of 2.32 and 2.47. However, any extensive use of the cargo facilities in Homer by OCS activities will create congestion and require new facilities. The new industrial complex on the Homer Spit will enable growth in fishing industry requirements for dock space to be transferred from existing facilities. Also, the possibility of a modal shift of freight goods from the land to the marine mode would also contribute to congestion but, on the other hand, such a shift must await construction of new facilities. At Kenai, the growth factor in the late 1990's exceeds the computed threshold value for the small, shallow draft public dock in Kenai. By this time, it is likely that an alternative facility for handling general cargo will have been developed, either at Kenai or at Homer to serve the entire Lower Cook Inlet area.

3.3.3 IMPACT ON CARRIERS AND ROUTES

Increases in tonnages are projected for the major marine routes, but the figures still will be small to those that would require establishment of formal shipping lanes. No scheduled freight carriers currently serve Kenai, and only the Marine Highway System operating from Kodiak serves Homer. Development of scheduled freight service to either Kenai or Homer is likely during the study period, either by TOTE or Sea-Land which both serve Anchorage; but such service must await construction of a facility which could provide efficient handling of cargo to and from deep-draft vessels. Traffic lanes in Kachemak Bay are expected to remain voluntary so that flexibility can be used in addressing seasonal concerns.

3.3.4 ISSUES

The major issue facing marine transportation in Lower Cook Inlet is the manner in which communities expand facilities to serve general cargo and the fishing industry. Alternative plans have been proposed by each of the Kenai port communities, and each are in various stages of planning and development. The ability to handle general freight and fuel requirements through new facilities would free up existing facilities for use by resource industries, especially bottomfishing and oil and gas development. The base case does not include construction of any new facilities to support offshore oil and gas activities, but incremental improvements might be required in the Homer area. Also, construction of additional refinery capacity in Nikiski rather than exporting all excess supplies from Drift River remains a possibility.

3.4 Air Mode

3.4.1 DESCRIPTION OF ACTIVITIES

Population growth at the regional and local levels as well as non-local employment for development projects within the study area will create additional demands on air carriers and terminal facilities. It is assumed that all non-local employees will utilize scheduled airlines to go to and from their place of residence. As population grows, general aviation and air taxi activities will respond to increased demands by recreational and commercial travelers. The Kenai Peninsula's availability of good truck service from Anchorage, adequate port facilities, and infrequent jet service together keep air freight tonnage at a relatively low level. Large shipments of high-value fish to processing facilities in Kenai and Homer have taken place in recent years and will have continued impact on air facilities, but only on a seasonal basis. Also, air freight flights into Kenai and Homer in conjunction with OCS activities can be expected during the study period.

Anchorage has taken on a greater importance for air freight as a result of expanded westbound shipments to the Far East. Anchorage is a convenient stop-over point between Seattle and Tokyo, and this triangular route allows general cargo originating in the Lower 48 to be offloaded in Anchorage and seafood products for the Japanese market then to be onloaded.

Four air activities which will be discussed in detail are as follows: (1) air carrier passenger traffic by link; (Z) passenger movements at terminals; (3) aircraft operations; and (4) helicopter operations for OCS activities. Unlike marine OCS activities, for which specialized facilities have been developed in Lower Cook inlet, those for the air mode tend to use the same facilities that are used for other activities, and, thus, are additive in nature. An exception would be helicopter landing areas in Nikiski and Drift River used solely by offshore oil and gas operators.

Weekly demand for air passenger services was forecast on a link-by-link basis for the month of August, which is the period of peak demand. The results are shown in Table 3-9, and passengers due to population growth and OCS activities are shown separately. The induced values are a product of the 1978 base year values and the growth factors for each year. The figures show the relative importance of Sale No. CI activities versus general population growth. On the Homer-Anchorage link, OCS passengers are a significant proportion of total passengers in the mid-1980's but never exceed 26%. An average growth rate of 15% occurs between 1982 and 1986, but thereafter smaller, but steady growth occurs. This link is third in importance amoung those studied, ahead of Homer-Kenai and Kenai-Seattle. The induced demand for service on the Homer-Kenai link is low because of the small distance between communities, a good road connection, and the relatively small size of both communities. All OCS employee movements between Homer and Kenai are assumed to use scheduled air carriers, although buses and air taxi services are viable alternatives. From 1985 to 1997, OCS travel will exceed induced forecasts. Peak total demand on the Homer-

Kenai link occurs in 1988 when 144 weekly trips are forecast from Homer to Kenai. This figure does not include any Homer-Anchorage traffic on the link. Homer-Kenai flights are also assumed to carry the existing level of passengers flying between Homer and Anchorage (see Table A-12).

Despite only being served by commuter airlines, the Kenai-Anchorage link will have 2,000 weekly passengers by 1982, which is 14% of the forecast Seattle-Anchorage figure for the same year. Sale No. CI travel on the Kenai-Anchorage link is relatively insignificant, exceeding 1% in only one year. The Kenai-Seattle link, which was initiated by Wien in 1979, is expected to continue and show slow growth. Jet service on this link is attractive but the infrequency of service will cause many travelers to route southbound trips through Anchorage. The Anchorage-Seattle link will include trips derived from all previous OCS lease sales in addition to induced growth. In four years, the link produces over 1,000 OCS-related trips per week, and beginning in 1983 every year until 1993 except one produces at least 600 OCS trips. Despite the size of these numbers, they never exceed 10% of total passengers. The effect is to push normal growth figures four to five years ahead. After construction of the gas and at the end of development phases in the early 1990's, the forecasts slightly decrease.

Helicopters will be used to transport personnel to and from offshore oil and gas activities in Lease Sale No. CI. All operations are assumed to be located in Homer. Helicopter trips are forecast to increase from five per week in 1982 to 16 in 1986 and for the latter part of the study period will steady at 3-4 trips per week (Table 3-10).

Table 3-11 presents data for use of passenger terminals. It is based on the passenger figures in Table 3-9. Passenger boardings and departures, including transfers, have been accumulated for scheduled flights in both directions. The Homer and Anchorage figures are incomplete because not all flights are considered. At Homer, passengers flying between Kodiak and Homer have not been included, and at Anchorage only the Seattle-Anchorage, Homer-Anchorage, and Kenai-Anchorage links are considered. If these limitations are kept in mind, the figures are still useful in assessing the impact on the airport terminals by base case activity within the study area. The figures show that greater percentage changes in demand occur for use of terminal facilities than for use of carriers. Each trip can produce as many as four terminal movements. For example, a Homer to Seattle trip via Anchorage has a boarding in Homer, both a deplaning and boarding in Anchorage, and a deplaning in Seattle.

Passenger movements (enplanements and deplanements) at the Kenai airport are forecast at 4,822 per week during peak summer periods by 1986, which is a 38.3% increase over the base 1978 period. Almost 30% of this growth occurs by 1982 due to OCS exploration and construction of Pacific-Alaska LNG facilities. By 1998, growth over the 1978 figure is estimated to reach 80.7%. For the Homer airport, passenger movements on links studied are forecast to increase 96.2% from 1978 to 1986, with the biggest jump occurring from 1985 to 1986. The largest usage during the study period is expected to be 2,404 passenger movements in 1998, a 120% increase over 1978. Anchorage figures show a sudden rise and drop in the mid-1980's corresponding to the construction period of the Northwest gas pipeline.

Total airport operations at Kenai, Homer, and Soldotna can be expected to increase proportionately with population because of the dominance of air taxi and general aviation operations. At Anchorage, training operations at Anchorage International Airport and Merrill Field will be curtailed so that capacity can be provided for growth in other user groups.

3.4.2 TERMINAL IMPACTS

Terminal (airport) impacts fall into four categories, as follows: (1) aircraft operations on runways and use of aprons and taxiways; (2) navigational aids; (3) runway strength; and (4) passenger terminals.

No capacity problems for operations on runways at Kenai, Soldotna, or Homer airports are anticipated during the study period as the population growth factors never exceed the computed threshold values. In the Kenai-Soldotna area, the highest population growth factor of 1.77 is 71% of the threshold value of 2.50. At Homer, the threshold value is not approached as closely, as the highest growth factor, 2.14, is only 52% of the threshold value. The use of these airports by freight planes to carry inbound supplies of fish and OCS supplies means that runway conditions should be carefully monitored and pavement overlays budgeted in advance of the time that damage would become evident. Stop-overs by freight planes should be considered in the development of aprons at Lower Cook Inlet airports.

Sufficient operations will occur at both Soldotna and Homer during the study period to justify establishment of control towers. Criteria for their establishment are based on a sum of separate ratings of operations by air carriers, air taxis, and general aviation (FAA, 1974). FAA indicates that at Homer justification may be reached by the end of the decade.

Existing runway lengths are adequate to handle all freight aircraft, although Kenai Peninsula airports would require lengthening if used by wide-body jets, e.g., DC-10 and 747.

Impacts will be felt most at passenger terminals. With an existing facility capable of being expanded easily, Kenai should be able to meet the significant increases forecast for the early 1980's and the slower growth thereafter. At Homer, a new facility is required to meet forecast increases. Several private companies have expressed interest in developing such a facility. Because most of the growth occurs in the early 1980's, the facility should be designed to meet demands for the entire study period. Completion on schedule of the projects included in the Anchorage International Airport Master Plan should enable the airport to adequately meet passenger demands, although some congestion can be expected in the early 1980's during construction of the gas pipeline. All three airports experience moderate boom-and-bust cycles, with annual increases and decreases of at least 6%. Homer experiences both the largest annual increase, 22%, and the largest annual decrease, 8%. However, peak demands during early periods in all cases are exceeded later in the study period, which means that providing for the early demands will not produce long periods of excess terminal capacity.

3.4.3 CARRIER IMPACTS

The estimated increase in air passenger demands on the five links studied will require adjustments in scheduled service by air carriers. The passenger forecasts have been converted into weekly one-way flights by type of aircraft, given assumptions for load factors and seating capacity. The results are shown in Table 3-9. The distance from Homer to Anchorage--190 km (118 mi .)--is such that use of both jet (110 passenger) flights and commuter aircraft is expected to continue. Commuter schedules can offer greater frequency while jets have shorter travel times. A larger growth in jet flights is expected than in commuter flights. Based on an even split of traffic between the two services, by 1986 the link could justify more than a jet flight per day and still maintain the current level of 26 non-stop flights per week. Increases in travel from Homer and Anchorage to Kodiak will help generate the demand for the extra jet flights. Current load factors on flights from Homer to Kenai are low, and even the significant increases could be accommodated by existing service levels. It has been assumed that all growth in the Homer-Anchorage market would occur on non-stop flights. Existing service appears on the Kenai-Anchorage link is forecast to be adequate until the mid-1990's. The short distance from Kenai to Anchorage favors carriers offering frequent service, and medium-size (110 passenger) jets are not assumed to be assigned to this link. Only small increases in service can be expected on the Kenai to Seattle route recently initiated by Wien. The current service level of three flights per week might be adequate for the entire study period. Of the four links studied which serve either Homer or Kenai, only the Homer-Anchorage link, which is served by both Wien and AAI, has two carriers with permanent operating authority by either the ATC or CAB. Polar Airlines has been operating on the Kenai-Anchorage link on an emergency basis, but its application for a permanent operating authority was still pending, as of March 1980. Introduction of competition on the three routes non-competitive likely would create lower overall load factors and, thus, would produce more flights than have been estimated. For the Anchorage-Seattle link, flights are expected to increase steadily during the study period. An estimated 54 additional flights will land per week in 2000 compared to 1982. Greater use of wide-body jets could reduce the number of additional flights. The forecast is based on the current average of seats per flight operating on the link.

Despite several periods of sharp increases and decreases in estimated ridership, none is of such great magnitude that a carrier would have to provide a level of service that could not be justified during later periods. If competitive service were introduced during peak periods, it could be maintained thereafter. The significant drop-off in traffic that occurred on the Anchorage-Valdez link after construction of the pipeline and oil tanker terminal were completed is not expected for activities in Kenai. The magnitude of projects in Kenai is considerably less, and a higher base travel demand exists for the Kenai market.

3.4.4 ISSUES

Air mode issues focus on terminals more than carriers. Major improvements in passenger terminal facilities will be required at all facilities, particularly Homer. Introduction on routes connecting Homer and Kenai to Anchorage and Kodiak of new airplane types, such as efficient turbo-prop or jet aircraft with seating capacities of 25-40 passengers, could change the mix of traffic between existing carriers.

3.5 Land Mode

3.5.1 DESCRIPTION OF ACTIVITIES

No changes in railroad operations are expected which will affect freight movements to the west side of the Kenai Peninsula. Moose River will continue to serve as an intermodal transfer point but at a low level of activity. Tonnage through Seward is not expected to reach past levels caused by construction of the trans-Alaska pipeline, but construction of the gas pipeline and oil and gas activities on the North Slope and in the Beaufort Sea will bring occasional large shipments of pipe and other industrial materials. In the discussion of baseline conditions (Chapter 2.0), five intercity highway links were examined by condition and capacity--three on the Sterling Highway and two on the Seward Highway. For the impact analysis, the focus will be on two road sections, Homer to Kenai and Kenai to Anchorage.

Traffic between Homer and Kenai increased faster than the other section during the 1970's. The average annual daily traffic increased from 679 in 1970 to 1,285 in 1976, representing an annual growth of 11.2%. This road section currently has both higher capacity and condition ratings, which will enable it to adequately handle continued both automobile and truck traffic growth during the study period.

The Kenai Peninsula has become an important recreation area both for local and Anchorage residents and non-Alaskan tourists. Assuming that traffic growth will be of the same magnitude as population growth, either in Kenai Peninsula communities or Anchorage, the Homer-Kenai road section will not require major improvements during the study period, as the population growth factors are less than the threshold growth factor, which is the inverse of the volume-capacity ratio. Increases in truck traffic will occur because of OCS activity and population growth. The predominant movement of OCS freight will be from Kenai to Homer. All major industrial freight is forecast to be shipped to Nikiski. A small percentage of this tonnage during the exploration and development phases will be shipped to Homer for delivery to offshore work sites by supply boat or helicopter. Population-related freight could be in either direction, depending upon the nature and location of port development projects occurring during the study period.

3.5.2 ROADWAY IMPACTS

The road section between Kenai and Anchorage consists of two distinct links--Kenai to the Sterling Highway Junction and the junction to Anchorage. Traffic increases on these links potentially will have greater impacts than similar increases on the Homer to Kenai section. A combination of high traffic and low capacity figures result in existing volume to capacity ratios (based on level of service B) of 0.60. Also, condition surveys from 1972 to 1976 show deficiencies in at least 70% of the mileage. Assuming a direct correlation between population and traffic growth, both the community and Anchorage region growth factors exceed the threshold values for the Sterling Highway junctions--Girdwood and the Soldotna--Sterling Highway junction links of 1.37 and 1.54, respectively, during the study period. Since travel has increased faster than population growth in recent years, this analysis can be seen as conservative. Congestion will occur more often unless construction is undertaken to significantly increase capacity. '

Three major projects, each costing $8-10 million, are scheduled for construction from 1983-1986 in the Granite Creek-Turnagain Pass section of the link between Anchorage and the Sterling Highway Junction (DOTPF, 1978). Improved alignments and cross-sections will provide incremental increases in capacity but far less than could be achieved by 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 to both rural and urban areas and to all regions.

Truck traffic between Anchorage and Kenai should grow but to a lesser extent than such traffic between Kenai and Homer because OCS freight will most likely arrive in Kenai by the air or marine mode.

Increased traffic on local roads in Homer and Kenai can be expected between the airports and supply base sites. Heavier traffic can be expected in the Kenai area, but the route is well-established and impacts should be minimal. Increased development activity on the Homer Spit related first to fishing and later to OCS logistics might create additional conflicts between commercial and recreational traffic. The recently constructed Homer by-pass route has reduced the impact of truck traffic on the downtown business area.

3.5.3 CARRIER IMPACTS

The trucking industry has an ability to expand capacity more quickly than other modes because of the comparatively small investments for equipment and term"inal facilities, as long as roadways exist. Impacts on carriers due to development projects normally occur when the downturn in demand occurs after development rather than during development. Carriers that have built up capacity to meet peak demands, either through acquiring their own drivers and equipment or contracting for services with individual drivers owning trucks, must then cut back. Cutbacks after OCS activities similar to the one that occurred in the State after completion of the trans-Alaska pipeline are not expected because of reliance on the water mode for logistics.

Patterns of truck traffic on the Peninsula during the study period are likely to change with a greater emphasis on hauls between Kenai and Homer then between these communities and Anchorage. The long-haul movements will not be completely displaced but will show a lower growth rate than short-haul movements, particularly if a regional port is established in a Lower Cook Inlet community.

3.5.4 ISSUES

For roads on the Kenai Peninsula, a major issue is whether the State of Alaska will have sufficient funds both to keep existing roads in adequate condition and to expand capacity on routes in a timely manner to avoid congestion. Attempts by the State to obtain additional Federal financing through creation of an interstate system for Alaska have to date been unsuccessful. The extent of growth in trucking will depend in part whether scheduled marine freight service will be provided to either Kenai or Homer during the study period. Another issue is the extent to which the Kenai

Peninsula will grow as a recreation area. The increasing cost of gasoline and decreasing domestic supplies may create constraints on the recreational use of automobiles and motorboats which do not exist at present.

3.6 Summary of Base Case

The Kenai area has already experienced a period of rapid development due to oil and gas activities. Much of the infrastructure constructed during that period will be adequate for activities during the base case, which will limit the need for high levels of onshore construction. The only major onshore construction activity anticipated is the Pacific-Alaska LNG facility.

Potential impacts are different for each community. In Anchorage where growth will be principally of an induced nature facilities to handle both freight and petroleum products appear to be adequate. At Kenai, dock facilities for development activities can meet requirements for development activities, although a possible imbalance between demand for Kenai and Drift River crude oil processing facilities could develop. Safety concerns will be a major concern of increased shipping at Nikiski. The modest facilities in Kenai for general cargo realistically cannot be expanded due to their location on the Kenai River, and the forecast growth eventually must be accommodated by a new facility or increased use of the truck mode. At Homer, impacts can come from several sources because of the multi-use nature of the city pier. Conflicts will develop unless OCS, general freight, or fishing activities can be diverted to a new area at the proposed industrial park or in conjunction with the small boat harbor expansion.

For the air mode, passenger terminals head the list of impacted facilities for the base case. Homer and Soldotna require new facilities, while expansion of existing facilities can take place at Kenai and Anchorage. No problems are expected due to runway capacity at any facilities. The development of a Seattle-Anchorage-Tokyo trade route and of air freight shipment of fish from Western Alaska to Central Alaska processing plants has created the need for air freight operations to be given greater consideration. Adequate tie-downs must be available as well as space for warehousing. Growth in demand for air passenger services is expected to lead to the introduction of additional scheduled carriers on links that have been studied, particularly Kenai to Anchorage and Homer to Anchorage. Control towers will be required at Homer and Soldotna before the end of the study period. Overall traffic increases are expected to be greater on the road section between Anchorage and Kenai than between Homer and Kenai. Continued traffic increases are expected to continue on all road sections between Homer and Anchorage, although at lower levels than have occurred during the past decade. The road section between Homer and Kenai, with slightly lower traffic levels than the other sections of the route and with greater capacities, will experience less impacts. Congestion on the section between Kenai and Anchorage can be expected during the latter years of the study period, even with the reconstruction projects that have been tentatively programmed by the State of Alaska. Trucking will remain an important means of moving freight between the Kenai Peninsula and Anchorage but growth in intra-Peninsula truck traffic is expected to increase at a greater rate, due to the establishment of a forward supply base at Homer and the possibility of a major general cargo facility being built either at Homer or Kenai.

Table 3-1

Lower Cook Inlet - Statistical Mean Resource Level Scenario - Sale No. CI
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 Const. (mi.) Onshore	Pipe Const. (mi.) Offshore	Oil Production Wells (Onshore Loading)(2)	Gas Production Wells (Non-Associated)(2)	Onshore Facility Construction
1982	5	2	1S			6							
1983	6		1S	2	2		12						
1984	7		1S	4	4		24						
1985	8			5	5		24	6	80				
1986	9			5	4		24	2	80	40	15		
1987	10			2	2		12			60	40	3	
1988	11										60	8	
1989	12										75	8	
1990	13										80	8	
1991	14										80	8	
1992	15										80	8	
1993	16										80	8	
1994	17										80	8	
1995	18										80	8	
1996	19										80		
1997	20										80		
1998	21										80		
1999	22												
2000	23												
2001	24												

Notes: (1) S = Steel
(2) Based on wells producing by July of each year.

Source: Dames and Moore, 1979.

Table 3-2

Regional Population Projection: Mean Base Case(BM)

Year	Mean Base Case(BM) South Central	Mean Base Case(BM) Anchorage	Growth Rate Factors South Central	Growth Rate Factors Anchorage
1977	58,904	183,606	-	
1982	60,037	201,016	1.02	1.09
1983	60,200	210,524	1.02	1.15
1984	62,339	211,796	1.06	1.15
1985	62,398	212,656	1.06	1.16
1986	62,616	215,219	1.06	1.17
1987	63,326	219,367	1.08	1.19
1988	64,471	224,793	1.10	1.22
1989	65,616	230,401	1.11	1.25
1990	66,762	235,413	1.13	1.28
1991	66,117	240,336	1.12	1.31
1992	66,301	244,878	1.13	1.33
1993	66,924	249,792	1.14	1.36
1994	67,710	255,067	1.15	1.39
1995	68,525	260,682	1.16	1.42
1996	69,561	267,068	1.18	1.45
1997	70,559	273,659	1.20	1.49
1998	71,642	280,757	1.22	1.53
1999	72,835	288,230	1.24	1.57
2000	74,596	293,554	1.27	1.60

Notes: (1) Growth rate factors derived by dividing forecast year population by 1977 population.

Source: ISER, 1979.

Table 3-3

Community Population Projection - Mean Base Case(BM)

Year	Mean Base Case(BM) Kenai Area	Homer Area	Growth Rate Factors (1) Kenai Area	Homer Area
1978	13,397	5,081		
1982	15,607	5,678	1.16	1.12
1983	15,732	5,916	1.17	1.16
1984	16,272	6,191	1.21	1.22
1985	16,781	6,616	1.25	1.30
1986	17,552	7,249	1.31	1.43
1987	18,077	7,688	1.35	1.51
1988	18,741	8,214	1.40	1.62
1989	18,781	8,178	1.40	1.61
1990	19,217	8,558	1.43	1.68
1991	19,543	8,679	1.46	1.71
1992	20,020	8,983	1.49	1.77
1993	20,471	9,259	1.53	1.82
1994	20,952	9,544	1.56	1.88
1995	21,425	9,838	1.60	1.94
1996	21,927	10,147	1.64	2.00
1997	22,304	10,373	1.66	2.04
1998	23,728	10,612	1.77	2.09
1999	22,765	10Y503	1.70	2.07
2000	23,313	10,857	1.74	2.14

NOTE : (1)Growth rate factors derived by dividing forecast year population by 1978 population.

Source: Alaska Consultants, 1979.

Table 3-4

Logistics Requirements for Sale No. CI Drilling - Mean Scenario
(Tons per Year)

	Nikiski[1]					Homer			
	Tons per Year					Tons per Year			
Year	Drill Pipe	Dry Bulk	Fuel	Total Dry Freight	Incoming Barges[2]	Dry Bulk	Fuel	Incoming Barges[2]	Incoming Tankers[3]
1982	2,829	5,400	9,600	8,229	2	2,700	4,800	1	1
1983	5,192	6,168	10,968	11,360	2	3,084	5,484	1	2
1984	10,384	12,336	21,936	22,720	4	6,168	10,968	2	3
1985	12,981	15,420	27,420	28,401	5	7,710	13,710	2	3
1986	11,250	13,364	23,764	24,614	5	6,682	11,882	2	3
1987	5,192	6,168	10,968	11,360	2	3,084	5,484	1	2

Notes: (1) Fuel requirements for Nikiski are assumed to be provided from local refineries.
(2) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage) /(6,000 tons/barge).
(3) Fuel tankers = (Fuel tonnage)/(5,000 tons/tanker.)

Source: Peter Eakland and Associates, 1979.

Table 3-5

Estimated Logistics Requirements for Pipe-Laying - Sale Cl Mean Resource Scenario

Nikiski(1) (tons)(*)

Year	Uncoated Pipe	Cement	Coated Pipe	Throughput Tonnage	Inbound Barges	Outbound Barges
1985	34,800	1,371		36,171	7	0
1986	59,680	4,407	22,480	86,567	11	4
1987			58,470	58,740	0	10

Notes: (1) All offshore pipeline materials are first delivered to Nikiski for coating the year before installation and then sent to work sites by barge.
(2) Tons can be converted to metric figures using the factor 0.90718.

Source: Peter Eakland and Associates, 1979.

Table 3-6

Average Monthly Consumable Demands, Lower Cook Inlet
Base Mean (Sale CI)

Year	Tons (1) Kenai	Homer
1982	5.3	25.5
1983	5.3	24.0
1984	4.7	24.5
1985	17.1	54.0
1986	29.4	89.0
1987	16.2	74.7
1988	5.4	71.3
1989	5.4	39.5
1990	5.4	22.4
1991	5.4	24.9
1992	5.4	27.2
1993	5.4	27.2
1994	5.4	27.2
1995	5.4	27.2
1996	5.4	27.2
1997	5.0	23.4
1998	3.6	19.7

NOTE : (1) Tons = (Offshore onsite + onshore onsite non-local employment) x (300 lbs./person) ÷ (2,000 lbs./tons).

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

Table 3-7

Monthly Supply Boat Round-trips by Service Base
Mean Resource Level Scenario (Sale No. CI)

Years After Lease Sale (Calendar Year)	Lower Cook Inlet (CI) Exploration	Development	Production	Nikiski	Minimum Berth Requirements	Homer	Minimum Berth Requirements
1 (1982)	24	24		32	1	16	1
2 (1983)		64		43	2	21	1
3 (1984)		104		69	2	35	1
4 (1985)		100		67	2	33	1
5 (1986)		123	4	86	3	41	2
6 (1987)		83	12	67	2	28	1
7 (1988)			12	12	1		
8 (1989)			12	12	1		
9 (1990)			12	12	1		
10 (1991)			12	12	1		
11 (1992)			12	12	1		
12 (1993)			12	12	1		
13 (1994)			12	12	1		
14 (1995)			12	12	1		
15 (1996)			8	8	1		
16 (1997)			8	8	1		
17 (1998)			4	4	1		

Source: Peter Eakland and Associates, 1979.

Table 3-8

Mean Base Case - Oil and Gas Production and Transportation(1)

	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995
Oil Production (MMBBL) - offshore(2)														
Upper Cook Inlet	32.0	27'.8	24.3	21.2	18.5	16.2	14.2	12.5	10.9	9.6	8.5	7.4	6.5	5.7
Lower Cook Inlet (Sale No. CI)	-	-	-	-	14.0	40.3	61.3	67 0	60.7	47.6	33.6	25.1	18.0	12.9
Tota 1	32.0	27.8	24.3	21.2	32.5	56.5	75.5	79.5	7156/7.2		42.1	32.5	24.5	18.6
Ni kiski -refinery capacity (70,500bpd)	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
Drift River-crude exports	6.3	2.1	-	-	6.8	30.8	49.8	53.8	45,9	31.5	16.4	6.8	-	-
Nikiski-refined exports	12.6	12.6	11.2	8.1	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	11.4	5.5
Oil Tanker Traffic(Round-trips/year)(3)														
Nikiski-25,000 DWT	66	66	58	42	66	66			66	66	66	66	59	29
Drift River-40,000 DWT	21	7	-	-	22	100	1:;	1%	149	102	53	22	-	-
Gas Production (BCF)-offshore(4)														
Lower Cook Inlet (Sale No. CI)						70.1	70.1	70.1	70.1	59.1	41.7	29.4	20.7	1.8
LNG Ship Traffic(round-trips/year)														
Pacific-Alaska LNG			26	52	52	52	52	52	52	52	52	52	52	52
Phillips-Marathon	23	23	23	23	23	23	23	23	23	23	23	23	23	23

Notes: (See following page.)

Source: Peter Eakland and Associates, 1979, except as noted. Production figures from Dames and Moore, 1979.

Table 3-8 (Continued)

Mean Base Case - Oil and Gas Production and Transportation [1]

	1996	1997	1998	1999	2000	2001
Oil Production (MMBBL) - offshore [2]						
Upper Cook Inlet						
Lower Cook Inlet (Sale No. CI)	9.2	6.8	2.9			
Total	9.2	6.8	2.9			
Nikiski-refinery capacity(70,500bpd)	25.7	25.7	25.7			
Drift River-crude exports						
Nikiski-refined exports						
Oil Tanker Traffic(Round-trips/year) [3]						
Nikiski-25,000 DWT						
Drift River-40,000 DWT						
Gas Production (BCF)-offshore [4]						
Lower Cook Inlet (Sale No. CI)						
LNG Ship Traffic(round-trips/year)						
Pacific-Alaska LNG	52	52	52	52	52	52
Phillips-Marathon	23	23	23	23	23	23

Notes: (See following page.)

Source: Peter Eakland and Associates, 1979, except as noted. Production figures from Dames and Moore, 1979.

Table 3-8 (Continued)

Mean Base Case - Oil and Gas Production and Transportation [1]

Notes: (1) Analysis based primarily on offshore production. Sale No. CI forecast production for the mean scenarior included in the mean base case.

(2) Analysis assumes Nikiski's refineries will operate at capacity as long as supplies are adequate. It is further assumed that of the 70,500 bpd refined 36,000 bpd will go to Anchorage by pipeline. The remaining 34,500 will be exported to communities within Alaska. All oil not refined at Nikiski is assumed to be exported as crude from Drift River to Lower 48 refineries.

(3) Tanker sizes based on data developed by ERCO/Frankel in "Study to Assess the Impart of Alaskan Petroleum Development on the Coast Guard through the Year 2000," 1978. Round-trips/year = (production in mmbbl)/(7.74)(tanker size in DWT).

(4) Analysis assumes ammonia and urea capacity will operate at full capacity whenever supplies of natural gas permit. Remaining supplies will be exported as LNG. Ammonia and urea capacity of 120 mmcfd of natural gas obtained from p.51 of BLM Lower Cook Inlet EIS, 1976.

(5) Natural gas for Pacific-Alaska LNG plant assumed to come from onshore wells on western side of Cook Inlet as described in Final EIS, 1974, for Cook Inlet-California LNG project. Offshore LNG assumed to be produced from existing Phillips-Marathon facility.

Table 3-9

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

Year	Homer - Anchorage(2) Passengers Induced	Sale CI	Total	Flights Jet	Commuter	Homer - Kenai Passengers Induced	Sale CI	Total	Flights Commuter	Kenai - Anchorage Passengers Induced	Sale CI	Total	Flights Commuter
1982	420	68	488	5	17	28	15	43	14	1,860	164(1)	2,024	144
1983	441	65	506	5	17	29	15	44	14	1,876	58(1)	1,934	138
1984	472	71	543	5	18	31	22	53	15	1,940	8	1,948	139
1985	514	124	638	6	21	33	43		16	2,004	16	2,020	144
1986	582	203	785	8	26	36	86	1;:	16	2,100	28	2,128	151
1987	623	159	782	a	26	38	92	130	20	2,165	12	2,177	154
1988	681	103	784	8	26	41	103	144	21	2,245	3	2,248	159
1989	675	51	726	7	24	41	69	110	19	2,245	3	2,248	159
1990	712	12	724	7	24	42	50	92	17	2,293	3	2,296	162
1991	727	13	740	7	25	43	55		18	2,341	4	2,345	165
1992	759	14	773	8	26	45	57	1%	18	2,389	4	2,393	168
1993	785	14	799	8	27	46	57	103	18	2,453	4	2,457	172
1994	816	14	830	8	28	47	57	104	18	2,501	4	2,505	176
1995	847	14	861	8	29	49	57	106	18	2,565	4	2,569	180
1996	878	14	892	9	30	50	57	107	18	2,629	4	2,633	184
1997	899	12	911	9	30	51	54	105	18	2,661	4	2,665	186
1998	925	10	935	9	31	53	50	103	18	2,838	4	2,842	198
1999	915		915	9	31	52		52	15	2,726	-	2,726	190
2000	951		951	9	32	54		54	15	2,790	-	2,790	194
1978			357	2	26			25	27		-	1,603	182

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.
(2) Forecasts made only for non-stop traffic.

Source: Peter Eakland and Associates, 1979.

Table 3-9 (Continued)

Induced and OCS Weekly Air Travel - Mean Base Case (BM)
(table continued)

	Kenai - Seattle				Anchorage - Seattle				
	Passengers			Flights	Passengers				Flights
Year	Induced	Sale CI	Total	Jet	Induced	Sale CI	ANC-SEA Other OCS	Total	Jet
1982	134	60 (1)	194	3	13,905	116 (1)	776	14,797	145
1983	135	22 (1)	157	2	14,670	76 (1)	1,210	15,956	156
1984	140	1	141	2	14,670	70	1,128	15,868	155
1985	144	6	150	2	14,797	125	322	15,244	149
1986	151	10	161	2	14,925	200	454	15,579	152
1987	156	5	161	2	15,180	154	638	15,972	156
1988	161	1	162	2	15,563	86	904	16,553	162
1989	161	1	162	2	15,945	40	1,189	17,174	168
1990	165	-	165	2	16,328	1	1,020	17,349	169
1991	168	-	168	2	16,711	1	821	17,533	-171
1992	172	-	172	2	16,966	1	723	17,690	173
1993	176	-	176	2	17,349	1	629	17,979	176
1994	180	-	180	3	17,731	1	48	17,780	174
1995	184	-	184	3	18,114	1	25	18,140	177
1996	189	-	189	3	18,497	1	9	18,507	181
1997	191	-	191	3	19,007	1	2	19,010	186
1998	204	-	204	3	19,517	1	2	19,520	191
1999	196	-	196	3	20,027		1	20,028	196
2000	201		201	3	20,410			20,410	199
1978			115	3				12,756	125

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 3-10

Weekly Helicopter Round-trips from Homer
Base Mean (Sale CI)

Year	Total offshore Average Monthly Employment (1)	Peak Weekly Round-trips (2)	Helicopter Trips Per Week(3)
1982	253	59	5
1983	243	57	5
1984	292	68	5
1985	516	120	9
1986	917	214	16
1987	870	203	15
1988	718	167	12
1989	371	87	7
1990	149	35	3
1991	166	39	3
1992	181	43	4
1993	181	43	4
1994	181	43	4
1995	181	43	4
1996	181	43	4
1997	156	37	3
1998	131	31	3

NOTES : (1) Total employment includes offshore 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: Pete Eakland and Associate, 1979.

Table 3-11

Growth of Passengers Per Week at Airport Terminals - Mean Base Case (BM)

	Kenai Aiport		Homer Airport		Anchorage Airport	
Year	Passengers	Percent Change Yearly	Passengers	Percent Change Yearly	Passengers	Percent Change Yearly
1978	3,486		1,092		29,760	
1982	4,522		1,390		36,170	-
1983	4,270	-.06	1,428	.03	39,212	.08
1984	4,284	-	1,520	.06	38,974	-.01
1985	4,492	.05	1,756	.16	36,448	-.07
1986	4,822	.07	2,142	.22	37,892	.04
1987	4,936	.02	2,152	.01	39,138	.03
1988	5,108	.04	2,184	.01	40,978	.05
1989	5,040	-.01	2,000	-.08	42,674	.04
1990	5,106	.01	1,960	-.02	42,778	
1991	5,222	.02	2,004	.02	42,878	
1992	5,334	.02	2,078	.04	43,158	.01
1993	5,472	.03	2,132	.03	43,728	.01
1994	5,578	.02	2,196	.03	42,326	-.03
1995	5,718	.03	2,262	.03	43,190	.02
1996	5,858	.02	2,326	.03	44,082	.02
1997	5,922	.01	2,360	.02	45,176	.03
1998	6,298	.06	2,404	.02	46,598	.03
1999	5,948	-.06	2,262	-.06	47,340	.02
2000	6,090	.02	2,338	.03	48,302	.02

Source: Peter Eakland and Associates, 1979.

4.0 SALE NO. 60 OCS CASES

4.1 Introduction

The purpose of this chapter is to assess the cumulative and incremental impacts of three different levels of OCS activity resulting from Lease Sale No. 60 for the water, air, and land modes. These levels of activity are documented in the scenarios based on low, moderate, and high discoveries of economic oil and gas resources. The low scenario does not include any economic finds and, thus, is also an exploration-only scenario. The OCS cases are constructed by combining each scenario separately with the base case discussed in the previous chapter. Emphasis will be placed on the moderate case, since it by definition represents the most likely sequence of events being studies. The low and high cases serve to bracket the range of impacts that might occur.

For each case, three sets of analyses are made. First, cumulative transportation demands are developed for each category of freight and passenger movements. Next, an assessment is made of impacts resulting from the cumulative transportation demands. Finally, the incremental impacts are examined. For the moderate OCS case, the focus is on differences from the base case, whereas for the high and low OCS cases the focus switches to differences from the moderate OCS case.

A discussion of factors that will affect transportation demands begins the examination of each case. Then demands and impacts for each mode are examined. Finally, a summary of each case is provided.

4.2 Review of Base Case

Forecasts for steady increases in the fishing, tourism, and oil and gas industries in Anchorage and Lower Cook Inlet communities are expected to produce corresponding increases in transportation demand. The overall population growth and the direct transportation demands of development activities, particularly those resulting from the moderate scenario of Lease Sale No. CI, can be met with existing facilities or those currently under development. Potential impacts vary from community to community.

The air, water, and land modes all are important to the Kenai Peninsula but for different reasons. Mobility requirements are provided by air and land modes. The air mode is used for small, high-value cargo shipments and the land mode for bulk, lower-value shipments. The water mode primarily supports resource extraction activities, e.g., oil and gas activities and fishing. Marine shipments of general cargo directly to Homer and Kenai are at a low level currently. The combination of increased general cargo demands and possible construction of new facilities on the Kenai Peninsula for their handling could cause shifts of freight traffic from the land to the marine mode. For the air and land modes, incremental improvements to existing facilities likely will occur rather than construction of major new facilities. These improvements will bring slight increases in aircraft and vehicle capacity but will primarily improve operating conditions. For air facilities at Kenai, Homer, and Soldotna, the focus will be on passenger terminals, improved taxiways and aprons, and navigational aids. At Anchorage, a new passenger terminal for international flights is scheduled for construction, and growth in training and general aviation activities is expected to shift to satellite airports in the Anchorage area, such as Birchwood. Congestion can be expetted on road sections between Kenai and Anchorage by the end of the study period, but traffic levels will still fall short of ultimate capacity levels.

Whereas all activities for the most part will use the same roads and airports, a clear distinction exists in the water mode between specialized port facilities and those available for general use. New facilities to be constructed and designed primarily for specialized use include a construction dock and LNG ship pier in Kenai related to the Pacific-Alaska LNG facility and an industrial park for fishing in Homer. Construction of these facilities will make specialized functions adequate during the study period. General cargo facilities in Homer and Kenai will become inadequate during the study period. In Kenai, physical limitations prevent expansion while in Homer the difficulty is a potential conflict among multiple users and the lack of efficient freight handling facilities.

4.3 Moderate OCS Case

4.3.1 FACTORS CAUSING GROWTH

All factors that exist for the base case are carried forward for the OCS cases. Additional factors are derived from the moderate scenario of Lease Sale No. 60. Three categories of influences on transportation systems have been identified, as follows: (1) direct transportation demands; (2) indirect transportation demands; and (3) structural changes in operation and management of transportation systems. Each is discussed separately.

The location of OCS activities, their extent, and their timing are factors in developing transportation demands and impacts, particularly as they relate to previous lease sales. Two separate fields are scheduled for development in the moderate scenario, one in Lower Cook Inlet 16 km (10 mi.) northwest of English Bay and another in Shelikof Strait west of Afognak Island. A listing of activities related to transportation demands are shown separately for each area in Tables 4-1 and 4-2.

Oil reserves that are discovered and developed in Lower Cook Inlet for Lease Sale No. 60's moderate scenario total 198 mmbbl, which is approximately one-half of the figure for Lease Sale No. CI (400 mmbbl) (Dames &Moore, 1979). Moderate scenario oil reserves in Shelikof Strait amount to 500 mmbbl. Transportation demands are not related solely to the size of economic reserves. The size of fields and their proximity to onshore facilities also are key factors. For example, Shelikof Strait reserves are more than twice those in Lower Cook Inlet (Sale No. 60) but the extent of activities is approximately the same. For each field, four years of development drilling take place from 1982 to 1986 and then a single steel platform is installed from which 48 wells are drilled. The Shelikof Strait field requires a separate pipeline to deliver oil to a shore terminal whereas the Lower Cook Inlet field is assumed to be able to take advantage of a pipeline serving fields discovered in either Lower Cook Inlet or Shelikof Strait as a result of the moderate scenario for Lease Sale No. 60. Production begins in 1989 and reaches its maximum value in 1993 for both fields.

Lease Sale No. 60 takes place four years after the previous lease sale in Lower Cook Inlet, Sale No. CI. Exploration for Sale No. CI ends in the year that exploration commences for Lease Sale No. 60. Homer and Nikiski are the supply bases for all exploration activities in both lease sales. When development begins, marine logistics requirements for the Shelikof Strait field will be supplied from a supply base on Afognak Island. However, employee movements from both offshore and Afognak employees are assumed to be rotated through Homer by helicopter. No overlap in development drilling occurs; the only overlap in development activities for the two Lower Cook Inlet lease sales is in 1987 when platform installation for Lease Sale No. 60 coincides with offshore pipeline laying and development drilling for Lease Sale No. CI.

Indirect transportation demands are based on population growth. Tables 4-3 and 4-4 contain regional and local population forecasts, respectively. Growth factors are provided as well as differences from the base case, shown both as incremental growth rate factors and as percentage difference in populations. At the regional level, Anchorage does not show in any year an incremental growth rate greater than 0.01. At the community level, the difference in factors between the moderate OCS case and the base case is greater, which is due in large part to smaller base populations. The largest difference in the Kenai area is 0.06 (804 persons) which occurs in 1990 and 1991. Beginning with 1988, the difference is at least 0.04 in every year except two. For Homer, the largest difference also occurs in 1990 and 1991 and is 0.15 (762 persons), and beginning in 1988 every year has a difference of at least 0.09. The effect is to produce growth in the late 1980's which is approximately 50% greater than that expected to occur for the base case. For example, the base year growth from 1986 to 1987 in Homer is 0.14 of the base year population, and the moderate OCS case is an additional 0.06.

The factors related to possible structural changes in the operation and management of transportation systems are the same as in the base case.

4.3.2 MATERM ODE

4.3.2.1 Description of Activities

As occurred with Lease Sale No. Cl, which is included in the base case, Lease Sale No. 60 will result in increased transportation demands at specialized marine facilities as well as at facilities handling general cargo. Three categories of direct OCS transportation demands exist--inbound industrial freight, outbound shipments on supply boats, and transportation of oil and gas. In addition, there are indirect transportation demands consisting primarily of general cargo. Direct OCS logistics requirements will be handled at three sites--Nikiski, Homer, and Afognak. The Lower Cook inlet fields in Sale No. 60 will be served as were those for Lease Sale No. CI. The Afognak site will handle most logistics for the Shelikof Strait field beginning with development. No new construction is proposed at either Homer or Kenai. Construction projects at Afognak include a supply base and oil terminal. Growth in indirect demands will be examined for Kenai, Homer, and Anchorage.

4.3.2.1.1 Industrial Freight

Industrial freight consists of requirements for drilling, construction of offshore and onshore pipelines, and construction of supply base and oil processing facilities. Onshore construction activities are limited to Afognak Island. On the Kenai Peninsula, the moderate scenario assumes the adequacy of onshore pipelines, supply bases, and oil processing facilities. No change in demand for gas processing facilities is anticipated, since the scenario assumes no economic gas discoveries in either Lower Cook Inlet or Shelikof Strait. Total tonnages resulting from Lease Sale No. 60 have been developed and then distributed to the three supply base sites, as shown in Figure 4-5. Tonnages for Sale No. CI have been added to produce total figures for Homer and Kenai.

The amount of dry goods handled at Nikiski more than doubles from 1982 to 1985 when exploration for Lease Sale No. 60 coincides with development for Lease Sale No. CI. The reason for the 'increase is that Nikiski handles all drill pipe for exploration and for Lower Cook Inlet development. From 1982 to 1987, Nikiski is expected to handle at least three-fourths of all dry goods associated with offshore drilling. Maximum inbound tonnage occurs in 1985 when 36,786 metric tons (40,550 tons) are forecast, which is the equivalent of seven barges. At Homer, inbound tonnage of fuel exceeds that for dry bulk. During exploration, shipments there in both categories are slightly less than double the figure for Lease Sale No. CI alone.

The Afognak supply base begins operations in 1988 and from 1989 to 1991 handles more dry goods tonnage than Nikiski. The maximum value of 14,444 tons is greater than the peak for Homer, even when both lease sales are considered.

Nikiski, as in the base case, is expected to handle logistics for all offshore pipelines. The increase in tonnage is slight because only 37 additional kilometers (23 mi.) of offshore are required for the moderate OCS case. A total of 18 inbound barges result from pipeline requirements in Lease Sale No. CI, while No. 60 is expected to produce only one each at Nikiski and Afognak (Table 4-6). Onshore construction activities are limited to Afognak, and a total of 15 barge shipments are expected from 1985 to 1987. Mobilization requirements in 1985 will create the largest number of barges.

Quantities of consumable goods, which are used to support employees working away from their place of residence, were developed by location for the moderate scenario and then added to requirements of the base case. The results are shown in Table 4-7. The pattern of shipments differs from that for industrial supplies. Homer as the forward supply base for Cook Inlet activities will handle the largest amount of tonnage in this category, followed by Afognak, and finally Kenai. The largest tonnage is registered in 1989, when Homer handles almost 90.7 metric tons (100 tons) and Afognak almost 72.6 metric tons (80 tons). The tonnages are small compared to requirements for industrial supplies. Most likely, they will be handled primarily by existing scheduled marine carriers. It is likely that the Homer tonnage will be trucked from Anchorage. The Afognak tonnage likely will go through Kodiak or Homer.

4.3.2.1.2 Supply Boat Movements and Berths

Table 4-8 shows the number of peak month supply boat round-trips required for each phase of OCS activity for both the Lower Cook and Shelikof Strait fields in Lease Sale No. 60. The trips are distributed to three supply base sites, and the resulting figures added to Lease Sale No. CI round-trips. At Nikiski, the addition of the Sale No. 60 moderate scenario increases the maximum number of round-trips from 86 to 101. The requirement for three berths begins two years earlier and extends a year later. At Homer, the number of required berths increases from 41 to 51, but the number of maximum required berths remains at two. Two berths are required from 1984 to 1986. For Afognak, intense development activity in 1988 produces 83 round-trips per month and a requirement for three berths. Supply boat activity is significantly less in other years, and only in two other years are as many as two berths required at Afognak.

4.3.2.1.3 Induced Growth

The level of induced growth is measured by the regional and local population forecasts provided in Tables 4-3 and 4-4. Induced growth for Anchorage compared to the base case is negligible. For Homer and Kenai, larger increments of growth occur but still are modest, never reaching 10% above the base case population figure for the same year. Such an increase by itself is not enough to cause a significant modal shift from trucking to marine freight but will cause an increased impetus for a regional port in either Kenai or Homer.

4.3.2.1.4 Transportation of Oil and Gas

Increases will only occur in the transportation of oil, since Lease Sale No. 60 is not expected to yield economic reserves of gas in the moderate scenario. Three oil processing facilities are examined--those at Nikiski, Drift River, and Afognak Island (Table 4-9). No changes from the base case occurs until 1989 when production begins in both of the fields developed in Lease Sale No. 60. Peak production for Upper and Lower Cook Inlet together is reached in 1990 and totals 92.6 mmbbl. Production increases in Cook Inlet resulting from Lease Sale No. 60 will be handled by Drift River, since production in the base case is greater than the refinery capacity of Nikiski until 1994. Exports of refined petroleum products from Nikiski will be possible two years longer than in the base case. Based on the use of 40,000 DWT tankers, peak tanker traffic at Drift River will increase from 174 round-trips per year in 1989 of the base case to 217 round-trips per year in 1990 of the moderate OCS case.

The Afognak field, being larger than economic Lower Cook Inlet oil reserves in either Sale No. CI or Sale No. 60, reaches the production level of all offshore Cook Inlet fields in 1992 and surpasses Cook Inlet production the following year. Shelikof Strait has a maximum production level of 70.1 mmbbl which converts to 76 oil tanker round-trips, assuming use of 120,000 DWT tankers. Smaller tankers will produce proportionately higher round-trips.

4.3.2.2 Impact on Terminals

Exports from Drift River and Afognak Island most likely will be shipped primarily to West Coast refineries but conceivably some shipments could also go to Valdez, site of the proposed Alpetco refinery, which has been guaranteed a specified amount of the State's royalty oil.

Impacts on Nikiski 's marine facilities clue to Lease Sale No. 60 will be limited. The requirement for three dedicated supply base berths does not exceed the requirement for the base case, and it can be handled with the existing docking space of the rig tenders' facility. Other activities are limited to logistics for a small amount of offshore pipeline. No increases in tanker sailings are forecast for Nikiski because new production is expected to be handled by Drift River.

The peak Cook Inlet production of 13.5 million tons is a 2.2 million ton increase over the base case-but still less than the combined capacities of Drift River and Nikiski. It might be necessary to develop processing facilities at Kenai should pier capacity become a constraint at Drift River. There are no existing port facilities on the west side of Afognak Island.

Two dedicated supply boat berths are required at Homer as in the base case, but the maximum number of monthly round-trips increases from 41 to 51 and occurs in the third year after the lease sale as opposed to the fifth year for the Sale No. CI figure. The main face of the city pier, which is 125 m (410 ft.) long, could easily provide simultaneous berthing of two supply boats, but the demands of other pier users probably would not permit dedicated use by OCS activities. Some activities might have to be shifted during the exploration phase to other facilities, either in Homer or at other ports.

At Afognak, three berths are minimally justified. No impacts on terminals will occur, since no facilities currently exist or are expected to be developed in the base case.

Facilities handling freight for induced tonnage in Anchorage will experience little if any additional impacts in the moderate OCS case compared to the base case. The highest population growth rate factors for Anchorage still fall below the computed threshold values for dry cargo and fuel. Annual differences between the growth factors for the base and moderate OCS cases are small, never exceeding 0.01.

In Homer, a greater potential for additional impacts exists in the moderate case, not only because of a higher level of OCS activities but because of larger population growth. The maximum growth rate factor of 2.25 in the moderate OCS case is still below the threshold values for dry freight and fuel, but is 0.11 higher than the maximum value in the base case. A growth rate factor value of 1.71, reached in 1988 during the moderate OCS case, was not reached until three years later in the base case. Higher levels of induced growth and OCS activity both would have to be handled by the city pier in the absence of new facilities and would create the likelihood of greater congestion.

The increase in population growth rate factors at Kenai from the base to the moderate OCS cast falls between the values for Homer and Anchorage. The maximum growth rate factor is approximately the same in both cases. The threshold for dry freight is first exceeded in the late 1990's. The need for a larger facility open to public carriers still exists but no more so than in the base case.

4.3.2.3 Impact on Carriers and Routes

Potential incremental impacts on routes due to the moderate scenario of Sale No. 60 have three sources, as follows: (1) supply boat movements; (2) transportation of processed oil; and (3) platforms. The larger number of supply boat movements in and out of Kachemak Bay and the longer period of such movements will create additional traffic for Homer's voluntary traffic 1 anes. The possibility of conflicts between supply boats and fishing gear will increase. The year-round nature of supply boat movements might restrict the flexibility to allow different traffic patterns during different times of the year. Until development activities are completed, it might be necessary to establish formal traffic lanes in the Kachemak Bay area. Use of Homer as a supply base facility ends in 1987 in the base case but extends to 1991 in the moderate OCS case, although at a relatively low level.

If the access routes to the onshore facilities on Afognak Island cross areas that are heavily fished, voluntary traffic lanes might have to be established to reduce conflicts. The time period for major conflicts between fishing gear and supply boats is only four years in duration, extending from six to nine years after the lease sale (1987 to 1990).

Increased tanker traffic is expected both from Cook Inlet and in Shelikof Strait as a result of Lease Sale No. 60. Given the assumption that Nikiski refineries will have priority use of oil that is processed, Sale No. CI oil requires all of Kenai's existing refining capacity. Thus, traffic increases due to Sale No. 60 will occur from Drift River and Afognak Island. Oil tankers currently use Shelikof Strait, but the level will be substantially increased over that which is expected to occur in the base case.

Except for traffic in the vicinity of ports, vessel traffic will be far short of levels required for establishment of shipping lanes.

'Lease Sales No. 60 and CI for the first time will produce large, man-made structures south of the point at which pilots board deep-draft ships. Lease Sale No. 60 will add only a single structure to both Shelikof Strait and Lower Cook Inlet. Depending upon their location, existing routes may have to be slightly changed, but no actions beyond publication of their position in a local Notice to Mariners and eventually in the Coast Pilot should be necessary.

No impacts on carriers are anticipated. The existing scheduled and seasonal carriers will easily be able to accommodate the forecast increases in induced tonnage. Contract carriers for oil industry activities, since they are able to draw upon a worldwide fleet of supply boats and tugs and barges, should have little problem in satisfying needs for direct OCS logistics. Should large sea-lift operations in the summer months be necessary to support industry activities in the Beaufort and Bering Seas, contract carriers might decide to carry as much freight as possible for Lease Sale No. 60 in the remaining months in order to reduce peak equipment requirements.

4.3.2.4 Issues

The issues for the marine mode in the moderate OCS case differ from the base case in two respects. First, issues for Lower Cook Inlet facilities in the base case are heightened, particularly for Homer where OCS and induced growth traffic will cause significantly greater traffic at the city pier and in the voluntary traffic separation system. Second, Lease Sale No. 60 introduces oil industry activity in Shelikof Strait for the first time. In the absence of existing facilities on Afognak Island, no terminal impacts will occur; and impacts on Shilikof Strait routes will be minimal, despite the increase in tanker traffic.

4.3.3 AIR MODE

4.3.3.1 Description of Activities

For the air mode, four types of activities are discussed, as follows: (1) air carrier passenger traffic by link; (2) passenger movements at terminals; (3) aircraft runway operations; and (4) helicopter operations for OCS activities. It should be kept in mind that airport facilities by and large are not specialized but serve a wide variety of users, from small general aviation planes to wide-body jets. It is assumed that not only are facilities shared but that induced passenger growth and direct OCS-related passengers both use scheduled carriers.

Five air carrier links have been examined, which provide for air movements from Kenai and Homer to interstate and intrastate destinations. Passenger figures are shown on Table 4-10. The increase for the Homer-Anchorage link is the most significant. One-way passengers per week are estimated to be 1,218 in the peak summer months of 1987, an increase of 55% over the base case level of 785 passengers for the same year. The increase is due primarily to construction activities on Afognak Island, since all onshore employees are assumed to be rotated through Homer. For this year, the breakdown of passengers is as follows: 54% population-related (induced), 13% OCS Lease Sale No. CI employees, and 33% Lease Sale No. 60 employees. The majority of trips is population-related, and traffic derived from Lease Sale No. 60 employees is more than twice as great as that from the previous Lower Cook Inlet lease sale.

The 1,218 passenger trip figure, which is the highest level of passenger demand for the entire study period on the link, represents a 53% increase from the previous year. In the base case, no passenger total exceeded 1,000 whereas in the moderate OCS case five years in a row beginning with 1987 produce at least 1,000 one-way passengers per week. By the end of the study period, the moderate OCS case is only 8% above the base case level of passenger activity. Peak passenger demands in J987 will require an estimated 41 commuter and 12 jet flights per week, assuming an equal distribution of passengers between the two types of service. These figures compare with 26 commuter and 8 jet flights for the base case in 1987 and 32 commuter and 9 jet flights for the peak year of base case travel.

The Homer-Kenai link, which carries offshore and Afognak OCS employees who live in the Kenai area in addition to population-related travel, experiences a sizable increase in traffic, though less dramatic than that for the Homer-Anchorage link. Maximum traffic occurs in 1987 for both cases, but the level increases from 144 in the base case to 212 in the moderate OCS case, an increase of 47%. At the end of the study period, the figures are smaller, but the percentage difference is larger. The moderate case figure of 124 one-way passengers per week in 2000 is a 730% increase over the base case figure.

OCS travel--the sum of Lease Sale No. CI and 60 employee trips--is greater than population-induced travel on this link for all years of the study period. The mix of traffic can be divided into three phases. For the first three years of the study period, induced and Lease Sale No. 60 employee travel demands are approximately the same. For the next five years, Lease Sale No. CI is the largest single contributor to travel demand. Thereafter, Lease Sale No. 60 employee movements become the dominant factor. The preference of travelers for non-stop flights from Homer to Anchorage should provide adequate seats on Homer-Kenai flights throughout the study period. The largest estimate for commuter flights per week on the link is 25 for the moderate case compared to 21 for the base case.

Only marginal increases are expected on the Kenai-Anchorage and Kenai-Seattle links which are used to transport non-local, Kenai-based OCS employees. The reason is two-fold. First, most OCS employees not living on the Kenai Peninsula are transported from Homer to Anchorage, either as a final destination or for transfer to another flight. Second, population-related passengers exceed those for OCS activities. On the Kenai-Anchorage link, transportation of OCS employees for Lease Sale No. 60 never exceeds 14 passengers per week. Only a 3% increase in commuter flight requirements occurs in 1988, when the peak demand occurs for the Homer-Kenai link.

Growth on the Anchorage-Seattle link is similar in nature to that on the links where Kenai is the origin. Induced traffic greatly exceeds traffic produced by OCS passengers. Weekly employee movements from Sale No. 60 reach a peak of 382 in 1987, but this figure is only 2% of the total passengers on the link. Compared to the base case, an increase of five weekly jet flights to 161 can be expected in 1987.

All helicopters operating to and from offshore work sites in Lower Cook Inlet and Shelikof Strait and Afognak Island are assumed to be based in Homer. Operations for Lease Sale No. CI and 60 are additive, and the number of helicopter trips per week out of Homer is shown in Table 4-11 for each year of the study period. The increases are substantially above the level of activity in the base case. Only three years in the base case required as many as ten trips per week, whereas in the moderate OCS case each year except the last two years of the study period requires at least this many trips. Peak activity--34 helicopter trips per week--is reached in 1988 and is more than twice that for the base case, 16 trips per week. Helicopter activity can be divided into three phases. From 1982 to 1987, the range is 14 to 18 helicopter trips per week. Then, a minimum of 20 trips per week is required for the next five years. Finally, demand falls to 10 or 11 trips per week for the next seven years.

Table 4-12 shows passenger movements at the Kenai, Homer, and Anchorage airports due to traffic on the five links studied. For the Homer and Anchorage airports, the figures shown are not the totals for the entire airport. Also, the figures do not reflect use of passenger terminals by helicopter or fixed-wing air taxi and charter operators. Nevertheless, the figures do indicate the extent of increased demand for terminal space. As can be expected from the previous discussion of carrier activities, the largest increase in demand is expected at Homer. Passenger movements, which are defined as either a boarding or deplaning, are expected to increase almost three-fold from 1,092 per week in 1978 to 3,118 in 1982. The 1987 figure is 45% greater than the figure for the same year in the base case. The percentage increases forecast for terminal facilities in Kenai and Anchorage are more modest than those for Homer. None of the surges in usage at any of the airports is as great as the figure at the end of the study period. The greatest increase over the base case for Kenai is 8% and is in 1990 while for Anchorage it occurs in 1987 and is 5%. Compared to 1978 figures, the increase in passenger movements for the five links studied is 80% at Kenai and 64% at Anchorage.

Airport operations at Kenai, Homer, and Soldotna can be expected to increase proportionately with population because of the dominance of air taxi and general aviation operations. Thus, a large increase in operations at Homer can be expected in the mid-1980's. The growth rate factor for the community increases from 1.27 in 1984 to 1.77 in 1988, an average of 0.11 per year. The total increase for the same period in the Kenai-Soldotna area is only 0.21. General aviation activities will increase in the Anchorage area also, but this growth will be accommodated primarily by satellite airports in the Anchorage area rather than by Anchorage International Airport.

4.3.3.2 Terminal Impacts

Four categories of terminal impacts for the air mode are considered, as follows: (1) aircraft operations on runways and the use of aprons and taxiways; (2) navigational aids; (3) runway strength and length; and (4) passenger terminal facilities.

The extent of impacts for two of the categories remains relatively unchanged from the base case. They are aircraft operations and runway strength and 1 ength. Annual operations will remain within the theshold values computed for the Kenai, Soldotna, and Homer facilities, based on the assumption that increased operations are proportional to population growth. Length and strength considerations are expected to be the same in the mean OCS case as in the BM case, since no larger or heavier aircraft are forecast to use facilities in the study area. An increase in air cargo shipments to Kenai and Homer is likely because of Lease Sale No. 60, but not so much as to create congestion or cause accelerated deterioration of runways. However, as for the base case, pavement condition should be carefully monitored and asphalt overlays provided in advance of when damage can be expected. Planning for ground-side facilities in Homer and Kenai should consider freight shipments of OCS materials and seafood as in the base case. In addition, at Homer the extensive helicopter operations will produce demands for apron space and hangars for maintenance and storage.

Control towers will be justified at Soldotna and Homer in the base case during the study period. For Homer, justification will occur at an earlier date because of significant population increases and the high level of helicopter activity.

As in the base case, passenger terminal improvements will be required in all communities. Improvements in Soldotna, Kenai, and Anchorage that are needed as a result of the base case should also be adequate for the moderate OCS case. No significant changes in timing are forecast because of the small differences between the two cases for a given year. At Homer, the situation is different, for two reasons. First, the difference in passenger movements between the cases is significant, being 19% in 1982 and increasing to 45% in 1987. Such increases will create the need for terminal improvements earlier than in the base case. Second, the peak value in 1987 is not reached again by the end of the study period. If construction occurs to handle the 1987 demand, overbuilding will result. In the base case, on the other hand, induced growth in the later years was sufficient after development activities to create only a short span when overcapacity would occur. The 1988 peak was surpassed in 1994. A decision in the moderate OCS case to live with terminal congestion for several years rather than provide space that would not be fully needed until 15 years later would create impacts not occurring in the base case.

4.3.3.3 Impact on Carriers

The impact on carriers for each link depends upon the growth in demand and link characteristics, including the distance from Anchorage and relationship to other links. Significant growth is expected for the Homer to Anchorage link, and a higher percentage of travelers are expected to fly by jets as their frequency of service increases compared to that of small commuter-type aircraft. By 1987, two jet flights per day (14 flights per week) can be expected on the Homer to Anchorage link. At least one and possibly both will originate in Kodiak. Such a level of service will be large enough to attract competition by other carriers operating medium-size passenger aircraft. Great Northern, which operates Convair turbo-prop planes, already has expressed an interest in serving cities in the Lower Cook Inlet area, as well as Kodiak and Dutch Harbor.

Growth in jet flights--currently operated only by Wien--will experience the largest increase, going from a current level of two flights per week to a maximum of 12 per week, but commuter flights will also increase. In the base case, no increase was forecast for commuter flights since most of the growth was absorbed by jet traffic, but in the moderate OCS case the current level of 26 flights per week is forecast to increase to a minimum of 41 by 1987. Such an increase most likely will cause introduction of another commuter carrier on the link. Currently, AAI is the only commuter airline with permanent authority to serve Anchorage from either Kenai or Homer. Growth in traffic originating in Homer will be such that a flight might originate in Homer with a final destination in Seattle and an intermediate stop in Kodiak or Kenai.

Increases in traffic on the Anchorage-Seattle link and the two links originating in Kenai--Kenai-Anchorage and Kenai-Seattle--can easily be handled by existing carriers through incremental additions to service. The existing service on the Kenai-Seattle link, which is three jet flights per week, should be minimally adequate throughout the study period. Besides the existing carriers operating between Anchorage and Seattle, several others have recently received authority from the CAB to operate between them. Even if they choose to do so, they are not expected to significantly cut into existing market shares.

The increase in travel demand on the Kenai-Anchorage route will create greater impetus for competition among at least two commuter airlines. Jet travel between Kenai and Anchorage is not considered likely, but extension of Wien's Seattle to Kenai flights to Anchorage is a possibility.

For the Homer-Kenai link, the increase in traffic is due primarily to movements of OCS employees. Based on the assumption that Homer-Anchorage passengers will favor non-stop flights, the growth in population-related passengers will be small. The direct OCS travel will enable the level of service to remain at current levels and probably even slightly increase. If OCS employees were to be moved between Homer and Kenai on buses or charter aircraft, the link would see no increase in the level of service and conceivably could even see a cutback in service.

4.3.3.4 Issues

The additional growth expected in the moderate OCS case compared to the base case produces an increased emphasis of several issues. Improvements in passenger terminals continue to be the focus of capital improvements that are required to meet increased air travel. Of particular concern is Homer, where demands mid-way through the study period will be in excess of those that come afterwards. If a percentage of helicopter operations are located in Kenai or Kodiak, the impacts could be significantly smaller. Shifting some of the logistics for the Shelikof Strait activities to Kodiak would be a distinct possibility. Some OCS-related helicopter activities in Kodiak can be expected because of Sale No. 46 (Western Gulf of Alaska).

The increase in carrier operations, especially on links originating in Homer, will create demand for additional service by existing carriers but will also create opportunities for new carriers to enter the expanding markets. Also, growth in the Homer market might cause new routes to be established, such as a commuter airline flight between Kodiak and Homer or jet flights to Anchorage or Seattle originating in Homer. It is now only an intermediate stop for jet flights.

4.3.4 LAND MODE

4.3.4.1 Description of Activities

The moderate OCS case will produce growth in three categories of highway users, as follows: (1) private vehicles; (2) commercial trucking handling direct OCS materials; and (3) other commercial trucking activities.

Private vehicle usage of intercity highways is substantially greater during summer months because of the Kenai Peninsula's recreational opportunities during that period. The private vehicle category includes automobiles, pick-ups, recreational vehicles, and vehicles with boat trailers and makes up approximately 90% of traffic. Steady growth in traffic is anticipated but not greatly in excess of that forecast for the base case because of the small differences in population for the Anchorage region. Anchorage-based traffic is a significant contributor to traffic on the Kenai Peninsula intercity road system because of its large population base, and the desire of its residents to seek out-of-town recreation on summer weekends.

OCS-related trucking will occur primarily from Kenai to Homer but shipments from Anchorage to Kenai and Homer can also be expected. The increase in activity over the base case should be modest. The Lower Cook Inlet field in Sale No. 60 is relatively small, only one-half that forecast for Sale No. CI. Beginning with development, logistics for Shelikof Strait are handled out of Afognak Island. Helicopter shipments of miscellaneous parts and supplies will continue out of Homer to all platforms throughout the study period, but quantities will be limited and a sizable percentage will reach Homer by air freight. Other commercial trucking activities to Homer and Kenai will increase as populations of the communities grow.

4.3.4.2 Roadway Impacts

Increasing congestion, particularly on the road section between Kenai and Anchorage, has been forecast for base case conditions. Although the traffic increase caused by the moderate OCS case will be relatively small, impacts on capacity will occur; and the level of service will further deteriorate. The capacity problems will be due more to private automobiles than trucking because of their dominance of traffic. Nevertheless, trucks have high auto equivalences on mountainous terrain, and their role on capacity must also be considered.

The level of truck traffic is not expected to produce accelerated deterioration of the Seward or Sterling Highways because the tonnages will not be large and enforcement will be possible between Anchorage and Kenai Peninsula destinations. To provide an enforcement capability between Homer and Kenai would require an additional scalehouse. One might be warranted if truck traffic on this link becomes substantial.

4.3.4.3 Carrier Impacts

The trucking industry historically has been able to respond quickly to increases in demand. Numerous carriers currently have the authority to operate between Anchorage and the Kenai Peninsula and within the Peninsula, Adequate competition will exist without the introduction of new carriers, and growth in the supply of services can be expected to occur by existing carriers rather than by the emergence of major new carriers. Growth can be expected to be greater in the short-haul business between Kenai and Homer during the development phase, but growth in the long-haul business to and from Anchorage should also take place. Growth in local demands for goods and building materials as population and employment grows in Homer and Kenai will further increase the feasibility of a regional port facility. Should one be developed, a large amount of long-haul truck traffic will be lost to the marine mode. The availability of greater frequency of marine carriers to Anchorage will never eliminate trucking from Anchorage, but a regional port would significantly affect existing tonnage levels.

4.3.4.4 Issues

The three issues raised in the base case exist in the moderate OCS case. They concern the availability of adequate funding to provided needed capacity on Kenai Peninsula roads, the likelihood of a regional port developing at either Kenai or Homer, and the extent to which recreational travel will grow. No developments in the moderate case point to any of these issues as being more important than they were for the base case. No changes from the base case are anticipated for the railroad or pipeline modes.

4.3.5 SUMMARY COMPARISON OF MODERATE OCS CASE WITH BASE CASE

In general, transportation demands and impacts of the moderate OCS case can be viewed as extensions of the base case, since activities are oriented around the communities of Homer and Nikiski, which was also true for OCS Lease Sale No. CI. However, growth and impacts are not always uniform in their distribution by mode or by community.

For the marine mode, impacts will be greatest at Homer, where no dedicated facilities for supply boats currently exist. Increases there in the demand for general cargo will also further the need for additional medium-draft port facilities. At Kenai-Nikiski, impacts will be limited. The existing facilities can provide the required three supply boat berths needed during peak demand periods. Increases in oil shipments from Drift River are expected to absorb most of the increase in production. No new construction in the Nikiski area is forecast. Impacts on Afognak Island will be the result of completely new facilities. The need for a support base facility is limited to the development and production phases, since all exploration activities will be handled from Nikiski and Homer. New facilities for general cargo will be required at either Kenai or Homer earlier in the study period than in the base case.

Facility demands for the air mode will increase dramatically in the moderate OCS case at Homer. Apron space and hangars will be required to handle the increase in helicopter operations to Lower Cook Inlet and Shelikof Strait work sites. The increase in passenger movements through Homer will create the need for a larger passenger terminal much earlier in the study period.

Table 4-1

Lower Cook Inlet - Statistical Mean Resource Level Scenario - Sale No. 60
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.	Pipe Const. (mi.) Offshore	Oil Production Wells (Onshore Loading)[2]
1982	1	1				3			
1983	2	2				6			
1984	3	2				7			
1985	4	1				2			
1986	5								
1987	6		1S						
1988	7			2	2		12		
1989	8			2	2		12		15
1990	9			2	2		12		25
1991	10			2	2		12		35
1992	11								40
1993	12								40
1994	13								40
1995	14								40
1996	15								40
1997	16								40
1998	17								40
1999	18								40
2000	19								40
2001	20								40

Notes: (1) S = Steel
(2) Based on wells producing by July of each year.

Source: Dames and Moore, 1979.

Table 4-2
Shelikof Strait Field - Statistical Mean Resource Level Scenario - Sale No. 60
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	Pipe Const. (mi.) Onshore	Pipe Const. (mi.) Offshore	Oil Production Wells (Onshore Loading) (2)	Onshore Facility Construction
1982	1	2				6					
1983	2	2				6					
1984	3	2				6					
1985	4	2				4					ASB(0.5/1)
1986	5										AOIL(0.5/2.5), ASB(1/1)
1987	6		1s								AOIL(1.5/2.5)
1988	7				2		9	2	20		AOIL(2.5/2.5)
1989	8			2	2		12			13	
1990	9			2	2		12			23	
1991	10			2	2		12			33	
1992	11			2			3			40	
1993	12									40	
1994	13									40	
1995	14									40	
1996	15									40	
1997	16									40	
1998	17									40	
1999	18									40	
2000	19									40	
2001	20										

Notes: (1) S = Steel
(2) Based on wells producing by July of each year.
(3) ASB(1/1) = Facility(Years under Construction/Years to Construct); ASB= Afognak Supply Base; AOIL = Afognak Oil Terminal.

Source: Dames and Moore, 1979.

Table 4-3

Regional Population Projections: Mean OCS - Mean Base Case(MBM)

	Mean OCS-Mean Base Case (MBM)		Growth Rate Factors Mean OCS-Mean Base Case(MBM)[1]		Incremental Growth Rate Factors (MBM)[2]		% Pop. Diff. (MBM-BM)	
Year	South-central	Anchorage	South-central	Anchorage	South-central	Anchorage	South-central	Anchorage
1977	58,904	183,606		-	-			
1982	60,567	201,050	1:03	1.10	.01		.01	
1983	60,916	210,715	1.03	1.15	.01		.01	
1984	63,103	212,116	1.07	1.16	.01		.01	
1985	62,999	213,119	1.07	1.16	.01		.01	
1986	62,758	215,783	1.07	1.18	. -			
1987	64,211	219,912	1.09	1.20	.02		.01	
1988	65,683	225,759	1.12	1.23	.02	.01	.02	-
1989	67,095	231,677	1.14	1.26	.03	.01	.02	.01
1990	68,552	236,831	1.16	1.29	.03	.01	.03	.01
1991	67,979	241,870	1.15	1.32	.03	.01	.03	.01
1992	67,723	246,515	1.15	1.34	.02	.01	.02	.01
1993	68,270	251,404	1.16	1.37	.02	.01	.02	.01
1994	69,291	256,731	1.18	1.40	.03	.01	.02	.01
1995	70,135	262,482	1.19	1.43	.03	.01	.02	.01
1996	71,191	268,960	1.21	1.46	.03	.01	.02	.01
1997	72,211	275,663	1.23	1.50	.03	.01	.02	.01
1998	73,316	282,866	1.24	1.54	.03	.01	.02	.01
1999	74,532	290,443	1.27	1.58	.03	.01	.02	.01
2000	76,311	295,847	1.30	1.61	.03	.01	.02	.01

NOTES : (1) Growth rate factors derived by dividing forecast year population by 1977 population.
(2) Incremental growth rate factors derived by subtracting BM population from MBM population and dividing by 1977 population.

Source: ISER, 1979.

Table 4-4

Community Areawide Population Projections: Mean OCS - Mean Base Case(MBM)

Year	Mean OCS-Mean Base (MBM) Kenai Area	Mean OCS-Mean Base (MBM) Homer Area	Growth Rate Factors Mean OCS-Mean Base Case(MBM)[1] Kenai Area	Growth Rate Factors Mean OCS-Mean Base Case(MBM)[1] Homer Area	Incremental Growth Rate Factors (MBM)[2] Kenai Area	Incremental Growth Rate Factors (MBM)[2] Homer Area	% Pop. Diff. (MBM-BM) Kenai Area	% Pop. Diff. (MBM-BM) Homer Area
1978	13,397	5,081	-	-	-	-	-	-
1982	15,777	5,858	1.18	1.15	.01	.04	.01	.03
1983	15,954	6,163	1.19	1.21	.02	.05	.01	.04
7984	16,494	6,438	1.23	1.27	.02	.05	.01	.04
1985	16,931	6,776	1.26	1.33	.01	.03	.01	.02
1986	17,562	7,259	1.31	1.43	-		-	
1987	18,392	7,968	1.37	1.57	.02	.06	.02	.04
1988	19,229	8,682	1.44	1.71	.04	.09	.03	.06
1989	19,325	8,715	1.44	1.72	.04	.11	.03	.07
1990	20,002	9,316	1.49	1.83	.06	.15	.04	.09
1991	20,328	9,437	1.52	1.86	.06	.15	.04	.09
1992	20,700	9,673	1.55	1.90	.05	.14	.03	.08
1993	20,926	9,727	1.56	1.91	.03	.09	.02	.05
1994	21,537	10,114	1.61	1.99	.04	.11	.03	.06
1995	22,010	10,408	1.64	2.05	.04	.11	.03	.06
1996	22,512	10,717	1.68	2.11	.04	.11	.03	.06
1997	22,889	10,943	1.71	2.15	.04	.11	.03	.05
1998	23,313	11,182	1.74	2.20	.04	.11	.03	.05
1999	23,350	11,073	1.74	2.18	.04	.11	.03	.05
2000	23,398	11,427	1.75	2.25	.01	.11		.05

NOTES : (1) Growth rate factors derived by dividing forecast year population by 1978 population.
(2) Incremental growth rate factor derived by subtracting BM population from MBM population and dividing by 1978 population.

Source: Alaska Consultants, 1979

Table 4-5
Logistics Requirements for Drilling - Mean OCS Scenario

Years After Lease Sale (Calendar Year)		Nikiski (1) Tons per Year: Drill Pipe	Dry Bulk	Fuel	Dry Goods Sale CI	Total Dry Goods	Incoming(2) Barges	Afognak Tons per Year: Drill Pipe	Dry Bulk	Fuel	Total Dry Goods	Incoming(2) Barges	Incoming(3) Tankers
1	(1982)	4,244	B,100	14,400	8,229	20,573	4						
2	(1983)	5,658	10,800	19,200	11,360	27,818	5						
3	(1984)	6,130	11,700	20,800	22,720	40,550	7						
4	(1985)	2,829	5,400	9,600	28,401	36,630	7						
5	(1986)				24,614	24,614	5						
6	(1987)				11,360	11,360	2						
7	(1988)	5,192	6,168	19,200		11,360	2	3,894	6,939	12,339	10,833	2	
8	(1989)	5,192	6,168	19,200		11,360	2	5,192	9,252	16,452	14,444	3	
9	(1990)	5,192	6,168	19,200		11,360	2	5,192	9,252	16,452	14,444	3	
10	(1991)	5,192	6,168	19,200		11,360	2	5,192	9,252	16,452	14,444	3	
11	(1992)							1,298	2,313	4,113	3,611	1	

Notes: (1) Fuel requirements for Nikiski are assumed to be provided from local refineries.
(2) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(3) Fuel tankers = (Fuel tonnage)/(5,000 tons/tonnage).

Source: Peter Eakland and Associates, 1979.

Table 4-5 (Continued)
Logistics Requirements for Drilling - Mean OCS Scenario

Years After Lease Sale (Calendar Year)		Homer							
		Tons per Year							
		Dry Bulk	Fuel	Dry Goods Sale CI	Fuel Sale CI	Total Dry Goods	Total Fuel	Incoming(z) Barges	Incoming(3) Tankers
1	(1982)	4,050	7,200	2,700	4,800	6,750	12,000	2	3
2	(1983)	5,400	9,600	3,084	5,484	8,484	15,084	2	3
3	(1984)	5,850	10,400	6,168	10,968	12,018	21,368	2	5
4	(1985)	2,700	4,800	7,710	13,710	10,410	18,510	2	4
5	(1986)			6,682	11,882	6,682	11,882	2	3
6	(1987)			3,084	5,484	3,084	5,484	1	2
7	(1988)	3,084	9>600			3,084	9,600	1	2
8	(1989)	3,084	9,600			3,084	9,600	1	2
9	(1990)	3,084	9,600			3,084	9,600	1	2
10	(1991)	3,084	9,600			3,084	9,600	1	2

Source: Peter Eakland and Associates, 1979.

Table 4-6
Estimated Logistics Requirements
For Pipe Laying and Construction - Mean Resource Scenario

	Nikiski (1) (tons) (2)						Afognak (tons) (2)	
Year	Uncoated Pipe	Cement	Coated Pipe	Throughput Tonnage	Inbound Barges	Outbound Barges	Uncoated Pipe	Inbound Barges
1987	4,460	322		4,782	1	0		
1988				7,018	0	2	420	1

Barge Estimates (*)

	1985	1986	1987	1988	1989
Nikiski (1)(3)					
Inbound pipeline barges	(7)	(11)	1		
Outbound pipeline barges		(4)	(10)	2	
	7	15	11	2	
Afognak - Inbound					
Support base	2	2			
Construction Equipment	2				
Construction camp	2				
Oil terminal - 192,000 bpd		3	4		
Onshore pipeline				1	
	6	5	4	1	

Notes: (1) All offshore pipeline materials are first delivered to Nikiski for coating the year before installation and then sent to work sites by barge.
(2) Tons can be converted to metric figures using the factor 0.90718.
(3) Numbers in parentheses refer to Sale CI materials.

Source: Peter Eakland and Associates, 1979.

Table 4-7
Average Monthly Consumable Demands, Lower Cook Inlet
Mean Base Mean

Year	Mean Scenario-Tons(1)			Sale CI-Tons(1)		Total MBM-Tons(1)		
	Kenai	Homer	Afognak	Kenai	Homer	Kenai	Homer	Afognak
1982	7.8	17.4	16.8	5.3	25.5	13.1	42.9	16.8
1983	10.4	28.8	16.8	5.3	24.0	15.7	52.8	16.8
1984	10.4	29.1	16.8	4.7	24.5	15.1	53.6	16.8
1985	5.3	11.4	38.1	17.1	54.0	22.4	65.4	38.1
1986	0	0	8.4	29.4	89.0	29.4	89.0	8.4
1987	4.7	24.2	35.7	16.2	74.7	20.9	98.9	35.7
1988	4.2	18.3	78.9	5.4	71.3	9.6	89.6	78.9
1989	.9	20.6	26.0	5.4	39.5	6.3	60.1	26.0
1990	1.8	24.3	33.8	5.4	22.4	7.2	46.7	33.8
1991	1.8	24.3	33.8	5.4	24.9	7.2	49.2	33.8
1992	1.8	7.5	19.5	5.4	27.2	7.2	34.7	19.5
1993	1.8	7.5	15.2	5.4	27.2	7.2	34.7	15.2
1994	1.8	9.8	18.6	5.4	27.2	7.2	37.0	18.6
1995	1.8	9.8	18.6	5.4	27.2	7.2	37.0	18.6
1996	1.8	9.8	18.6	5.4	27.2	7.2	37.0	18.6
1997	1.8	9.8	18.6	5.0	23.4	6.8	33.2	18.6
1998	1.8	9.8	18.6	3.6	19.7	5.4	29.5	18.6
1999	1.8	9.8	18.6			1.8	9.8	18.6
2000	1.8	9.8	18.6			1.8	9.8	18.6

NOTES : (1) Tons = (Offshore onsite + onshore onsite non-local(z) employment) x (300 lbs/person) ÷ (2,000 lbs/tons.
(2) for Afognak total onshore onsite employment.

Source: Peter Eakland and Associates, 1979.

Table 4-8
Monthly Supply Boat Round-trips by Service Base - Mean Resource Level Scenario (Sale No. 60)

Years After Lease Sale (Calendar Year)	Lower Cook Inlet			Shelikof Straits			Nikiski			Minimum Berth Requirements	Homer			Minimum Berth Requirements	Afognak	
	Exploration	Development	Production	Exploration	Development	Production	Sale No. 60	Sale No. CI	Total		Sale No. 60	Sale No. CI	Total		Sale No. 60	Minimum Berth Requirements
1 (1982)	12			24			24	32	56	2	12	16	28	1		
2 (1983)	24			24			32	43	75	2	16	21	37	1		
3 (1984)	24			24			32	69	101	3	16	35	51	2		
4 (1985)	12			24			32	67	99	3	16	33	49	2		
5 (1986)								86	86	3		41	41	2		
6 (1987)		24			24		16	67	83	3	8	2B	36	1	24	1
7 (1988)		40	4		83		31	12	43	2	13		13	1	83	3
8 (1989)		40	4		40	4	31	12	43	2	13		13	1	44	2
9 (1990)		40	4		40	4	31	12	43	2	13		13	1	44	2
10 (1991)		40	4		40	4	31	12	43	2	13		13	1	‘4	1
11 (1992)			4			4	4	12	16	1					4	1
12 (1993)			4			4	4	12	16	1					4	1
13 (1994)			4			4	4	12	16	1					4	1
14 (1995)			4			4	4	12	16	1					4	1
15 (1996)			4			4	4	8	12	1					4	1
16 (1997)			4			4	4	8	12	1					4	1
17 (1998)			4			4	4	4	8	1					4	1
18 (1999)			4			4	4		4	1					4	1
19 (2000)			4			4	4		4	1					4	1
20 (2001)			4			4	4		4	1					4	1

Source: Peter Eakland and Associates, 1979.

Table 4-9

Mean Resource Level Scenario - Oil and Gas Production and Transportation (1)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Oil Production (MMBBL) (2)														
Upper Cook Inlet	14.2	12.5	10.9	9.6	8.5	7.4	6.5	5.7						
Lower Cook Inlet (Sale No. CI) (3)	61.3	67.0	60.7	47.6	33.6	25.1	18.0	12.9	9.2	6.8	2.9			
Lower Cook Inlet (Sale No. 60)	–	11.2	21.0	28.0	28.0	25.3	19.9	15.8	12.6	10.0	8.0	6.3	5.0	4.0
Total	75.5	90.7	92.6	85.2	70.1	57.8	44.4	34.4	21.8	16.8	10.9	6.3	5.0	4.0
Nikiski-refinery capacity (70,500bpd)	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
Drift River-crude exports	49.8	65.0	66.9	59.5	44.4	32.1	18.7		8.7	-	-	-		
Nikiski-refined exports	12.6	12.6	12.6	12.6	12.6	12.6	12.6		12.6	8.7	3.7	-	-	-
Shelikof Strait		28.0	52.6	70.1	70.1	63.0	49.8	38.1	29.8	23.4	18.3	14.3	11.2	8.8
Oil Tanker Traffic (Round-trips/year) (4)														
Total Nikiski-25,000 DWT	66	66	66		66	66	66	66		45	20	-	-	-
Total Drift River-40,000 DWT	161	210	217	1::	144	104	61	28	-	-	-	-	-	-
Total Afognak-120,000 DWT	0	31	57	76	76	68	54	41	33	26	20	16	13	10

Notes: (See following page.)

Source: Peter Eakland and Associates, 1979, except as noted. Production figures from Oames and Moore, 1979.

Table 4-9 (Continued)
Mean Resource Level Scenario - Oil and Gas Production and Transportation (Cent'd)

Notes: (1) Analysis based primarily on offshore oil and gas production. Production and transportation for 1982-1987 are the same as in the base case.

(2) Analysis assumes Nikiski's refineries will operate at capacity as long as supplies are adequate. It is further assumed that of the 70,500 bpd refined 36,000 bpd will go to Anchorage by pipel inc. The remaining 34,500 will be exported to communities within Alaska. All oil production not refined at Nikiski is assumed to be exported as crude from Drift River to Lower 4a refineries.

(3) Mean resource level scenario used for Sale No. CI.

(4) Tanker sizes based on data developed by ERCO/Frankel in "Study to Assess the Impart of Alaskan Petroleum Development on the Coast Guard through the Year 2000," 1978. Round-trips/year = (production in mmbbl)/(7.74)(tanker size in DWT).

Table 4-10

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

	Homer - Anchorage						Homer - Kenai				
	Passengers				Flight		Passengers				Flights
Year	Induced	Sale CI	Mean OCS (MBM)	Total	Jet	Commuter	Induced	Sale CI	Mean OCS (MBM)	Total	Commuter
1982	436	68	91	595	6	20	29	15	25	69	16
1983	467	65	124	656	6	22	31	15	33	79	16
1984	498	71	125	694	7	23	32	22	33	87	17
1985	529	124	88	741	7	25	34	43	21	98	18
1986	582	203	10	795	8	27	36	86	2	124	19
1987	654	159	405	1,218	12	41	40		45	177	23
1988	727	103	355	1,185	11	39	43	1%	66	212	25
1989	733	51	246	1,030	10	34	43	69	69	181	23
1990	790	12	255	1,057	10	35	46	50	94	190	24
1991	806	13	248	1,067	10	36	47	55	94	196	24
1992	826	14	27	867	8	29	48	57	58	163	22
1993	832	14	19	865	8	29	48	57	53	158	22
1994	873	14	22	909	9	30	50	57	67	174	23
1995	905	14	22	941	9	31	52	57	67	176	23
1996	936	14	22	972	9	32	53	57	67	177	23
1997	957	12	22	991	10	33	54	54	67	175	23
1998	983	10	22	1,015	10	34	55	50	67	172	23
1999	972		22	994	10	33	55		67	172	19
2000	1,009		22	1,031	10	34	57		67	124	19

Source: Peter Eakland and Associates, 1979.

Table 4-10(Continued)
Induced and OCS Weekly Air Travel - Mean OCS - Mean Base Case(MBM)

Year	Kenai - Anchorage Passengers Induced	Sale CI	Mean OCS (MBM)	Total	Flights Commuter	Kenai - Seattle Passengers Induced	Sale CI	Mean OCS (MBM)	Total	Flights Jet
1982	1,892	164[1]	10	2,066	147	136	60[1]	6	202	3
1983	1,908	58[1]	14	1,980	141	137	22[1]	8	167	2
1984	1,972	8	14	" 1,994	142	142	1	8	151	2
1985	2,020	16	7	2,043	145	145	6	4	155	2
1986	2,100	28	0	2,128	151	151	10	0	161	2
1987	2,197	12	8	2,217	157	158	5	1	164	2
1988	2,309	3	6	2,318	163	166	1	2	169	2
1989	2,309	3	2	2,314	163	166	1	1	168	2
1990	2,389	3	2	2,394	168	172		1	173	2
1991	2,437	4	2	2,443	172	175		1	176	2
1992	2,485	4	2	2,491	175	179		1	180	3
1993	2,501	4	2	2,507	176	180		1	181	3
1994	2,581	4	2	2,587	181	186		1	187	3
1995	2,629	4	2	2,635	184	189		1	190	3
1996	2,694	4	2	2,700	188	194		1	195	3
1997	2,742	4	2	2,74a	192	197		1	198	3
1998	2,790	4	2	2,792	194	201		1	202	3
1999	2,790		2	2,792	194	201		1	202	3
2000	2,806		2	2,808	196	202		1	203	3

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-10(Continued)
Induced and OCS Weekly Air Travel - Mean OCS - Mean Base Case (MBM) (Table Continued)

Year	Anchorage-Seattle Passengers Induced	Sale CI	ANC-SEA Other OCS	Mean OCS (MBM)	Total	Flights Jets
1982	14,032	116 (1)	776	85	15,009	147
1983	14,670	76 (1)	1,210	116	16,072	157
1984	14,797	70	1,128	117	16,112	157
1985	14,797	125	322	72	15,316	150
1986	15,053	200	454	5	15,712	153
1987	15,308	154	638	382	16,482	161
1988	15,690	86	904	324	17,004	166
1989	16,073	40	1,189	238	17,540	171
1990	16,456	1	1,020	238	17,715	173
1991	16,838	1	821	227	17,887	175
1992	17,094	1	723	11	17,829	174
1993	17,476	1	629	2	18,108	177
1994	17,859	1	48	2	17,910	175
1995	18,242	1	25	2	18,270	178
1996	18,624	1	9	2	18,636	182
1997	19,134	1	2	2	19,139	187
1998	19,645	1	2	2	19,650	192
1999	20,155		1	2	20,158	197
2000	20,538			2	20,540	201

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-11
Weekly Helicopter Round-trips from Homer
Mean Base Mean

Year	Total Offshore Average Mcthly Employment (1)	Peak Weekly Round-trips (2)	Helicopter Trips Per Week (3)	Helicopter Trips per Week (2) Sale CI	Total Helicopter Trips Per Week (3)
1982	355	119	9	5	14
1983	473	158	12	5	17
1984	475	159	12	5	17
1985	435	119	9	9	18
1986	62	13	1	16	17
1987	661	211	16	15	31
1988	1,009	304	22	12	34
1989	589	197	15	7	22
1990	700	234	17	3	20
1991	700	234	17	3	20
1992	286	96	7	4	11
1993	228	77	6	4	10
1994	289	97	7	4	11
1995	289	97	7	4	11
1996	289	97	7	4	11
1997	289	97	7	3	10
1998	289	97	7	3	10
1999	289	97	7		7
2000	289	97	7		7

NOTES: (1) Total employment includes offshore 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. Afognak is treated as an "offshore site" and offshore employment added with offshore Homer employment.

(2) Peak weekly trips = (0.717 round-trips per month) x (2.0 peak factor) ÷ 4.3 weeks per month for all employees except for construction employees on Afognak where .430 round-trips per month are used.

(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979

Table 4-12
Passengers Handled Weekly at Airport Terminals for Selected Years[1] - Lower Cook Inlet OCS Development, Mean Base Mean (MBM)

Kenai Airport

Year	Passengers[2] Mean Base (BM) Case	Passengers[2] Mean Base Mean(MBM)	Percent Change OCS over BM Case
1978	3,486	3,486	
1982	4,522	4,674	.03
1988	5,108	5,398	.06
1990	5,106	5,514	.08
2000	6,090	6,270	.03

Homer Airport[3]

Year	Passengers[2] Mean Base (BM) Case	Passengers[2] Mean Base Mean(MBM)	Percent Change OCS over BM Case
1978	1,092	1,092	-
1982	1,390	1,656	.19
1987	2,152	3,118	.45
2000	2,338	2,638	.13

Anchorage Airport[4]

Year	Passengers[2] Mean Base (BM) Case	Passengers[2] Mean Base Mean(MBM)	Percent Change OCS over BM Case
1978	29,760	29,760	
1982	36,170	36,892	.02
1987	39,138	41,110	.05
1988	40,978	42,822	.04
1989	42,674	44,146	.03
2000	48,302	48,758	.01

Notes: (1) Years selected are those which showed greatest increase from previous years in OCS Case, in addition to years 1982 and 2000.
(2) Total of enplaning and deplaning passengers.
(3) Kodiak to Homer trips are not included.
(4) For Anchorage airport, OCS passengers from previous lease sales are considered as well as total passengers on Anchorage-Seattle link.

Source: Peter Eakland and Associates, 1979.

The increase in passenger traffic could cause additional scheduled carriers to enter Homer markets, since at present scheduled jet and commuter operations to and from Homer are each operated by a single carrier. Also, construction of a control tower at Homer will be justified earlier than in the base case. The timing of improvements required at other airports in the prime study area--Anchorage, Kenai, and Soldotna--will not change more than several years.

Increased commercial truck and private vehicle traffic, especially the latter, will not be dramatic but will cause increased impacts because of the congested condition that will exist midway through the study period. Ultimate highway capacity will not be reached, but free-flow traffic conditions will no longer exist during summer weekends.

4.4 Low OCS Case

4.4.1 FACTORS CAUSING GROWTH

The low OCS case is a combination of base case conditions and an exploration-only scenario in both the Lower Cook Inlet and Shelikof Strait portions of Lease Sale No. 60. It is assumed for this case that the exploration does not yield any economic discoveries of either oil or gas.

All drilling activities occur within three years after the lease sale, and no impacts extend afterwards. A total of 19 wells are drilled, eight in Lower Cook Inlet and 11 in Shelikof Strait. Table 4-13 lists the number of wells drilled as a result of Lease Sale No. 60. Tables 4-14 and 4-15, respectively, provide the regional and local population forecasts.

Comparisons of populations in the moderate and low OCS cases with those in the base case are virtually identical for the first two years of the study period. The incremental growth rate factors for Anchorage, Kenai, and Homer as shown in Tables 4-14 and 4-15 are the same for both cases. In the third year, the exploration program for the low OCS case is cut back whereas in the moderate case the level of activity is maintained and continued into a fourth year. The peak year of activity for the low case, thus, is the second year after the lease sale, 1983. The timing of exploration activities in the low scenario for Lease Sale No. 60 coincides with the beginning of development activities for Sale No. CI. In 1983, the second of three platforms is installed, and development drilling begins. By the time Sale No. CI activities peak, low case activities for Sale No. 60 have ended.

The limited duration of activities in the low scenario does not create any new stimuli to local and regional growth. Even the growth that does re-suit from 1982 to 1984 is not sufficient to produce even a temporary peak in population; no population in the first three years is greater than the figure for the following year.

4.4.2 WATER MODE

4.4.2.1 Description of Activities

Three categories of marine activity in the low case will be briefly described, as follows: (1) industrial freight; (2) supply boat movements and berths; and (3) induced growth. The transportation of oil and gas has not been included since no economic discoveries result from exploration activities in the low scenario of Lease Sale No. 60. Assumptions regarding the use of marine facilities are the same as those used for 'exploration in the moderate OCS scenario. Nikiski will handle all drill pipe, Homer will serve as a forward supply base, and no facilities will be constructed in Shelikof Strait.

The extent of drilling in the three years of the low case is somewhat less than drilling in the moderate scenario for the same years. The largest difference occurs in the third year when only two wells are drilled compared to 13 for the moderate case. In the first two years, the figures of seven and 10 wells are only two less than the corresponding figures for the moderate case.

4.4.2.1.1 Industrial Freight

Table 4-16 contains a listing of tonnages likely to be handled by facilities in Nikiski and Homer as a result of Sales No. CI and 60. The total figures are slightly less than those for the moderate case. The estimated number of barges in the low case is 13 at Nikiski for the three years which compares to 16 for the moderate case. For Homer, the three-year totals are five for the low case and six for the moderate case.

Construction activities are absent from the low scenario, although even in the moderate scenario construction requiring logistics support from Nikiski or Homer were limited to 37 km (23 mi.) of offshore pipeline. Consumable demands, likewise, are less in the low case than would occur in the moderate case. The three-year figures, as shown in Table 4-17, are considerably smaller than those that occur later in the study period when development drilling and construction for Sale No. CI take place.

4.4.2.1.2 Supply Boat Movements and Berths

The number of supply boat movements in 1982 and 1983 are forecast to be the same for the low and moderate cases during summer months. Despite a lower level of annual activity in the low case, the same number of drilling rigs are used; and logistics requirements will be the same during periods when they are all operating. While activities of the low scenario are in progress, the largest total number of supply boat movements occurs at both Homer and Kenai in 1983, which is the same year that peaks occur in the moderate case. The low and moderate case figures for Nikiski are 85 and 101, respectively, while the corresponding figures for Homer are 43 and 51. The difference in monthly movements is not so great as to change minimum berth requirements, which is three in Nikiski and two in Homer. The low case figures for 1983 are approximated two years later when movements are due solely to Sale No. CI activities.

4.4.2.2.3 Induced Growth

For the first two years of the study period, the growth rate factors are the same as those for the moderate OCS case. The largest growth occurs in Homer, where in 1983 the population is forecast to be 4% higher than for the base case. In the Kenai area, the percentage growth is only 1% and for the Anchorage region even less. Due to the small induced growth and its limited duration, the low case can be represented by the base case without introducing any errors after 1984 and only minor errors in the first three years of the study period.

4.4.2.2 Impact on Terminals

Compared to the moderate OCS case, the impact on terminals of the low OCS case can be compared from two perspectives, the level of peak demands for the study period and the duration of demands.

Because exploration for Lease Sale No. 60 coincides with development activities for Lease SaJe No. CI, OCS-related peak demands on transportation facilities in the low case are similar to those of the moderate case, despite the different Sale No. 60 activities. The principal difference between the two cases is the duration of demand. For example, at least 40 supply boat round-trips per month are required for the first six years of the low case but for ten years in the moderate case. Another way to view the low OCS case is by comparing it to the base case. The peak demands are similar but occur two years earlier in the low case.

*

At Nikiski, supply boat facilities will be adequate for the low case as they were for the moderate case. The potential for impacts is lessened principally by the smaller amount of inbound tonnage. Without any additional oil production compared to the base case, potential conflicts rising from increased traffic at Drift River are eliminated.

Potential impacts at Homer fall below those of the moderate case, but the first year in which one dedicated supply boat berth no longer meets OCS needs occurs at the same time.

Induced demands in the low and moderate OCS cases differ significantly in Homer and to a lesser extent in Kenai. The potential for development of a regional port facility in Lower Cook inlet, which was cited in the discussion of the base case, continues to exist.

4.4.2.3 Impact on Carriers and Routes

Impacts arising from the low OCS case on routes will be markedly less than in the moderate OCS case due to the following factors: (1) the absence of a supply base and oil terminal on Afognak Island; (2) shorter duration of major logistics requirements; (3) no increase in tanker traffic over the base case figures in Cook Inlet and Shelikof Strait; and (4) a slightly lower level of activity when Lease Sale No. 60 exploration activities are in progress.

4.4.2.4 Issues

In the low case, the issue of impacts beyond exploration in Shelikof Strait does not exist because no permanent structures will be constructed either onshore or offshore in that area. The eventual timing of OCS activities for both Lease Sale No. CI and No. 60 is an important issue for this case as in the other two OCS cases. If a two-year postponement of low scenario activities occurs from those forecast, the height of exploration would coincide with the height of development activities for Sale No. CI. The result would be greater impacts. A minor difference between the low and moderate cases concerns the justification of improvements to supply facilities should they be required. The shorter duration of activities in the lower case would provide less justification for improvements and could prevent them from being undertaken, which could produce minor impacts at the height of demand in 1983.

4.4.3 AIR MODE

4.4.3.1 Description of Activities

Air activities resulting from the low OCS scenario, as for water mode activities, do not extend beyond the three years of exploration. The addition of at least 100 OCS employee trips per week occurs only on the Homer-Anchorage and Anchorage-Seattle links (Table 4-19). On links originating in Kenai and Anchorage, the impact of the low OCS case is negligible compared to the total traffic. For the two Homer links, the increase is more substantial. Low OCS scenario employees represent 21% of the 1983 peak season weekly traffic on the Homer-Anchorage link and 43% on the Homer- Kenai link. Slight decreases in total weekly traffic occur on all of the links except Anchorage to Seattle in year three after the 1 ease sale (1 984). In the moderate OCS case, decreases in this year occurred only on the Kenai-Seattle link.

The peak for helicopter flights from Homer is 17 flights per week and occurs in year two of the study period (Table 4-20). This figure is only one-half of the moderate case peak of 34 flights per week which occurs in 1988. The low case peak, however, is not significantly exceeded until 1987 hen 31 flights per week is reached.

Table 4-21 shows passenger movements through passenger terminals due to traffic on the five links selected for analysis. For the years selected, no significant differences are observed from the base case.

The small changes forecast for population increases and their occurrence only at the beginning of the study period will produce aircraft operations substantially the same as those for the base case.

4.4.3.2 Terminal Impacts

Terminal impacts will more closely resemble those of the base case than the moderate OCS case. In particular, the large amount of traffic forecast to be handled by Homer during development activities in the moderate OCS case will not be generated in the low OCS case. Improvements will be required at Lower Cook Inlet airport facilities, including control towers at Homer and Soldotna, passenger terminal improvements at Kenai, Homer, and Soldotna, and miscellaneous improvements in aprons, taxiways, and runway surfaces at all airports, but their extent and timing will be determined by base case conditions rather than those for the moderate case.

4.4.3.3 Impact on Carriers

The short-term increases brought about by the low OCS case will not create the level of demand in the moderate OCS case that might lead to route changes and introduction of new carriers. The increases, from 1982 to 1984, at the most, produce traffic figures two years in advance of when they were forecast for the base case. The long-term growth prospects of the Anchorage and Southcentral regions forecast for the base case will lead to increases in service, possibly by new carriers on links where only one carrier has permanent operating authority.

4.4.3.4 Issues

The absence of development or production activities in the low OCS scenario, particularly in the Shelikof Strait area, limits impacts on the air mode. Even changes in timing, which are important in assessing impacts that might occur for the water mode, are not important for the air mode in the low OCS case. Facilities and services that will be required in the moderate case can be substantially justified in the low case. The issue is when will funding agencies decide on constructing the facilities and whether the size is based on intermediate peaks or higher peaks that occur at the end of the study period.

Table 4-13

Exploration Resource Level Scenario - Sale No. 60
Transportation - Related Activities

Calendar Year	Year After Lease Sale	Lower Cook Inlet Rias	Lower Cook Inlet Wells	Shelikof Strait Rigs	Shelikof Strait Wel 1s
1982	1	1	2	2	5
1983	2	2	5	2	5
1984	3	1	1	1	1

Source: Dames and Moore, 1979.

Table 4-14

Regional Population Projections: Low OCS - Mean Base Case(LBM)

Year	Low OCS-Mean Base (LBM) South-central	Low OCS-Mean Base (LBM) Anchorage	Growth Rate Factors Low OCS-Mean Base Case(LBM)(1) South-central	Growth Rate Factors Low OCS-Mean Base Case(LBM)(1) Anchorage	Incremental Growth Rate Factors (LBM)(2) South-central	Incremental Growth Rate Factors (LBM)(2) Anchorage	% Pop. Diff. (LBM-BM) South-central	% Pop. Diff. (LBM-BM) Anchorage
1977	58,904	183,606					-	
1982	60,565	201,033	.03	1.09	.01		.01	
1983	60,941	210,693	.03	1.15	.01		.01	
1984	62,534	212,051	.06	1.15				
1985	62,424	212,830	.06	1.16				
1986	62,631	215,334	.06	1.17				
1987	63,337	219,455	.08	1.20				
1988	64,485	224,879	.09	1.22				
1989	65,629	230,480	.11	1.26				
1990	66,775	235,486	1.13	1.28				
1991	66,129	240,404	1.12	1.31				
1992	66,313	244,940	1.13	1.33				
1993	66,935	249,850	1.14	1.36				
1994	67,723	255,130	1.15	1.39				
1995	68,537	260,743	1.16	1.42				
1996	69,574	267,130	1.18	1.45				
1997	70,574	273,730	1.20	1.49				
1998	71,658	280,828	1.22	1.53				
1999	72,852	288,302	1.24	1.57				
2000	74,613	293,630	1.27	1.60				

NOTES : (1) Growth rate factors derived by dividing forecast year population by 1977 population.
(2) Incremental growth rate factors derived by subtracting" BM population from" LBM population and di vialing by 1977 population.

Source: ISER, 1979.

Table 4-15

Community Population Projections: Low OCS - Mean Base Case(LBM)

Year	Low OCS-Mean Base (LBM) Kenai Area	Low OCS-Mean Base (LBM) Homer Area	Growth Rate Factors Low OCS-Mean Base Case(LBM)(1) Kenai Area	Growth Rate Factors Low OCS-Mean Base Case(LBM)(1) Homer Area	Incremental Growth Rate Factors (LBM)(2) Kenai Area	Incremental Growth Rate Factors (LBM)(2) Homer Area	% Pop. Diff. (LBM-BM) Kenai Area	% Pop. Diff. (LBM-BM) Homer Area
1978	13,397	5,081		-				-
1982	-15,777	" 5,858	1.18	1.12	.01	.04	.01	.03
1983	15,954	6,163	1.19	1.16	.02	.05	.01	.04
1984	16,322	6,239	1.22	1.22		.01		.01
1985	16,781	6,616	1.25	1.30				
1986	17,552	7,249	1.31	1.43				
1987	18,077	7,688	1.35	1.51				
1988	18,741	8,214	1.40	1.62				
1989	18,782	8,178	1.40	1.61				
1990	19,217	8,558	1.43	1.68				
1991	19,543	8,679	1.46	1.71				
1992	20,020	8,983	1.49	1.77				
1993	20,471	9,259	1.53	1.82				
1994	'20,952	9,544	1.56	1,88				
1995	21 ,425	9; 838	1.60	1.94				
1996	21,927	10,147	1.64	2.00				
1997	22,304	10,373	1.66	2.04				
1998	22,728	10,612	1.77	2.09				
1999	22,765	10,503	1.70	2.07				
2000	23,313	10,857	1.74	2.14				

NOTES : (1)Growth rate factors derived by dividing forecast year population by 1978 population.
(2) Incremental growth rate factor derived by subtracting BM population from LBM population and dividing by 1978 population.

Source: Alaska Consultants, 1979

Table 4-16

Logistics Requirements for Drilling - Low OCS Scenario

Years After Lease Sale (Calendar Year)	Nikiski(1) Tons per Year Drill Pipe	Dry Bulk	Fuel	Dry Goods Sale CI	Total Dry Goods	Incoming(2) Barges	Homer Tons per Year Dry Bulk	Fuel	Dry goods Sale CI	Fuel Sale CI	Total Dry Goods	Total Fuel	Incoming(2) Barges	Incoming(3) Tankers
1 (1982)	3,301	6,300	11,200	8,229	17,830	3	3,150	5,600	2,700	4,800	5,850	10,400	1	3
2 (1983)	4,715	9,000	16,000	11,360	25,075	5	4,500	8,000	3,084	5,484	7,584	13,484	2	3
3 (1984)	943	1,800	3,200	22,720	25,463	5	900	1,600	6,168	10,968	7,068	12,568	2	3

Notes: (1) Fuel requirements for Nikiski are assumed to be provided from local refineries.
(2) Dry goods barges = (Drill pipe tonnage + Dry Bulk tonnage)/(6,000 tons/barge).
(3) Fuel tankers = (Fuel tonnage)/(5,000 tons/tonnage),

Source: Peter Eakland and Associates. 1979.

Table 4-17

Average Monthly Consumable Demands, Lower Cook Inlet
Low Base Mean

Year	Exploration Scenario-Tons (1) Kenai	Homer	Afognak	Sale CI-Tons (1) Kenai	Homer	Total LBM-Tons (1) Kenai	Homer	Afognak
1982	7.8	16.8	16.8	5.3	25.5	13.1	42.3	16.8
1983	10.4	28.2	16.8	5.3	24.0	15.7	52.2	16.8
1984	2.3	5.7	3.6	4.7	24.5	6.0	30.2	3.6
1985				17.1	54.0	17.1	54.0	
1986				29.4	89.0	29.4	89.0	
1987				16.2	74.7	16.2	74.7	
1988				5.4	71.3	5.4	71.3	
1989				5.4	39.5	5.4	39.5	
1990				5.4	22.4	5.4	22.4	
1991				5.4	24.9	5.4	24.9	
1992				5.4	27.2	5.4	27.2	
1993				5.4	27.2	5..4	27.2	
1994				5.4	27.2	5.4	27.2	
1995				5.4	27.2	5.4	27.2	
1996				5.4	27.2	5.4	27.2	
1997				5.0	23.4	5.0	23.4	
1998				3.6	19.7	3.6	19.7	
1999								
2000								

NOTE : (1) Tons = (Offshore onsite + onshore onsite non-local (2) employment) x (300 lbs/person) ÷ (2,000 lbs/tons.
(2) for Afognak total onshore onsite employment.

Source: Peter Eakland and Associates, 1979

Table 4-18

Monthly Supply Boat Round-trips by Service Base - Exploration Resource Level Scenario (Sale No. 60)

Years After Lease Sale (Calendar Year)	Lower Cook Inlet	Shelikof Straits	Nikiski			Minimum Berth Require-ments	Homer			Minimum Berth Require-ments
	Exploration	Exploration	Sale No. 60	sale No. CI	Total		Sale No. 60	Sale No. CI	Total	
1 (1982)	12	24	24	32	56	2	12	16	28	1
2 (1983)	24	24	32	43	75	2	16	21	37	1
3 (1984)	12	12	16	69	85	3	8	35	43	2
4 (1985)				67	67	2		33	33	1
5 (1986)				86	86	3		41	41	2
6 (1987)				67	67	2		28	28	1
7 (1988)				12	12	1				
8 (1989)				12	12	1				
9 (1990)				12	12	1				
10 (1991)				12	12	1				
11 (1992)				12	12	1				
12 (1993)				12	12	1				
13 (1994)				12	12	1				
14 (1995)				12	12	1				
15 (1996)				8	8	1				
16 (1997)				8	8	1				
17 (1998)				4	4	1				
18 (1999)										

Source: Peter Eakland and Associates, 1979.

Table 4-19

Induced and OCS Weekly Air Travel - Low OCS - Base Mean Case (LBM)

	Homer - Anchorage						Homer - Kenai				
	Passengers				Flights		Passengers				Flights
Year	Induced	Sale CI	Low OCS (LBM)	Total	Jet	Commuter	Induced	Sale CI	Low OCS (LBM)	Total	Commuter
1982	420	68	103	591	6	20	28	15	25	68	16
1983	441	65	137	643	6	22	29	15	33	77	16
1984	472		30	573	6	19	31	22	6	59	15
1985	514	1;:		638	7	21	33	43		76	16
1986	582	203		785	8	26	36	86		122	16
1987	623	159		782	8	26	38	92		130	20
1988	681	103		784	8	26	41	103		144	27
1989	675	51		726	8	24	41	69		110	19
1990	712	12		724	8	24	42	50		92	17
1991	727	13		740	8	25	43	55		98	18
1992	759	14		773	8	26	45	57		102	18
1993	785	14		799	8	27	46	57		103	18
1994	816	14		830	9	28	47	57		104	18
	847	14		861	9	29	49	57		106	18
1996	878	14		892	9	30	50	57		107	18
1997	899	12		911	10	30	51	54		105	18
1998	925	J0		935	10	31	53	50		103	18
1999	915			915	10	31	52			52	15
2000	950			950	10	32	54			54	15

Source: Peter Eakland and Associates, 1979.

Table 4-19 (Continued)

Induced and OCS Weekly Air Travel - Low OCS - Base Mean Case (LBM)

	Kenai - Anchorage					Kenai - Seattle				
	Passengers				Flights	Passengers				Flights
Year	Induced	Sale CI	Low OCS (LBM)	Total	Commuter	Induced	Sale CI	Low OCS (LBM)	Total	Jet
1982	1,892	164(1)	10	2,066	147	136	60(1)	6	202	3
1983	1,908	58(1)	14	1,980	141	137	22(1)	8	167	2
1984	1,956	8	.4	1,968	140	141	1	2	144	2
1985	2,004	16		2,020	144	144	6		150	2
1986	2,100	28		2,128	151	151	10		161	2
1987	2,165	12		2,177	154	156	5		161	2
1988	2,245	3		2,248	159	161	1		162	2
1989	2,245	3		2,248	159	161	1		162	2
1990	2,293	3		2,296	162	165			165	2
1991	2,341	4		2,345	165	168			168	2
1992	2,389	4		2,393	168	172			172	2
1993	2,453	4		2,457	172	176			176	2
1994	2,501	4		2,505	176	180			180	3
1995	2,565	4		2,569	180	184			184	3
1996	2,629	4		2,633	184	189			189	3
1997	2,661	4		2,665	186	191			191	3
1998	2,838	4		2,842	198	204			204	3
1999	2,726			2,726	190	196			196	3
2000	2,790			2,790	194	201			201	3

Notes: (1) Includes North Kenai LNG construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-19 (Continued)

Induced and OCS Weekly Air Travel - Low OCS - Base Mean Case (LBM)

	Anchorage-Seattle					
	Passengers					Flights
Year	Induced	Sale CI	ANC-SEA Other OCS	Low OCS (LBM)	Total	Jets
1982	13,905	116(1)	776	84	14,881	145
1983	14,670	76(1)	1,120	113	16,069	157
1984	14,760	70	1,128	25	15,893	155
1985	"14,797	125	322		"15,244	149
1986	14,925	200	454		15,579	152
1987	15,308	154	638		16,100	157
1988	15,563	86	904		16,553	162
1989	16,073	40	1,189		17,302	169
1990	16,328	1	1,020		17,349	169
1991	16,711	1	821		17,533	171
1992	16,966	1	723		17,690	173
1993	17,349	1	629		17,979	176
1994	17,731	1	48		17,780	174
1995	18,114	1	25		18,140	177
1996	18,497	1	9		18,507	181
1997	19,007	1	2		19,010	186
1998	19,517	1	2		19,520	191
1999	20,027		1		20,028	196
2000	20,410				20,410	199

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-20

Weekly Helicopter Round-trips from Homer
Low Base Mean

Year	Total Offshore Average Monthly Employment(1)	Peak Weekly Round-trips(2)	Helicopter Trips Per Week(3)	Helicopter Trips per Week(2) Sale CI	Total Helicopter Trips Per Week(3)
1982	351	118	9	5	14
1983	469	157	12	5	17
1984	98	33	3	5	8
1985				9	9
1986				16	16
1987				15	15
1988				12	12
1989				7	7
1990				3	3
1991				3	3
1992				4	4
1993				4	4
1994				4	4
1995				4	4
1996				4	4
1997				3	3
1998				3	3
1999					
2000					

NOTES: (1) Total employment includes offshore 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. Afognak is treated as an "offshore site" and offshore employment added with offshore Homer employment.

(2) Peak weekly trips = (0.717 round-trips per month) x (2.0 peak factor) ÷ 4.3 weeks per month for all employees except for construction employees on Afognak where .430 round-trips per month are used.

(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979

Table 4-21

Passengers Handled Weekly at Airport Terminals for
Selected Years - Lower Cook Inlet OCS Development, Low Base Mean (LBM)

Kenai Airport			
	Passengers (2)		
Year	Mean Base (BM) Case	Low Base Mean (LBM)	Percent Change OCS over BM Case
1978	3,486	3,486	
1982	4,522	4,672	.03
1986	4,822	4,822	
1988	5,108	5,108	
1992	5,334	5,334	
1998	6,298	6,298	
2000	6,090	6,090	

Homer Airport (3)			
	Passengers (2)		
Year	Mean Base (BM) Case	Low Base Mean (LBM)	Percent Change OCS over BM Case
1978	1,092	1,092	
1982	1,390	1,390	
1987	2,152	2,152	
2000	2,338	2,338	

Anchorage Airport (4)			
	Passengers (2)		
Year	Mean Base (BM) Case	Low Base Mean (LBM)	Percent Change OCS over BM Case
1978	29,760	29,760	
1982	36,170	36,628	.01
1989	42,674	42,930	.01
2000	48,302	48,300	

Notes: (1) Years selected are those which showed greates increase from previous years in OCS Case, in addition to years 1982 and 2000.
(2) Total of enplaning and deplaning passengers.
(3) Kodiak to Homer trips are not included.
(4) For Anchorage airport, OCS passengers from previous lease sales are considered as wel l as total passengers on Anchorage-Seattle link.

Source: Peter Eakland and Associates, 1979.

4.4.4. SUMMARY COMPARISON OF LOW OCS CASE WITH MODERATE OCS CASE

Transportation demands for the low case closely resemble those for the first two years of the study period, 1982 and 1983. After the third year they are identical to those of the base case since the low case only includes OCS development and production activities that are in the base case. Peak demands for facilities and services occur after impact of the low case has receded, either in the 1980's at the height of Lease Sale No. CI development or at the end of the study period. Thus, all peak demands for the low case are the same as those for the base case.

4.5 High OCS Case

4.5.1 FACTORS CAUSING GROWTH

OCS activities in the lower Cook Inlet area consist of those for the moderate scenario of Lease Sale No. CI and those for the high scenario of Lease Sale No. 60. Three categories of influences on transportation systems have been identified as follows for each of the cases: (1) direct OCS transportation demands; (2) indirect transportation demands; and (3) structural changes in the operation and management of transportation systems. Differences between transportation demands and impacts for the high and mean cases relate to differences in the location of Lease Sale No. 60 OCS activities, their extent, and their timing. Generally, transportation demands in the high OCS case are higher levels of demands that appeared in the moderate OCS case. Even the discovery in the high case of economically recoverable gas reserves in both Lower Cook Inlet and Shelikof Strait, which did not occur in the moderate case, can be viewed as an extension of activities since no gas processing facilities are planned for Afognak Island. All gas will be piped to existing facilities at Nikiski for processing (Dames &Moore, 1979.)

The high scenario is based on recoverable oil reserve; approximately twice as great as those in the moderate scenario. They are 400 mmbbl in Lower Cook Inlet compared to 198 in the moderate case and 1,000 mmbbl in Shelikof Strait compared to 500 mmbbl in the moderate case (Dames & Moore, 1979). Gas reserves, which are assumed to be non-associated with the oil reserves, are forecast at 363 BCF for Lower Cook Inlet and 1,000 BCF for Shelikof Strait. The level of activities is not strictly comparable to the size of economic reserves. As in the moderate case, oil activities in Lower Cook Inlet and Shelikof resulting from Lease Sale No. 60 have similar drilling requirements despite substantial differences in reserves. The same number of oil development wells is drilled in each area, and the 31 exploration wells drilled in Shelikof Strait is only five more than the Lower Cook Inlet figure. For gas, the relationship in drilling activities more closely resembles that for reserves. Each area has a total of three platforms in the high case compared to only one each in the moderate case.

Construction activities include a 400,000 bpd oil terminal on Afognak Island which is twice the capacity of the terminal in the moderate case, a supply base in the same location as the oil terminal, improvements to supply base facilities at Homer and Nikiski for the development phase, and pipeline laying. The length of offshore pipelines--201 km (125 mi.)--is substantially greater than the 32 km (20 mi.) estimated for the moderate case. For onshore pipelines, the increase is from 4.8 to 19.3 km (3 to 12 mi.).

The relationship between the level of activities for Lease Sale No. CI and No. 60 determines when the peak demand for logistics support will occur. For this study, Lease Sale No. CI activities were assumed to be the same as those for the moderate scenario Cook Inlet fields in Lease Sale No. 60, except that they were scheduled to occur four years earlier. This assumption was made because the estimated reserves were the same and no schedule of activities had previously been developed for Sale No. CI. Peak demands will occur at the height of development for one of the two sales. Since exploration activities for Lease Sale No. 60 will be greater than production activities for Lease Sale No. CI, the peak can be expected in the mid-1980's when Sale No. 60 exploration coincides with Sale No. CI development.

Concerning factors causing structural changes in the operation and management of transportation facilities and services, many would originate at the Federal/State levels and would not be significantly affected by Lease Sale No. 60 alone. Increased transportation demands will create more opportunities in the transportation sector of the economy serving the study area. It is cliff" cult to forecast which factors will emerge that are different from other OCS cases, but the possibility of new routes and facilities being developed s the largest for the high OCS case. Communities within the study area have basic transportation services and facilities. Cooperative decision-making will be required since not all communities can justify major new investments in marine or air facilities, particularly the former.

The differences between the moderate and high OCS cases in the timing of activities are less than their extent but equally important in the assessment of impacts. In the moderate scenario, the peak of Lease Sale No. 60

exploration activities occurred one year before the peak of Lease Sale No. CI development activities. However, in the high OCS case Lease Sale No. 60 exploration drilling lasts a year longer and with an additional drilling rig is more intensive. The result is that the peak for exploration drilling coincides with peak development drilling for Lease Sale No. CI.

Tables 4-22 and 4-23, respectively, summarize the transportation-related activities for Sale No. 60 in Lower Cook Inlet and Shelikof Strait. Exploration activities extend from 1982 to 1986, development activities from 1986 to 1994, and production activities from 1989 to the end of the study period.

Increased population in the high case will produce greater demands for transportation services in water, air, and land modes. Table 4-24 presents regional population forecasts and Table 4-25 local population forecasts. At the regional level, the difference in population between the high and moderate OCS cases reaches 0.01 of the base year (1977) population in 1990 and 0.02 in 1995. The differences are more pronounced at the local level. As late as 1987, the population figures in both Homer and Kenai are approximately the same for both cases. However, by 1990 a doubling occurs in the incremental growth rate, which compares OCS population growth to that for the base case. High case incremental growth rates are 0.14 for Kenai and 0.37 for Homer which compare to 0.06 and 0.15, respectively, for the moderate OCS case. The 1990 differences of 0.09 and 0.21 in incremental growth rates, respectively, for Kenai and Homer reduce to slightly lower levels for the remainder of the study period. The largest population figures at both the regional and local levels are at the end of the study period as in the moderate case.

4.5.2 WATER MODE

4.5.2.1 Description of Activities

Transportation demands for the marine mode in the high OCS case consist of those that existed in the base case and those additional demands derived, either directly or indirectly, from the high scenario for Lease Sale No. 60. Three categories of direct OCS transportation demands exist as in previous cases--inbound industrial freight, outbound shipments on supply boats, and transportation demands consisting primarily of general cargo.

The assumptions made in the analysis of direct OCS logistics requirements for the moderate OCS case will also be used in the high OCS case. Homer and Nikiski will operate as supply bases for all exploration activities. These bases will also support development and production activities in Lower Cook Inlet fields, but activities in Shelikof Strait will be supported from a new supply base on Afognak Island.

Growth in direct demands will be examined for Kenai, Homer, and Anchorage.

4.5.2.1.1 Industrial Freight

Industrial freight consists of requirements for drilling, construction of offshore and onshore pipelines, and construction of supply base and oil processing facilities. Table 4-26 shows the forecasts for drilling supplies by supply base. Peak demand for Nikiski is 43,184 metric tons (47,602 tons) of dry goods in 1985, which is 17% greater than the peak for the moderate case. Fuel requirements are provided in the table, but it is assumed that local refineries will provide fuel for supply boats operating out of Nikiski. For Afognak, the increase is more substantial, going from 13,103 metric tons (14,444 tons) to 32,759 metric tons (36,111 tons), an increase of 150%. Peak demand at Afognak exceeds the peak forecast for Homer and is exceeded in only two years at Nikiski. At Nikiski, the high case produces only an additional barge of dry goods at both Nikiski and Homer compared to the moderate case. At Afognak, the increase is from three to seven barge shipments and from four to nine tanker shipments.

Logistics requirements for construction activities are shown in Table 4-27. Pipeline logistics activities at Nikiski do not overlap for Lease Sales No. CI and 60. The level of peak activity--15 barges in 1986--remains unchanged. The additional logistics requirements are less in magnitude than the total for Lease Sale No. CI because connections are made to these pipelines for the transportation of gas reserves. On the other hand, no use of oil pipelines constructed in the base case is assumed, as was the case in the moderate scenario. Significant shipments of pipe occur in 1989 and 1990. At Afognak, the need for larger onshore facilities and longer pipelines increases logistics requirements. Peak requirements remain approximately the same as the flow of materials is spread out over the four main years of construction activity, 1986 to 1989.

In Table 4-28, monthly requirements for consumables is shown for each area of activity. Slight increases over the moderate case occur for Homer and Kenai, but almost a doubling of consumables occurs at Afognak during the height of development, which is due to the larger amount of construction and drilling activities.

4.5.2.1.2 Supply Boat Movements and Berths

The estimated supply boat movements from the three supply base sites produce results similar to industrial supplies. For Homer and Kenai, only incremental increases over the moderate case develop, whereas at Afognak, once the supply base is operational, significantly larger requirements occur. At Nikiski, the peak level of supply boat activity, 11.8 round-trips per month, is 17% higher than the moderate OCS case figure. A minimum of three berths is required until 1990, three years longer than in the moderate case. At Homer, the high case causes only a 12% greater peak number of supply boat round-trips than in the moderate case. The need for a minimum of two berths is required from 1983 to 1990 for the high case, compared to the 1984-1986 period for the moderate case. An 82% increase in supply boat movements is forecast for Afognak. In the moderate case, the maximum number of boat movements that can be serviced by" two berths, 80, is exceeded in only one year and only by a small amount. In the high case, it is substantially exceeded in three years, with the high of 151 round-trips per month reached in 1990.

4.5.2.1.3 Induced Growth

Induced growth in marine transportation is measured by the population increases at the community and regional levels. Growth above that forecast for the moderate OCS case is negligible in Anchorage, never exceeding 2%. The increases in Homer and Kenai are more substantial. The effect in Kenai beginning in the late 1980's is to produce a given population approximately two years earlier. The effect for the same period in Homer is a five-year advance in population figures. Despite large increases in population, induced marine freight demand will be relatively small, as in both Kenai and Homer the base value of throughput tonnage has been estimated at less than 31,750 metric tons (35,000 tons). Given the base values shown in Table A-8 and assuming no shift in modal split of freight and a direct relationship between population and freight demand, peak throughput tonnage values for Homer and Kenai are, respectively, 32,839 metric tons (36,199 tons) and 48,938 metric tons (53,945 tons).

4.5.2.1.4 Transportation of Oil and Gas

The high scenario of Lease Sale No. CI involves major levels of production for both oil and gas. All gas reserves will be processed in the Nikiski area. For oil, Shelikof Strait reserves will be processed at Afognak Island. Lower Cook Inlet oil reserves will be piped to Drift River. It is assumed that the oil will be exported south from here at least until production in other fields falls below the capacity of the Nikiski refineries.

Oil production in Cook Inlet peaks at 106.2 mmbbl in 1991. This figure is 15% higher than the figure for the moderate case. Total production is at least the capacity of the existing Nikiski refineries through 1997. The peak for Shelikof Strait production occurs in 1993 and is 135.8 mmbbl. Oil production for Lease Sale No. 60 begins in 1989 in both Lower Cook Inlet and Shelikof Strait and extends through the end of the study period. Tanker traffic at Nikiski is assumed to remain stable at 66 tankers per year (based on an average size of 25,000 DWT) until tale in the study period. Tanker trips out of Drift River can be expected to have a greater range, from 260 in 1991 to 12 in 1997. An average tanker size of 40,000 DWT for Drift River is assumed. The forecast tanker traffic to Afognak is 146 trips, but it would be higher if the average tanker size falls below 120,000 DWT.

The oil reserves in Shelikof Strait are greater than the combined total for those in the Lower Cook Inlet fields of Lease Sales No. CI and 60. The difference between the moderate and high cases is more pronounced for gas than oil because no economic gas reserves were discovered in the moderate scenario. Base case gas production, thus, also represents production for the moderate case. High case gas production is estimated to begin in 1990 and extend until 1997 for the Lower Cook field and two years longer for the Shelikof Strait field. Total gas production in 1990 is expected to be 2½ times the level of that in the base case. Total production in 1991 is 5-3/4 times the base level. Once the gas has reached Nikiski, three alternatives exist for its utilization. It can be piped to Anchorage, be liquefied and exported, or be processed into ammonia and urea. Movements of LNG ships from the two plants in Nikiski, one of which has not as yet been constructed but for which the necessary permits have been secured, will remain relatively constant, despite changes in the quantity of OCS supplies, since they also can draw upon onshore supplies. Pacific-Alaska LNG, in fact, intends to derive all of its supplies from onshore fields on the west side of Cook Inlet.

4.5.2.2 Impact on Terminals

The high scenario calls for improvements to be made at supply base facilities in both Homer and Kenai. These improvements can be justified by a higher level of inbound freight and the larger number of required supply boat movements. The peaks in activity, as noted, are not significantly above those for the moderate case but the longer duration of both exploration and development activities helps justify additional construction. The rig tenders' dock in Nikiski at present can handle three supply boats and with improvements should have no trouble also handling inbound and outbound barges. At Homer, incremental improvements to meet OCS requirements will be difficult at the City Pier, because of its configuration and multiple users. The eight-year duration in which two dedicated berths would be required should be sufficient to justify a separate supply base facility. The scenario calls for improvements to be made in 1986. Given this schedule, maximum impacts would occur in 1984 and 1985, when at least 50 supply boat round-trips per month are forecast.

At Afognak, three berths are required as in the moderate case but are more fully justified. Assuming an additional berth in the high case, approximately 61 m (200 ft.) of additional waterfront and additional storage areas would be required.

Peak oil production for Cook Inlet offshore fields is approximately 15.5 million tons, which is a 2 million ton increase over the moderate case but still less than the combined capacity for Drift River and Nikiski. A single berth is adequate for Nikiski but two berths are required at Drift River. Two berths will also be required at Afognak. These figures are the same as those for the moderate case.

Gas production exceeds the capacity of forecast processing facilities in the Nikiski area in 1991 and 1992. It is possible that increased capacity would be developed for either LNG, ammonia, or urea. Onshore gas supplies will help justify additional capacity.

No change in impacts for marine facilities in Anchorage is forecast compared to the moderate case. The small difference in population figures does not cause even the low capacity threshold figures to be reached for either dry goods or fuel tonnage. The situation differs at Homer and Kenai. Although base level tonnages are low, so are the computed capacities, and both communities are expected to have problems by the end of the study period, if the computed threshold values are assumed to be representative of when congestion will occur. At Kenai, the threshold value of 1.71 for dry goods is first exceeded in 1995. At Homer, the corresponding figure of 2.32 is first exceeded in 1997. The situation here is somewhat different, since the same facility handles both dry goods and fuel. The assumed allocation of capacity was two-thirds to general freight and one-third to liquid bulk. The threshold value for liquid bulk was not exceeded, so that a redistribution of capacity could produce values in both cases less than the threshold in 1997. However, by the end of the study period when the growth rate factor is 2.40, both values are exceeded no matter how the use of berthing space is distributed. Congestion can be expected to occur earlier because these calculations did not consider use of the main dock face by the Marine Ferry System or OCS activities. Even if OCS activities are segregated, it appears that growth in the lower Homer and Kenai areas will require new marine cargo facilities. The other alternative is for a higher percentage of freight to be shipped by truck.

Shipping traffic to and from Nikiski will increase in the high case due to greater production of natural gas products (ammonia and urea) and larger goods movements in and out of the rig tenders' facility. No increase is forecast for either oil tankers or LNG ships, given the assumptions used in the analysis. The additional shipping will create greater concern for the safety of ships entering, leaving, and moored at Nikiski in winter months.

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4.5.2.3 Impact on Carriers and Routes

As in the previous cases, no restrictions will be necessary on marine routes due to capacity restrictions. Tanker traffic will increase from both Drift River and Afognak Island but no additional safety hazards will be created. Shelikof Strait remains ice-free throughout the year and Drift River is more protected than Nikiski from the effects of ice floes. Increased supply boat activity in Homer, both in terms of peak movements and the duration of activity, could bring a greater need for use of the voluntary vessel traffic lanes at the entrance to Kachemak Bay. Conceivably, the six platforms scheduled for installation in the high scenario, three each in Lower Cook Inlet and Shelikof Strait, could be placed on existing marine routes. Adjustments in routes could be made as a result of information published in the Coast Pilot, a NOAA publication.

No impacts on existing carriers are forecast. Scheduled carriers will be able to increase service to meet induced demands. Industrial freight will experience sudden rather than incremental growth, but major contract carriers will be able to draw upon their worldwide fleet of tugs and barges to meet the demand.

4.5.2.4 Issues

The major issues for the high case relate to port facilities in Homer and the distribution of oil and gas reserves to processing facilities in Cook Inlet. The levels of marine activity forecast for Homer as a result of direct and induced transportation demands, although not significantly greater than for the moderate OCS case, does increase potential impacts on existing port facilities. Of critical importance is the extent and timing of supply base improvements assumed to be part of the high scenario. Activities in fishing, the Marine Highway System, and local freight needs will influence the need for these improvements as much as the level of OCS activity.

4.5.3 AIR MODE

4.5.3.1 Description of Activities

The same four types of activities will be examined that have been examined for other cases. They are as follows: (1) air carrier passenger traffic by link; (2) passenger movements at terminals; (3) aircraft runway operations; and (4) helicopter operations for OCS activities. Helicopter operations are directly related to the level of OCS activity, but other activities depend upon a combination of direct and indirect effects of OCS development,

The air links studied are Homer to Anchorage, Homer to Kenai, Kenai to Seattle, Kenai to Anchorage, and Anchorage to Seattle. Peak season weekly forecasts by year are shown on Table 4-31 for each link. Total traffic has three components--population-induced traffic, Lease Sale No. Cl employees, and Lease Sale No. 60 employees. The links can be divided into two groups--those for which population impacts dominate and those for which OCS employee movements dominate. The three links originating from Kenai and Anchorage make up the first category and the remaining two links from Homer the second. The effect of OCS development on traffic growth depends on several factors, including the base level of traffic, the extent of OCS activity at the origin, and population growth. On the Homer-Anchorage link, the peak travel demand occurs in 1989 when 1,309 passengers per week are forecast, of which 35% are OCS employees for Lease Sale No. 60 and an additional 4% for Lease Sale No. CI employees. It is estimated that 12 jet and 44 commuter flights will be required to handle this traffic. A steady drop in traffic then occurs, and the traffic level in 1994 is 21% less than the peak. Population influences then cause an increase but by the end of the study period the traffic level has not regained the level reached in 1989. The peak for the high case is 7% above the peak for the moderate case and occurs two years later, The decrease in total traffic after development is greater in the moderate case because of lower induced values. The 1992 traffic level in the moderate case is 867 passengers per week, whereas beginning in 1988 for the high case traffic never falls below 1,000 passengers per week.

The traffic patterns for the Homer-Kenai link are similar to those for Homer-Anchorage. However, due to the lower level of base traffic, OCS employee movements make up a higher percentage of total traffic. Peak traffic occurs in 1991, one year later than for the Homer-Anchorage link, and has a level of 327 passengers. This level is 54% higher than the peak for the moderate case and occurs two years later. The breakdown of the high case peak travel figure is 69% Lease Sale No. 60 employees, 16% Lease Sale No. CI employees, and the remaining 15% population-related. Because of the low level of induced travel, at the end of the study period total traffic for the high case is only 58% of the peak. Weekly service requirements are 33 commuter flights per week for peak travel and 24 flights at the end of the study period.

On the Kenai-Anchorage link, OCS employees in the high case never contribute more than 17 trips per week, or less than 1% of the total traffic. Popul a-tion increases for the high OCS case in the Kenai area cause a given traffic level to occur several years earlier than in the moderate case. The peak traffic figure for the high case, which occurs at the end of the study period, is only 5% above the value for the moderate OCS case. Results for the Kenai-Seattle and Anchorage-Seattle links are similar to that for Kenai-Anchorage. Peak OCS employee travel is only 6% of total Kenai-Seattle traffic and only 2% of total Anchorage-Seattle traffic. Three jet flights per week are ade-quate on the Kenai-Seattle link in both the HBM and MBM cases throughout the Study period. On the Anchorage-Seattle link, the biggest difference in ser-vice is four flights per week in 1993, but this is only 2% of the moderate case service level of 775 flights that year.

All helicopter operations serving offshore activities and onshore activities in Afognak Island are assumed to be based in Homer. A summary of peak weekly operations is! shown in Table 4-33. For the moderate case, a significant in-crease in helicopter activity over the base case was forecast, and the additional increase for the high case is equally significant. The moderate case high of 34 trips per week in 1998 is reached in 1986 for the high case, and at least 25 trips per week are required from then through 1992. The peak traffic level occurs in 1989 when 2,336 employees per week must be transferred in each direction. This traffic level is estimated to require 59 helicopter weekly round-trips from Homer, only seven of which are due to Lease Sale No. CI.

On Table 4-33, passenger movements through terminal facilities on the five links analyzed are provided for selected years. The largest increases compared to the base case occur at Homer. It is the only location where the peak HBM activity does not occur at the end of the study period but rather at the height of OCS development in the late 1980's. Significant increases in terminal activity are also recorded at Kenai and Anchorage. In 1991, high case passenger movements at Kenai are 19% greater than those for the base case, as compared to only 8% for the moderate case. This difference of 11% between the two OCS cases lessens to 7% by the end of the study period. For the Anchorage terminal, effects of the high case are most noted in 1989 when the percent change from the base case differs by 4%.

The level of airport operations at Kenai, Soldotna, and Homer will closely follow local population growth, because of the predominance of general aviation and air taxi operations at the facilities. The highest period of growth will be in the late 1980's. Between 1987 and 1990 at Homer, the population growth rate factor increases from 1.57 to 2.05, an average annual increase of 0.16 per year. The rate of growth will be less pronounced in the Kenai-Soldotna area. The number of operations will stabilize at the major air facilities in the Anchorage area, as training and general aviation activities will gravitate to satellite airstrips.

4.5.3.2 Terminal Impacts

Impacts identified for the moderate OCS case do not change significantly in the high OCS case. The adequacy of runway capacity and bearing capacity is expected to exist throughout the study period. Neither in Homer nor the Kenai-Soldotna area are population increases sufficient to create congestion in aircraft operations. Improvements in navigational and control facilities, aprons and taxiways, and passenger terminals that were identified for the moderate OCS case will be required at approximately the same time and will be of the same magnitude. One difference will be the major increase in helicopter activity at Homer. Accommodating major facilities for helicopter operations at Homer will have to be a priority concern for the State of Alaska. Increases in transportation demands will provide additional justification for constructing the facilities by the mid-1980's when they will be needed. At Homer, a smaller drop-off in the demand for passenger facilities occurs after the height of development, which limits the potential impact of constructing a facility that will be underutilized for many years afterwards.

4.5.3.3 Impacts on Carriers and Routes

The incremental growth in traffic on links originating in Kenai and Anchorage most likely can be handled by existing carriers, For the two Homer links, peak traffic occurs midway through the study period. The degree of peaking due to development activities beyond normal population-related growth is not so great that carriers will be unwilling to invest in equipment to serve the demand. The use of contract carriers to partially handle the movement of OCS employees is a possibility and would reduce impacts on carriers once a slowdown in development occurs.

4.5.3.4 Issues

For terminals, the issue revolves around the willingness of public agencies and private companies to plan for and construct facilities by the time of peak development activities. At Homer, where OCS demands outdistance those of the local population, the decision-making is most difficult, since the size of facilities required midway in the study period will not again be required until after 2000. Decision-makers might examine the possibility of innovative operating and management strategies to keep capital construction to a-minimum until the facilities are required on a continuing basis.

Carriers face the decision of how to best deploy their equipment to produce maximum profit. Certainly, existing carriers on the links analyzed will choose to increase service as demand grows, but other carriers will try to seize the opportunity to enter the markets. For the most part, traffic on the links will experience sustained growth, and decisions by regulatory agencies and carriers can be made on a permanent rather than short-term basis. For Homer, some short-term arrangements may have to be made in order to provide adequate capacity.

4.5.4 LAND MODE

4.5.4.1 Description of Activities

Congestion on intercity routes will be little different from that in the moderate OCS case because of the small differences in population for the Anchorage region. Traffic can be expected to show larger growth rates between Homer and Kenai, both for commercial trucking and private automobiles. Trucking will move supplies from Kenai to Homer to be carried by supply boats and helicopters to work sites. The extensive OCS activities in both Kenai and Homer through the development phase most likely will increase interactions between the communities.

4.5.4.2 Roadway Impacts

The largest increase in traffic compared to other OCS cases will be between Homer and Kenai, which at present has good capacity and condition characteristics. Impacts will occur first on the road sections between Kenai and Anchorage. The level of trucking will not produce serious impacts on road condition but will be such that a monitoring station between Homer and Kenai perhaps should be established. Impacts on roadways will depend to an extent on developments that occur for other modes. For example, development of a regional port in either Kenai or Homer could substantially reduce truck traffic. Likewise, as problems develop with congestion on the road network, travelers might prefer travel by the air mode, which can make adjustments more easily. To increase capacity on the roadway requires large investments over entire road sections rather than only at terminal points as is the case for the air and marine modes.

4.5.4.3 Carrier Impacts

As in the moderate case, carriers should easily be able to handle the additional demands resulting from the high OCS case,

4.5.4.4 Issues

No additional issues emerge in the high case.

4.5.5 SUMMARY COMPARISON OF HIGH OCS CASE WITH MODERATE OCS CASE

The principal increases in transportation demands for the high OCS case compared with the moderate OCS case occur in direct OCS activities for two reasons. First, the oil and gas reserves developed and produced in the high scenario are considerably greater than those in the moderate scenario. Oil reserves are doubled, and no gas was developed in the moderate scenario. Second, the peak of exploration activities in the high scenario corresponds with peak development activities in the base case. Increases in population-related transportation demands are not as dramatic. The largest single increase in incremental growth rate factors is 0.21 for Homer in 1990. Several important differences exist for the marine and air modes, but for the land mode conditions are expected to be approximately the same in both cases. This situation exists because of the reliance on air and marine modes for direct transportation demands.

Potential impacts at Homer due to direct OCS activities is increased, but the scenario does call for construction of improved supply base facilities in both Kenai and Homer which would reduce impacts during the development activities of the high scenario. However, as noted, critical demands occur during the exploration phase. Construction as scheduled will not affect potential impacts during that period. Decisions as to the location and processing method for both oil and gas will affect the potential impacts of product"ion activities, which could be considerably greater in the high case. The likelihood exists of more oil refining and gas liquefaction facilities at Nikiski, which could lead to serious marine safety problems during the winter because of ice floes. The thresholds computed for population-related freight at both Kenai and Homer are exceeded in the high case, while only the value at Kenai was exceeded in the moderate case. It is emphasized that the thresholds have served as guidelines only. The availability of alternative routings through Anchorage, Whittier, or Seward would help reduce the impact of increased demands; but the level of demand does suggest the increased need to develop port facilities on the Kenai Peninsula other than specialized facilities for the petroleum and fishing industries.

The major increase in air mode activities is in helicopter operations out of Homer. At the peak of development activities, almost nine round-trips per day are forecast (59 per week) which is almost twice the level of peak activity for the moderate case. A major helicopter maintenance and operations center probably will have to be developed at the Homer airport. Increased passenger service will be required, particularly on the Homer-Anchorage and Homer-Kenai links. As in the moderate case, peaks will occur in the late 1980's and will also require terminal improvements.

Table 4-22
Lower Cook Inlet Field - High (5%) Resource Level Scenario - Sale No. 60
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 Const. (mi.) Onshore	Pipe Const. (mi.) Offshore	Oil Production Wells (Onshore Loading)(2)	Gas Production Wells(2) (Non-Associated)	Onshore Facility Construction(3)
1982	1	1				3							
1983	2	2				6							
1984	3	2				5							
1985	4	2				6							
1986	5	2	1S			6							ENSB(1/1), EHSB(1/1)
1987	6		1S	2	2		12						
1988	7		1S	4	4		24						
1989	8			5	5		24	6	10	40	15		
1990	9			5	4		24	2		15	40	3	
1991	10			2	2		12				60	8	
1992	11										75	8	
1993	12										80	8	
1994	13										80	8	
1995	14										80	8	
1996	15										80	8	
1997	16										80	8	
1998	17										80		
1999	18										80		
2000	19										80		
2001	20										80		

Notes: (1) S = Steel
(2) Based on wells producing by July of each year.
(3) ENSB(1/1) = Facility(Years under Construction/Years to Construct); ENSB = Extended Nikiski Supply Base; EHSB = Extended Homer Supply Base.

Source: Dames and Moore, 1979.

Table 4-23

Shelikof Strait - High (5%) Resource Level Scenario - Sale No. 60
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 Const.(mi.) Onshore	Pipe Const.(mi.) Offshore	Oil Production Wells (Onshore Loading)(2)	Gas Production Wells(2) (Non-Associated)	Onshore Facility Construction
1982	1	2				5							
1983	2	3				8							
1984	3	3				7							
1985	4	3				8							
1986	5	2				3							ASB (0.75/1)
1987	6		1S										ASB (1/1)
1988	7		1S		2		9						AOIL (1/2)
1989	8		1S	2	3		12	4	2	20	13		AOIL (2/2)
1990	9			3	5		21	6		50	23	7	
1991	10			5	5		24	6			46	13	
1992	11			5	3		15	6			63	19	
1993	12			3	2		12	2			73	24	
1994	13			2			3				80	24	
1995	14										80	24	
1996	15										80	24	
1997	16										80	24	
1998	17										80	24	
1999	18										80	24	
2000	19										80		
2001	20										80		

Notes: (1) S = Steel
(2) Based on wells producing by July of each year.
(3) ASB(1/1) = Facility (Years under Construction/Years to Construct); ASB = Afognak Supply Base; AOIL = Afognak Oil Terminal.

Source: Peter Eakland and Associates, 1979.

Table 4-24

Regional Population Projections: High OCS - Mean Base Case(HBM)

Year	High OCS-Mean Base Case (MBM) South-central	High OCS-Mean Base Case (MBM) Anchorage	Growth Rate Factors High OCS-Mean Base Case(HBM)(1) South-central	Growth Rate Factors High OCS-Mean Base Case(HBM)(1) Anchorage	Incremental Growth Rate Factors (HBM)(2) South-central	Incremental Growth Rate Factors (HBM)(2) Anchorage	% Pop. Diff. (HBM-BM) South-central	% Pop. Diff. (HBM-BM) Anchorage
1977	58,904	183,606	-					
1982	60,567	201,040	1.03	1:09	.01		.01	
1983	61,127	210,716	1.04	1.15	.02		.02	
1984	63,323	212,144	1.08	1.16	.02		.02	
1985	63,402	213,113	1.08	1.16	.02		.02	
1986	63,668	215,870	1.08	1.18	.02		.02	
1987	64,248	220,188	1.09	1.20	.02		.01	
1988	66,506	225,992	1.13	1.23	.03	.01	.03	.01
1989	70,151	232,565	1.19	1.27	.08	.01	.07	.01
1990	71,908	238,817	1.22	1.30	.09	.02	.08	.01
1991	71,180	244,368	1.21	1.33	.09	.02	.08	.02
1992	71,072	249,180	1.21	1.36	.08	.02	.07	.02
1993	71,297	254,243	1.21	1.38	.07	.02	.07	.02
1994	71,979	259,629	1.22	1.41	.07	.02	.06	.02
1995	72,866	265,417	1.24	1.45	.07	.03	.06	.02
1996	74,014	272,053	1.26	1.48	.08	.03	.06	.02
1997	75,133	278,944	1.28	1.52	.08	.03	.06	.02
1998	76,047	286,320	1.29	1.56	.07	.03	.06	.02
1999	77,073	293,979	1.31	1.60	.07	.03	.06	.02
2000	78,726	299,385	1.34	1.63	.07	.03	.06	.02

NOTES: (1) Growth rate factors derived by dividing forecast year population by 1977 population.
(2) Incremental growth rate factors derived by subtracting BM population from HBM population and dividing by 1977 population.

Source: ISER, 1979.

Table 4-25

Community Areawide Population Projections: High OCS - Mean Base Case(HBM)

Year	High OCS-Mean Base (tIBM) Kenai Area	High OCS-Mean Base (tIBM) Homer Area	Growth Rate Factors High OCS-Mean Base Case(HBM)[1] Kenai Area	Growth Rate Factors High OCS-Mean Base Case(HBM)[1] Homer Area	Incremental Growth Rate Factors (HBM)[2] Kenai Area	Incremental Growth Rate Factors (HBM)[2] Homer Area	% Population Difference Kenai Area	% Population Difference Homer Area
1978	13,397	5,081		-	-	-		-
1982	15,772	5,861	1.18	1.15	.01	.04	.01	.03
1983	16,012	6,216	1.20	1.22	.02	.06	.02	.05
1984	16,552	6,491	1.24	1.28	.02	.06	.02	.05
1985	17,061	6,916	1.27	1.36	.02	.06	.02	.05
1986	17,824	7,534	1.33	1.48	.02	.06	.02	.04
1987	18,391	7,978	1.37	1.57	,02	.06	.02	.04
1988	19,508	8,964	1.46	1.76	.06	.15	.04	.09
1989	20,092	9,436	1.50	1.86	.10	.25	.10	.15
1990	21,082	10,418	1.57	2.05	.14	.37	.10	.22
1991	21,503	0,577	1.61	2.08	.15	.37	.10	.22
1992	21,805	0,725	1.63	2.11	.13	.34	.09	.19
1993	21,976	0,746	1.64	2.11	.11	.29	.07	.16
1994	22,462	11,006	1.68	2.17	.11	.29	.07	.15
1995	23,005	11,370	1.72	2.24	.12	.30	.07	.16
1996	23,572	11,744	1.76	2.31	.12	.31	.08	.16
1997	23,949	11,970	1.79	2.36	.12	.31	.07	.15
1998	24,250	12,117	1.81	2.38	.11	.30	.07	.14
1999	24,195	11,926	1,81	2.35	.11	.28	.06	.14
2000	24,678	12,207	1.84	2.40	.10	.27	.06	.12

NOTES: (1) Growth rate factors derived by dividing forecast year population by 1978 population.
(2) Incremental growth rate factor derived by subtracting BM population from HBM population and dividing by 1978 population.

Source: Alaska Consultants, 1979

Table 4-26

Logistics Requirements for Drilling - High OCS Scenario

Years After Lease Sale (Calendar Year)	Nikiski(1) Tons per Year: Drill Pipe	Dry Bulk	Fuel	Dry Goods Sale CI	Total Dry Goods	Incoming(2) Barges	Afognak Tons per Year: Drill Pipe	Dry Bulk	Fuel	Total Dry Goods	Incoming(2) Barges	Incoming Tankers(3)
1 (1982)	3,772	7,200	12,800	8,229	19,201	4						
2 (1983)	6,601	12,600	22,400	11,360	'30,561	5						
3 (1984)	5,658	10,800	19,200	22,720	39,178	7						
4 (1985)	6,601	12,600	22,400	28,401	47,602	8						
5 (1986)	4,244	8,100	14,400	24,614	36,958	6						
6 (1987)	5,192	6,168	10,968	11,360	22,720	4						
7 (1988)	10,384	12,336	21,936		22,720	4	3,894	6,939	12,339	10,833	2	
8 (1989)	12,981	15,420	27,420		28,401	5	6,923	12,336	21,936	19,259	4	
9 (1990)	11,250	13,364	23,764		24,614	4	11,683	20,817	37,017	32,500	6	
10 (1991)	5,192	6,168	10,968		11,360	2	12,981	23,130	41,130	36,111	7	
11 (1992)							9,087	16,191	28,791	25,278	5	
12 (1993)							6,058	10,794	19,194	16,852	3	
13 (1994)							1,298	2,313	4,113	3,611	1	

Notes: (1) Fuel requirements for Nikiski are assumed to be provided from local refineries.
(2) Dry goods barges = (Drill pipe tonnage + Dry bulk tonnage)/(6,000 tons/barge).
(3) Fuel tankers = (Fuel tonnage) /(5 ,000 tons/tonnage).

Source: Peter Eakland and Associates, 1979.

Table 4-26 (Continued)

Logistics Requirements for Drilling - High OCS Scenario

Years After Lease Sale (Calendar Year)		Homer: Tons per Year: Dry Bulk	Fuel	Dry Goods Sale CI	Fuel Sale CI	Total Dry Goods	Total Fuel	Incoming Barges (2)	Incoming Tankers (3)
1	(1982)	3,600	6,400	2,700	4,800	6,300	11,200	2	3
2	(1983)	6,300	11,200	3,084	5,484	9,384	16,684	2	4
3	(1984)	5,400	9,600	6,168	10,968	11,568	20,568	2	5
4	(1985)	6,300	11,200	6,168	10,968	12,468	22,168	3	5
5	(1986)	4,050	7,200	6,168	10,968	10,218	18,168	2	4
6	(1987)	3,084	5,484	3,084	5,484	6,168	10,968	2	3
7	(1988)	6,168	10,968			6,168	10,968	2	3
8	(1989)	7,710	13,710			7,710	13,710	2	3
9	(1990)	6,682	11,882			6,682	11,882	2	3
10	(1991)	3,084	5,484			3,084	5,484	1	2

Source: Peter Eakland and Associates, 1979.

Table 4-27

Estimated Logistics Requirements
For Pipe Laying and Construction - High Resource Scenario

	Nikiski[1] (tons)[2]						Afognak (tons)[2]		Drift River	
Year	Uncoated Pipe	Cement	Coated Pipe	Throughput Tonnage	Inbound Barges	Outbound Barges	Uncoated Pipe	Inbound Barges	Uncoated Pipe	Inbound Barges
1988	13,680	1,111		14,791	3	0				
1989	20,650	3,052	22,500	46,202	4	4	568		2,100	1
1990			44,875	44,875	0	8				

Estimated Barge Trips[*]

	1985	1986	1987	1988	1989	1990
Nikiski[1][3]						
Inbound pipeline barges	(7)	(11)	0	3	4	8
Outbound pipeline barges	0	(4)	(10)	0	4	0
	7	15	10	3	8	8
Afognak - Inbound						
Support base		3				
Construction Equipment		1	2			
Construction camp		2	2			
Oil terminal - 400,000 bpd				6	6	
Onshore pipeline					1	
		6	4		7	

Notes: (1) All offshore pipeline materials are first delivered to Nikiski for coating the year before installation and then sent to work sites by barge.
(2) Tons can be converted to metric figures using the factor 0.90718.
(3) Numbers in parentheses refer to Sale CI materials.

Source: Peter Eakland and Associates, 1979.

Table 4-28

Average Monthly Consumable Demands, Lower Cook Inlet
High Base Mean

Year	High Scenario-Tons(1) Kenai	High Scenario-Tons(1) Homer	High Scenario-Tons(1) Afognak	Sale CI-Tons(1) Kenai	Sale CI-Tons(1) Homer	Total HBM-Tons(1) Kenai	Total HBM-Tons(1) Homer	Total HBM-Tons(1) Afognak
1982	7.8	17.1	16.8	5.3	25.5	13.1	42.6	16.8
1983	13.1	31.4	25.2	5.3	24.0	18.4	55.4	25.2
1984	13.1	30.8	25.2	4.7	24.5	17.8	55.3	25.2
1985	13.1	31.4	25.2	17.1	54.0	30.2	85.4	25.2
1986	10.4	27.9	51.9	29.4	89.0	39.8	116.9	51.9
1987	4.7	24.2	31.1	16.2	74.7	20.9	98.9	31.1
1988	4.7	41.0	128.0	5.4	71.3	10.1	112.3	128.0
1989	17.0	79.8	148.8	5.4	39.5	22.4	119.3	148.8
1990	8.7	60.2	113.4	5.4	22.4	14.1	82.6	113.4
1991	5.4	56.3	84.8	5.4	24.9	10.8	81.2	84.8
1992	5.4	39.5	74.0	5.4	27.2	10.8	66.7	74.0
1993	5.4	22.4	61.7	5.4	27.2	10.8	49.6	61.7
1994	5.4	24.9	48.9	5.4	27.2	10.8	52.1	48.9
1995	5.4	27.2	47.9	5.4	27.2	10.8	54.4	47.9
1-996	5.4	27.2	51.3	5.4	27.2	10.8	54.4	51.3
1997	5.4	27.2	51.3	5.0	23.4	10.4	50.6	51.3
1998	4.5	23.4	51.3	3.6	19.7	8.1	43.1	51.3
1999	3.6	19.7	51.3			3.6	19.7	51.3
2000	3.6	19.7	47.6			3.6	19.7	47.6

NOTES: (1) Tons = (Offshore onsite + onshore onsite non-local(2) employment) x (300 lbs/person) ÷ (2,000 lbs/ton)
(2) for Afognak total onshore onsi te employment.

Source: Peter Eakland and Associates, 1979.

268

Table 4-29

Monthly Supply Boat Round-trips by Service Base - High Resource Level Scenario (Sale No. 60)

Years After Lease Sale (Calendar Year)	Lower Cook Inlet Explora-tion	Lower Cook Inlet Develop-ment	Lower Cook Inlet Produc-tion	Shelikof Straits Explora-tion	Shelikof Straits Develop-ment	Shelikof Straits Produc-tion	Nikiski Sale No. 60	Nikiski Sale No. CI	Nikiski Total	Minimum Berth Require ments	Homer Sale No. 60	Homer Sale No. CI	Homer Total	Minimum Berth Require ments	Afognak Sale 60	Afognak Minimum Berth Require ments
1 (1982)	12			24			24	32	56	2	12	16	28	1		
2 (1983)	24			36			40	43		3	20	21	41	2		
3 (1984)	24			36			40	69	1;:	3	20	35	55	2		
4 (1985)	24			36			40	67	107	3	20	33	53	2		
5 (1986)	24	24		24			32	86	118	3	16	41	57	2		
6 (1987)		64			24		43	67	110	3	21	28	49	2	24	1
7 (1988)		104			64		69	12	81	3	35		35	1	64	2
8 (1989)		143	4		127	4	99	12	111	3	48		48	2	131	3
9 (1990)		123	12		143	8	94	12	106	3	41		41	2	151	3
10 (1991)		40	12		100	12	39	12	51	2	13		13	1	112	3
11 (1992)			12		60	12	12	12	24	1					72	2
12 (1993)			12		40	12	12	12	24	1					52	2
13 (1994)			12			12	12	12	24	1					12	1
14 (1995)			12			12	12	12	24	1					12	1
15 (1996)			12			12	12	8	20	1					12	1
16 (1997)			12			12	12	8	20	1					12	1
17 (1998)			8			12	8	4	12	1					12	1
18 (1999)			8			12	8		8	1					12	1
19 (2000)			8			8	8		8	1					8	1
20 (2001)			8			8	8		8	1					8	1

Source: Peter Eakland and Associates, 1979.

Table 4-30

Nigh **Resource** Level Scenario - Oil and Gas Production and Transportation (1)

	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Oil Production (MMBBL)(2)														
Upper Cook Inlet	14.2	12.5	10.9	9.6	8.5	7.4	6.5	5.7						
Lower Cook Inlet (Sale No. CI)(3)	61.3	67.0	60.7	47.6	33.6	25.1	18.0	12.9	9.2	6.8	2.9			
Lower Cook Inlet Sale No. 60)		11.2	32.2	49.0	56.0	53.3	45.2	35.7	28.4	22.6	18.0	14.3	11.3	9.0
Total	75.5	90.7	103.8	106.2	98.1	85.8	69.7	54.3	37.6	29.4	20.9	14.3	11.3	9.0
Nikiski-refinery capacity(70,500bpd)	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7	25.7
Drift River-crude exports	49.8	65.0	78.1	80.5	72.4	60.1	44.0	28.6	11.9	3.7	-			
Nikiski-refined exports	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	12.6	7.8	3.2	-	-
Shelikof Strait		28.0	52.6	98.1	122.7	135.8	122.7	103.9	80.1	61.8	47.4	37.2	28.9	22.5
Oil Tanker Traffic(Round-trips/year) (4)														
Nikiski-25,000 DWT	66	66	66	66	66	66	66	66	66	66	44	16	-	-
Orift River-40,000 DWT	161	210	253	260	234	195	143	93	39	12				
Afognak-120,000 DWT	o	31	57	106	132	146	132	112	86	67	51	41	32	25
Gas Production (BCF)-offshore (5)														
Lower Cook Inlet (Sale No. CI)	70.1	70.1	70.1	59.1	41.7	29.4	20.7	1.8						
Lower Cook Inlet (Sale No. 60)(3)			70.1	70.1	70.1	59.1	41.7	29.4	20.7	1.8				
Shelikof Strait			105.1	210.2	210.2	172.6	114.8	76.4	50.8	33.8	22.5	3.6		
Total Lease Sale 60 and CI	70.1	70.1	245.3 (6)	339.4 (6)	322.0 (6)	261.1 (6)	177.2 (6)	107.6	71.5	35.6	22.5	3.6		
Gas Demand(BCF)-offshore and onshore (8)														
Anchorage	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0	30.0		
Collier-ammonia and urea	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8	43.8		
Phillips-Marathon LNG	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5	63.5		
Pacific-Alaska LNG	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0	146.0		
Total	283.3	283.3	283.3	283.3	283.3	283.3	283.3	283.3	283.3	283.3	283.3	283.3		
Excess supply				56.1	38.7	-	-	-	-	-	-			
LNG Ship Traffic(round-trips/year) (7)														
Pacific-Alaska LNG	52	52	52	52	52	52	52	52	52	52	52	52		
Phillips-Marathon	23	23	23	23	23	23	23	23	23	23	23	23		
Total	75	75	75	75	75	75	75	75	75	75	75	75		

Notes: (See following page.)

Source: Peter Eakland and Associates, 1979, except as noted. Production figures from Dames and Moore, 1979.

Table 4-30(Continued)

High Resource Level Scenario - Oi 1 and Gas Production and Transportation

Notes: (1) Analysis based primarily on offshore oil and gas production. Production and transportation for 1982-1987 are the same as in the base case.

(2) Analysis assumes Nikiski's refineries will operate at capacity as long as supplies are adequate. It is further assumed that of the 70,500 bpd refined 36,000 bpd wi 11 go to Anchorage by pipel inc. The remaining 34,500 will be exported to communities within Alaska. All oil production not refined at Nikiski is assumed to be exported as crude from Orift River to Lower 48 refineries.

(3) Mean resource level scenario used for Sale No. CI.

(4) Tanker sizes based on data developed by ERCO/Frankel in "Study to Assess the Impart of Alaskan Petroleum Development on the Coast Guard through the Year 2000," 1978. Round-trips/year = (production in mmbbl)/(7.74)(tanker size in DWT).

(5) Analysis assumes ammonia and urea capacity will operate at full capacity whenever supplies of natural gas permit. Remaining supplies will be exported as LNG. Ammonia and urea capacity of 120 mmcfd of natural gas obtained from P.51 of BLM Lower Cook Inlet EIS, 1974.

(6) These figures exceed existing Nikiski LNG capacity of 174 mmcfd (Phil lips-Marathon). From 1991-1993, the natural gas supply exceeds forecast capacity of 574 mmcfd, which includes the Pacific-Alaska LNG facilities (400 mmcfd).

(7) Annual capacity of projected facilities equals 209.5 BCF(574 mmcfd x 365 days).

(8) Natural gas for Pacific-Alaska LNG plant assumed to come from onshore wells on western side of Cook Inlet as described in Final EIS for Cook Inlet-California LNG project, 1974, except when production exceeds annual capacity of Phillips-Marathon facility (63.5 BCF). Pacific-Alaska facility then is assumed to favor offshore supplies.

Table 4-31

Induced and OCS Weekly Air Travel - High OCS - Base Mean Case (HBM)

	Homer - Anchorage						Homer - Kenai				
	Passengers				Flights		Passengers				Flights
Year	Induced	Sale CI	High OCS (HBM)	Total	Jet	Commuter	Induced	Sale CI	High OCS (HBM)	Total	Commuter
1982	436	68	95	599	6	20	29	15	25	69	16
1983	472	65	156	693	7	23	31	15	41	87	17
1984	503	71	154	728	7	24	32	22	41	95	18
1985	545	124	156	825	8	28	34	43	41	118	19
1986	608	203	161	972	9	32	37	86	37	160	22
1987	654	159	138	951	9	32	40	92	47	179	23
1988	753	103	329	1,185	11	39	44	103	106	253	28
1989	806	51	452	1,309	12	44	47	69	120	236	27
1990	905	12	331	1,248	12	42	52	50	225	327	33
1991	920	13	219	1,152	11	38	52	55	212	319	32
1992	936	14	146	1,096	10	37	53	57	183	293	31
1993	936	14	82	1,032	10	34	53	57	148	258	28
1994	967	14	48	1,029	10	34	55	57	141	253	28
1995	1,004	14	39	1,057	10	35	56	57	151	264	29
1996	1,040	14	44	1,098	10	37	58	57	153	268	29
1997	1,066	12	44	1,120	11	37	59	54	153	266	29
1998	1,076	10	42	1,128	11	38	60	50	143	253	28
1999	1,061		40	1,101	11	37	59	-	137	196	24
2000	1,087		38	1,125	11	38	60	-	129	189	24

Source: Peter Eakland and Associates. 1979.

Table 4-31(Continued)

Induced and OCS Weekly Air Travel - High OCS - Base Mean Case(HBM) (Table Continued)

	Kenai - Anchorage					Kenai - Seattle				
	Passengers				Flights	Passengers				Flights
Year	Induced	Sale CI	High OCS (HBM)	Total	Commuter	Induced	Sale CI	High OCS (HBM)	Total	Jet
1982	1,892	164(1)	10	2,066	147	136	6(3(1)	6	202	3
1983	1,924	58(1)	17	1,999	142	138	22(1)	10	170	2
1984	1,988	8	17	2,013	143	143	1	10	154	2
1985	2,036	16	17	2,069	147	147	6	10	163	2
1986	2,132	28	14	2,174	154	153	10	8	171	2
1987	2,197	12	7	2,216	157	158	5	3	166	2
1988	2,341	3	7	2,351	165	168	1	3	172	2
1989	2,405	3	17	2,425	170	173	1	5	179	3
1990	2,517	3	7	2,527	177	181		3	184	3
1991	2,581	4	4	2,589	181	186		1	187	3
1992	2,613	4	4	2,621	183	188		1	189	3
1993	2,629	4	4	2,637	184	189		1	190	3
1994	2,694	4	4	2,702	189	194		1	195	3
1995	2,758	4	4	2,766	193	198		1	199	3
1996	2,822	4	4	2,830	197	203		1	204	3
1997	2,870	4	4	2,878	200	206		1	207	3
1998	2,902	4	3	2,909	202	209		1	210	3
1999	2,902		3	2,905	202	209		1	210	3
2000	2,950		3	2,953	205	212		1	213	3

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-31 (Continued)

Induced and OCS Weekly Air Travel - High OCS - Base Mean Case (HBM) (Table Continued)

Year	Anchorage-Seattle Passengers: Induced	Sale CI	ANC-SEA Other OCS	High OCS (HBM)	Total	Flights: Jets
1982	13,905	116 (1)	776	87	14,884	145
1983	14,670	76 (1)	1,210	142	16,098	157
1984	14,797	70	1,128	141	16,136	158
1985	14,797	125	322	142	15,386	150
1986	15,053	200	454	131	15,838	155
1987	15,308	154	638	120	16,220	158
1988	15,690	86	904	268	16,948	166
1989	16,201	40	1,189	384	17,814	174
1990	6,583	1	1,020	290	17,894	175
1991	9,666	1	821	177	20,665	202
1992	7,349	1	723	106	18,179	178
1993	7,604	1	629	45	18,279	179
1994	7,986	1	48	11	18,046	176
1995	8,497	1	25	2	18,525	181
1996	8,879	1	9	2	18,891	184
1997	9,390	1	2	2	19,395	189
1998	19,900	1	2	2	19,905	194
1999	20,410		1	2	20,413	199
2000	20,793			2	20,795	203

Notes: (1) Includes North Kenai LNG Plant construction employee round trips.

Source: Peter Eakland and Associates, 1979.

Table 4-32

Weekly Helicopter Round-trips from Homer
High Base Mean

Year	Total Offshore Average Mcthly Employment (1)	Peak Weekly Round-trips(z)	Helicopter Trips P r Week (37	Helicopter Trips per Week (2) Sale CI	Total Helicopter Trips Per Week (3)
1982	353	118	9	5	14
1983	589	197	15	5	20
1984	585	196	14	5	19
1985	589	197	15	9	24
1986	727	243	18	16	34
1987	585	196	14	15	29
1988	1,691	505	37	12	49
1989	2,336	720	52	7	59
1990	1,990	664	48	3	51
1991	1,562	521	38	3	41
1992	1,138	380	28	4	32
1993	750	251	18	4	22
1994	580	194	14	4	18
1995	581	194	14	4	18
1996	612	205	15	4	19
1997	612	205	15	3	18
1998	587	196	14	3	17
1999	562	188	14		14
2000	531	178	13		13

NOTES : (1) Total employment includes offshore 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. Afognak is treated as an "offshore site" and offshore employment added with offshore Homer employment.

(2) Peak weekly trips = (0.717 round-trips per month) x (2.0 peak factor) ÷ 4.3 weeks per month for all employees except for construction employees on Afognak where .430 round-trips per month are used.

(3) Based on 14 passengers per trip.

Source: Peter Eakland and Associates, 1979

Table 4-33

Passengers Handled Weekly at Airport Terminals for
Selected Years(1) - Lower Cook Inlet OCS Development, High Base Mean (HBM)

Kenai Airport

Year	Passengers(2) Mean Base (BM) Case	Passengers(2) High Base Mean (HBM)	Percent Change OCS over BM Case
1978	3,486	3,486	-
1982	4,522	4,674	.03
1988	5,108	5,552	.09
1991	5,222	6,190	.19
2000	6,090	6,710	.10

Homer Airport(3)

Year	Passengers(2) Mean Base (BM) Case	Passengers(2) High Base Mean (HBM)	Percent Change OCS over BM Case
1978	1,092	1,092	-
1982	1,390	1,664	.20
1988	2,184	3,204	.47
2000	2,338	2,956	.26

Anchorage Airport(4)

Year	Passengers(2) Mean Base (BM) Case	Passengers(2) High Base Mean (HBM)	Percent Change OCS over BM Case
1978	29,760	29,760	
1982	36,170	36,650	.01
1988	40,978	42,776	.04
1989	42,674	45,474	.07
2000	48,302	49,746	.03

Notes: (1) Years selected are those which showed greates increase from previous years in OCS Case, in addition to years 1982 and 2000.
(2) Total of enplaning and deplaning passengers.
(3) Kodiak to Homer trips are not included.
(4) For Anchorage airport, OCS passengers from previous lease sales are considered as well as total passengers on Anchorage-Seattle link.

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 Lower Cook Inlet 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 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. Kenai boasts a well-developed infrastructure to serve all phases of oil and gas activity both offshore and onshore. Oil companies will rely heavily on existing Kenai facilities for all Sale No. CI and Sale No. 60 activities except for development and production activities in the Shelikof Strait. Homer currently does not have facilities for adequately handling and storing heavy industrial freight, but can adequately serve the role as a forward supply base. Both Kenai and Homer have airports with adequate facilities. Their runways have the length and bearing capacity to accommodate jet passenger and Hercules C-130 freight aircraft and routinely receive both types.

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 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 then the oil recovered in as short a period as possible. Inactive equipment produces heavy financial penalties. 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, which occurred first in the Gulf of Mexico and later in the North Seas as well as other parts of the world, have produced specialized technologies and equipment and companies to operate 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 is required, such as moving goods from supply bases to offshore work sites and laying underwater pipelines.

1.3.3 REQUIREMENT FOR DEDICATED FACILITIES

Economic 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 those near Anchorage. 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. The transportation impact assessment will assume that supply boats will require exclusive use of required dock space or have priority.

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 Lower Cook Inlet and Shelikof Strait depends upon the location and the mode involved. The more important climatic impacts are discussed below:

- Ice Conditions. Cook Inlet experiences ice problems as far south as Kenai. Tug and barge operators do not operate to Anchorage during the winter months. Freight ships operated by TOTE and Sea-Land have reinforced hulls, and the thin ice does not present difficulties for them. Strong Cook Inlet currents and ice conditions produce mooring problems at Kenai during the winter months. Mooring lines have been broken on several occasions. Ships becoming adrift, besides being in danger themselves, present a danger to other vessels in the area.

- Snow Conditions. Snow conditions can affect the efficiency of supply base operations and close an airport for several days at at time. Despite the inconvenience caused by snow, its impacts on transportation movements are relatively short-lived and make it of minor importance in assessing impacts.

- Visibility. Fog conditions can curtail airport operations during parts of the day and reduce operating speeds of marine vessels. Transportation demands are forecast for annual, monthly, or weekly time periods. 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. It is assumed that storage capabilities for supplies at offshore work sites shall be adequate to provide for periods of time when supply boats are unable to make deliveries. The number of supply boats shall be greater than the absolute minimum requirements, which will enable reserves to be built back up during good weather.

Lower productivity is expected during winter months, not only for ship activities, such as pipe laying, but on platforms because of long periods of darkness and cold temperatures in addition to wind and heavy seas.

Lower productivity stretches out somewhat the minimum allowable time between deliveries for supply boats. The impacts on productivity have been considered by Dames & Moore in their development of 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. For the air and water modes, aircraft and vessel movements, respectively, will grow more slowly than growth in freight carried.

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 or disposable income. Figures A-la to A-lc show six categories of transportation demands, fourof which are direct and two that are indirect. The detailed methodologies for each are described below.

FIGURE 1a. FLOW CHARTS FOR DEVELOPMENT OF TRANSPORTATION DEMAND CATEGORIES 1,2, AND 3

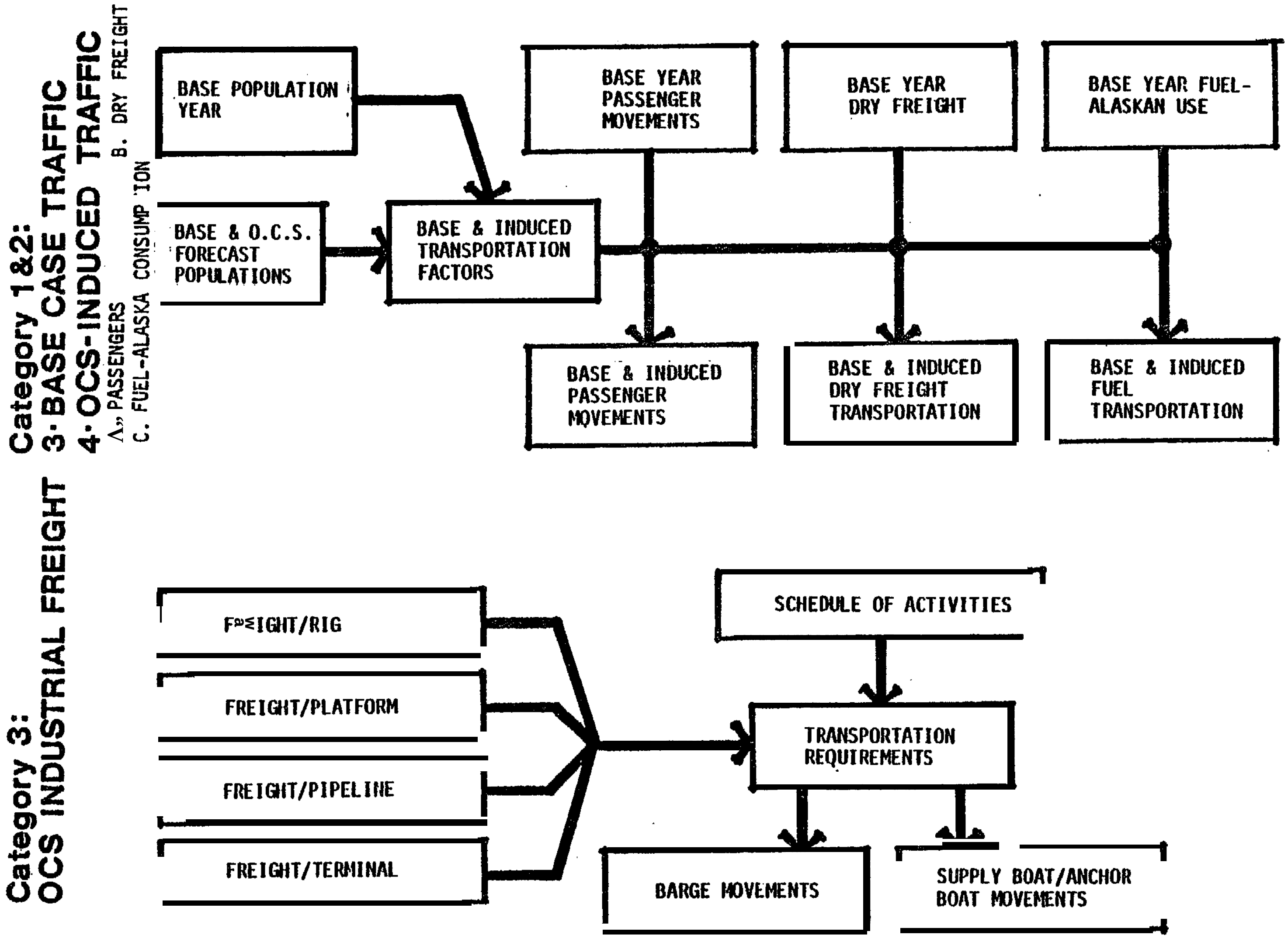


FIGURE lb. FLOWCHARTS FOR **DEVELOPMENT OF** TRANSPORTATION **DEMAND** CATEGORIES 3AND 4

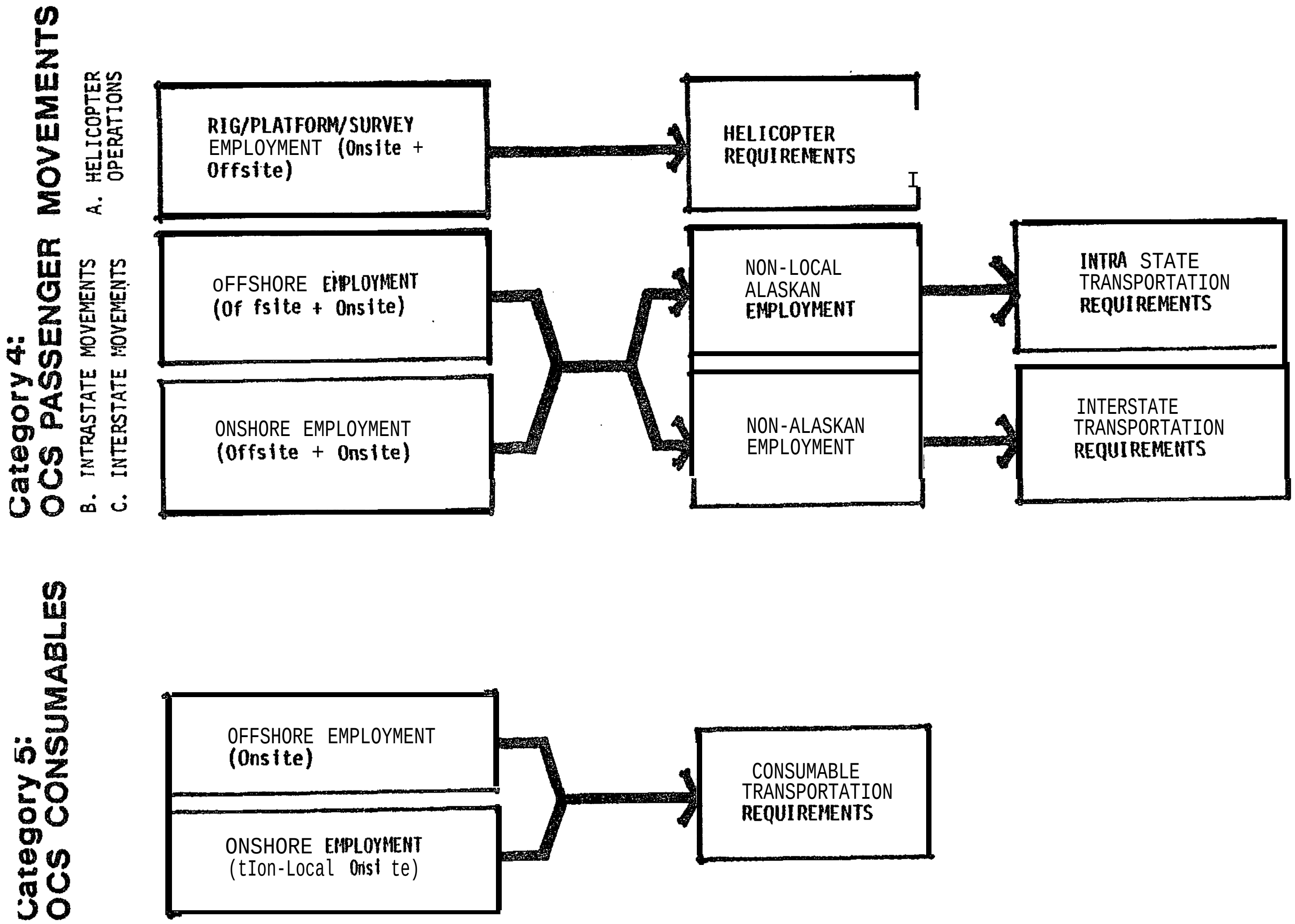
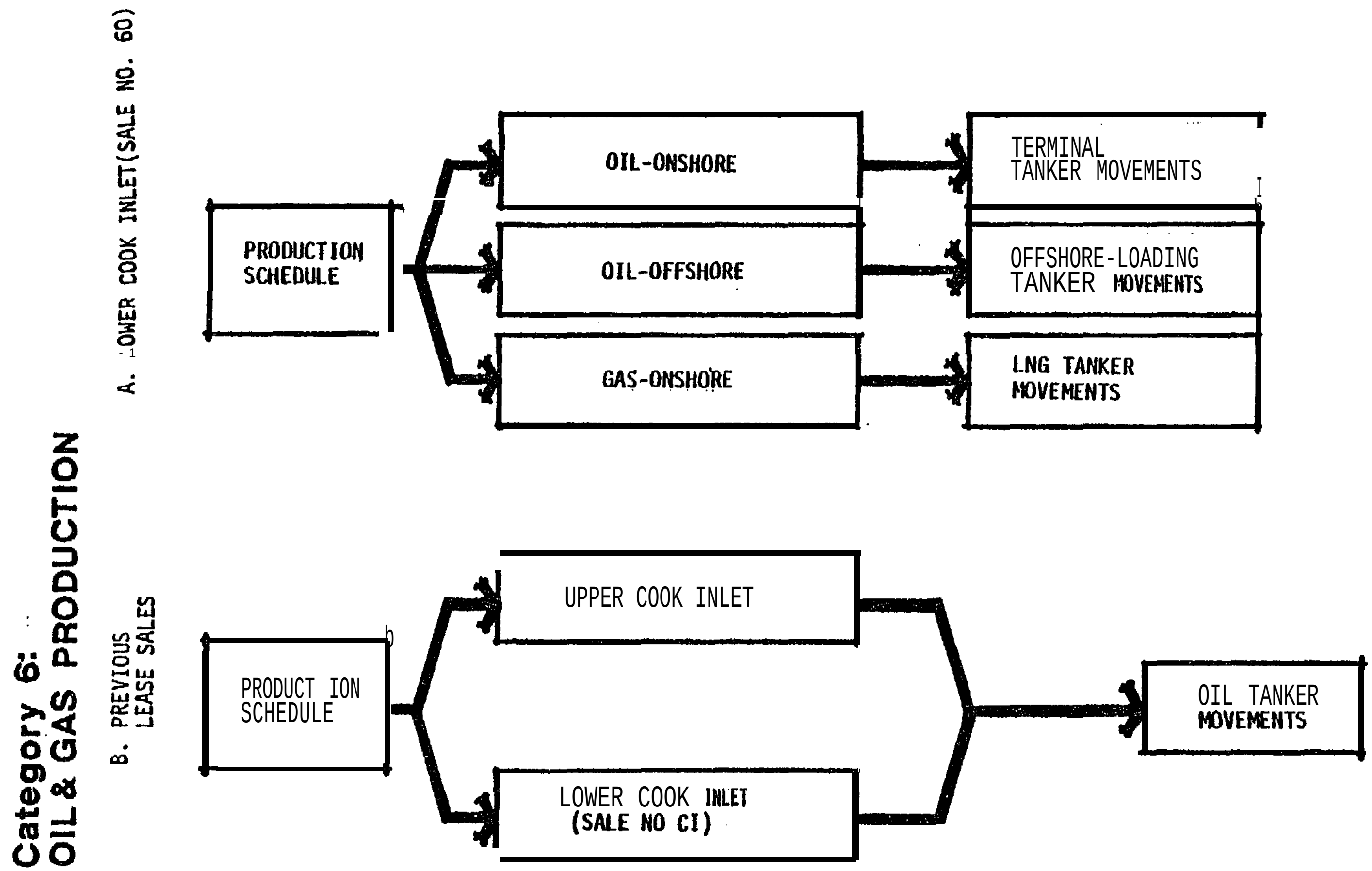


FIGURE 1c. FLOWCHARTS FOR DEVELOPMENT OF TRANSPORTATION DEMAND CATEGORY 6



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 1982-2001 are made for the base case and for each of the 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 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. For Homer, tonnage that did not originate in the community has been subtracted, For Kenai, the analysis of induced freight does not consider port facilities at Nikiski.

(2) Development of Freight Distribution Factors. Population data was available for two regions--Anchorage and Southcentral--which 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. 60. 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 general freight facilities in Kenai and Homer is assumed to be local in nature. For Kenai, none of the freight or fuel passing over facilities used exclusively by

Table A-1

Distribution of Final Destination of Tonnage Handled by Ports

Facility	Commodity	Local	Regions	
			Anchorage	Southcentral
Port of Anchorage	Dry Bulk		1.0	
	Petroleum Bulk		1.0	
Port of Homer	Dry Bulk	1.0		
	Petroleum Bulk	1.0		
Port of Kenai	Dry Bulk	1.0		
	Petroleum Bulk	N/A		

Source: Peter Eakland and Associates, 1979.

oil and gas companies is assumed to be population-related. The Port of Anchorage has a market area beyond the Anchorage region, but approximately 80% of tonnage has a local destination. Assignment of a 1.0 distribution factor to the Anchorage region does not introduce a significant error.

(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 case, base year factors are developed only for total population, whereas for the OCS cases values are developed for incremental as well as cumulative changes. The base year factors for individual regions and communities do not require adjustment when applied to port tonnage since a 1.0 distribution factor has been used for the major ports under consideration. 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 a capacity figure to base year throughput tonnage.

1.6.1.2 Induced Air Passenger Movements

The process of forecasting induced passenger movements on scheduled airlines as with the marine mode uses the base year growth factors. However, the forecasting occurs for links rather than terminal points. The process is as follows:

(1) Development of Links to Be Analyzed. Air links on scheduled airlines will be studied that involve flights between Homer, Kenai, Anchorage, and Seattle. They include Homer-Anchorage, Homer-Kenai, Kenai-Anchorage, Kenai-Seattle, and Anchorage-Seattle. On the shorter links, particularly Kenai-Anchorage, air taxis carry a significant percentage of the total passengers. On the Kenai-Anchorage links, the estimate is as high as 50%, but it is assumed that existing percentages will not significantly change and that forecasts can be made independently. This assumption is reasonable since no dramatic changes in aircraft used or other service variables is anticipated. 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 were collected for scheduled passenger service by carrier and route from the Civil Aeronautics Board or the Alaska Transportation Commission, as appropriate. August, 1978 was used

as the base period in order to reflect peak demand. The figures were divided by 4.3 to produce weekly trips. For service that did not exist at that time but now is being provided, traffic was estimated on the basis of available seats and a reasonable load factor. Except for the Homer-Anchorage link, all base level figures represent link traffic. For this link, the figure includes non-stop traffic as well as traffic that stops en route at Kenai. A listing of base level figures can be found on Table A-2.

(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 Homer and Kenai 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.

Table A-2

Data by Link for Forecasting Future Scheduled Air Flights

Link	Distribution of Passengers by Aircraft Type	Threshold Load Factor (1)	Seats/Plane	Base Level Flights/Week (3)	Base Level Passengers/Week
Homer-Anchorage	Jet- 0.50(4)	0.50	110	2	29
	Commuter - 0.50	0.80	19	26	328 } 521
			19	27 (Kenai stop)	164
Homer-Kenai	Commuter - 1.0	0.80	19	27	25
Kenai-Seattle	Jet - 1.0	0.80	110	3	115
Anchorage-Seattle	Jet- 1.0	0.80	128(2)	125	12,756
Kenai-Anchorage	Commuter - 1.0	0.80	19	182	1,603

Notes: (1) The threshold load factor is the point at which another flight is justified. Factors chosen are based on how many flights include passengers from other links.
(2) For the Anchorage-Seattle link, a weighted seating capacity has been developed based on passengers and flights for August, 1978.
(3) Non-stop unless otherwise indicated.
(4) Jet flights are assumed to originate in Kodiak.

Source: Peter Eakland and Associates, 1979.

(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 with one exception. So that all forecasts are only for non-stop traffic, the estimated traffic from Homer to Anchorage stopping in Kenai is subtracted from the forecast demand for this city pair. The level of traffic on this route is assumed to remain constant at the base level figure, 164 riders per week. All growth in Homer to Anchorage traffic, thus, is expected to occur on non-stop flights.

1.6.1.3 Miscellaneous Induced Transportation Demands

Several additional areas of transportation demand are examined which are based primarily on population growth. Airplane operations at airports in Kenai, Soldotna, and Homer are assumed to grow proportionately to the growth in local, areawide population. 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 forecast number of passenger arrivals and departures 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 in 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 these subjects 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. Industrial freight demands for each of the Lease Sale No. 60 scenarios will be added to demands for the medium scenario of Lease Sale No. CI.

1.6.2.1 Role of Supply Bases

The transportation impacts of OCS oil and gas activities on marine facilities depend 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 4.9 m (16 ft.) draft.

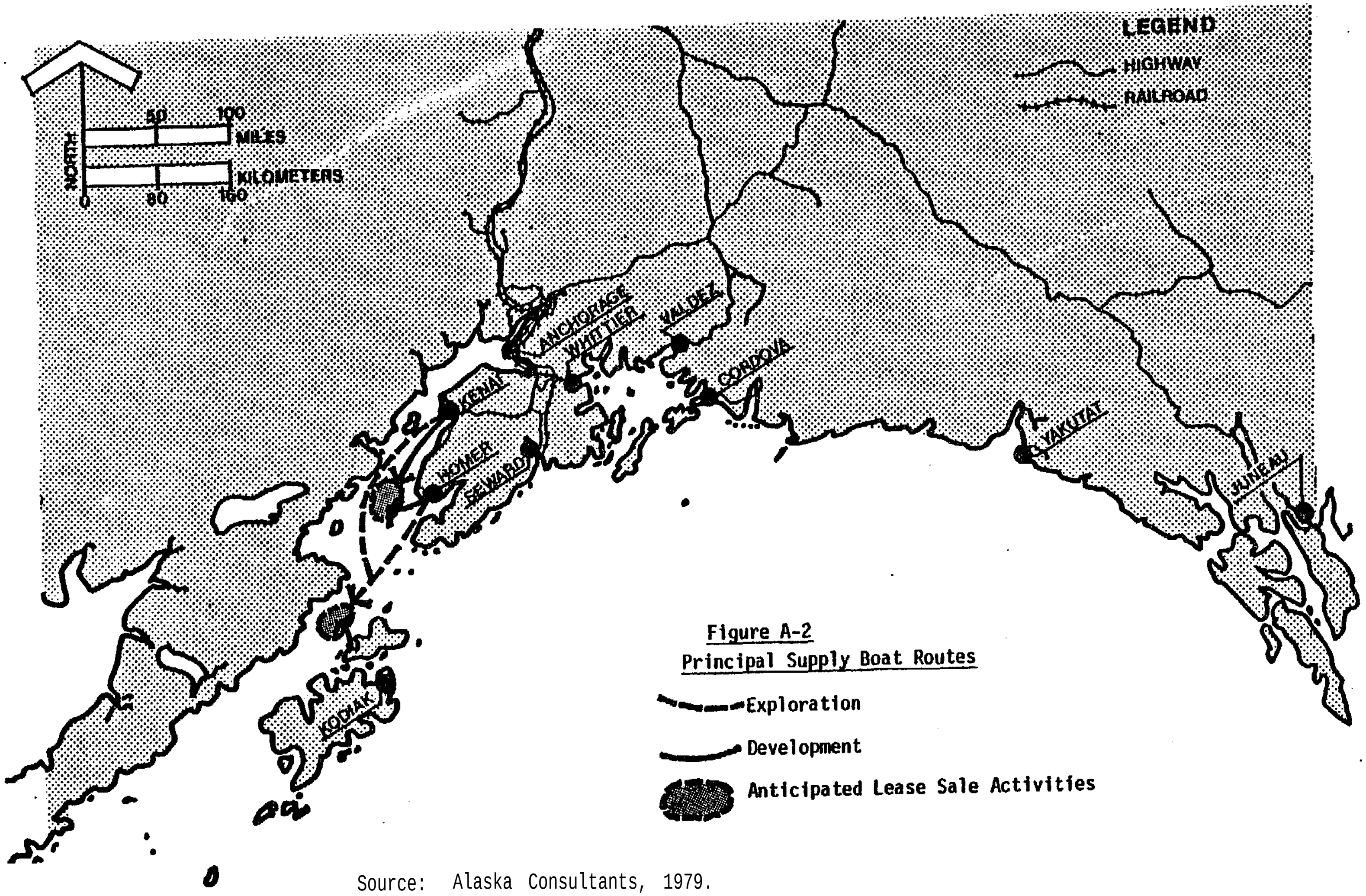


Figure A-2
Principal Supply Boat Routes

Source: Alaska Consultants, 1979.

Safe anchorage should be available for boats not tied up at docks . Efficient means of transferring freight and fuel from the shore to supply boats should be available as well as adequate landside storage.

- Airport facilities. An airfield at least 1,524 m. (5,000 ft.) in length should be available to handle jet or Hercules C-130 freight shipments.

- Existing industrial infrastructure to serve the oil and gas industry.

- Suitable location for onshore production facilities, including oil terminals and LNG plants. Savings can result if supply bases are constructed adjacent to other facilities rather than in separate locations.

1.6.2.1.1 Exploration

During the exploration phase, an emphasis is placed on using existing facilities. A great variation in logistics strategies among oil companics 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 rather than invest 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 usually exist during the exploration and development phases. The primary facilities are referred to as rear supply bases and handle bulk commodities and major industrial freight. They require dock equipment to efficiently transfer cargo, adequate storage space, and dedicated berth areas. Nikiski is the only port in Cook Inlet or the Western Gulf of Alaska with facilities designed specifically for use by the oil industry and will serve as the rear supply base during the exploration phase for all drilling.

Forward supply bases are those used principally for obtaining fuel, water and miscellaneous industrial supplies that have arrived by air or land. These facilities are located closer to the drilling areas and do not require extensive infrastructure or landside storage.

Nikiski is expected to serve as the rear supply base for exploration activities in both Lower Cook Inlet and Shelikof Strait, and Homer will serve as the forward supply base. Seldovia, Seward, and Kodiak possibly will play minor roles as forward supply bases but will not be considered in this report. On the basis of estimated supply base employment at Nikiski and Homer (Alaska Consultants, 1979), an estimated two-thirds of supply boat movements will occur at Nikiski and the remaining one-third at Homer, as shown in Table A-3.

Table A-3

Distribution of Supply Boat Functions to Supply Bases

Supply Base	Exploration: Well Drilling, LCI	Exploration: Well Drilling, SS	Development: Well Drilling LCI	Development: Well Drilling SS	Development: Platform Installation LCI	Development: Platform Installation SS	Development: Offshore Pipeline Construction LCI	Development: Offshore Pipeline Construction SS	Production: Resupply LCI	Production: Resupply SS
Nikiski	2/3	2/3	2/3	0	2/3	0	2/3	0	1	0
Homer	1/3	1/3	1/3	o	1/3	0	1/3	o	0	0
Afognak	0	0	0	1	0	1	0	1	0	1

Note: LCI = Lower Cook Inlet; SS = Shelikof Strait.

Source: Alaska Consultants, 1979.

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 oftentimes change during development. Changes occur for activities in Shelikof Strait but not for those in Lower Cook Inlet. A summary of the expected mix of supply base responsibilities is shown in Figure A-1. In Lower Cook Inlet, the roles of Homer and Nikiski will remain unchanged for drilling, and the same division of supply boat movements will also hold for platform installation and pipe-laying. Incremental improvements are scheduled for existing facilities, particularly in Homer. Dedicated facilities for supporting oil and gas activities will be required there for the high and possibly the medium scenarios.

Neither Homer nor Nikiski will serve Shelikof Strait during the development phase. Instead, a support base facility will be constructed on Afognak Island at one of five potential sites (Dames & Moore, 1979) in both the medium and high scenarios. It will be constructed in time to serve all development activities. Support base construction resulting from medium scenarios of previous lease sales in the Gulf of Alaska has been forecast in 1984 at Kodiak and in 1985 in Seward. The Seward facility, however, was based on resource discoveries in the Middleton Shelf, which was not included in the area selected for leasing. Minor support during development could come from the Kodiak facility.

1.6.2.1.3 Production

Marine support during the production phase is forecast to come exclusively from supply base facilities at Nikiski and Afognak. The low level of support requirements during this phase favors use of a single facility. 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. Two vessels currently provide logistics requirements for 13 platforms in Upper Cook Inlet (Waggoner, 1979).

1.6.2.2 Inbound Drilling Supplies (Barges and Tankers)

Table A-4 summarizes the estimated material requirements for individual exploration and development wells at depths outlined in the Lease Sale No. 60 scenarios. Development wells are assumed to require 80% of the materials/foot needed for exploration wells, except for water which will retain the same per foot requirements. 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

Table A-4

Materials Requirements for Sale No. 60 Drilling Activities

Material	Oil and Gas Exploration[2] Depth 14,000 feet				Oil and Gas Development[2,3] Depth 10,000 feet			
	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		
20 in.	1,000 ft.	66.5			800 ft.	53.2		
13-3/8 in.	3,500 ft.	119.0			2,800 ft.	95.2		
9-5/8 in.	10,500 ft.	278.3			7,200 ft.	190.8		
5" tubing					10,000 ft.	87.3		
		471.5	0.08	0.94		432,7	0.07	0.87
Dry Bulk:								
Bentonite		700		4.73		400		2.70
Cement		300		1.30		171		0.74
Barite		350		1.05		200		0.60
		1,350	0.23	7.08		771	0.13	4.04
Fuel:		2,400	0.40	5.33		1,371	0.23	3.05
Drill Water:		3,750	N/A	6.25		2,679	N/A	4.47

Notes: (See following page.)

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

Table A-4 (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% of materials/foot as needed for exploration wells except of water. See page 5 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 82 of reference cited in Note (2) above.

the development well depth of 3,048 m (10,000 ft.). 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 the required tonnage of a given commodity to drill one well. The barge requirements are cumulative, because each commodity would arrive on a separate barge. Assuming an average barge load of5,443 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 enclosed areas for carrying fuel, drill water, and dry bulk and have 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 for exploratory wells is dry bulk followed closely by drill water. 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 will be supplied from refineries in Nikiski.

Data in Table A-4 can be used to forecast the number of barges and supply boats minimally required to meet the logistics requirement for well drilling. The estimate for supply boats will significantly underestimate the actual number of round trips carried out. The minimum number of trips 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, thus, 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. The existence of the service base facility at Nikiski precludes competition by OCS operators for other dock facilities in the area, at least until its facilities become inadequate. Even then, expansion of the existing facility is more likely than use of another facility.

At Homer, circumstances are different, as no separate OCS facilities exist. The major dock is used by the Alaska Ferry System, oil tankers, and freight barges at the present time, and one end is used by a Coast Guard buoy tender. 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. For Homer, the causes of major demands will be platform installation and offshore pipeline laying and not movements of drilling-related freight, which will be supplied from Nikiski.

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, although it requires six support vessels, does not produce measurable impacts on the transportation systems, because the platforms are moved directly to where they will be installed from construction sites outside of Alaska.

Careful planning for construction off onshore facilities 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 built. 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 Nikiski, 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 large 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 unnecessarily divert them from other activities which would better use their capabilities. Onshore pipeline supplies will be delivered directly to work sites.

1.6.2.4 Outbound Logistics (Supply Boats)

supply boats serve a variety of functions from anchor handling for pipelaying barges to resupply missions. For some offshore activities, supply boats move offshore employees to and from offshore work sites, but it is assumed that this task will be performed exclusively by helicopters. Typical values of required boat trips per month have been established for each offshore activity (Alaska Consultants, 1976). This information is summarized in Table A-5. The peak summer period is used for computing

Table A-5

Supply Boat Movements by Activity

Phase	Activity	Trips/Month	Time of Year	Berth Requirements[1]
A. Exploration	1. Well Drilling	12/rig	Year-round	3.33 rigs/berth
B. Development	1. Well Drilling	20/rig[2]	Year-round	2 platforms/berth (1 rig) 1 platform/berth (2 rigs)
	2. Platform Installation	24/platform (6 vessels, 4 resupplies/month)	May-October	1.67 platforms/berth
	3. Offshore Pipeline Construction	43/80.5 km (50 mi.) of pipeline/year	May-October	0.93 pipelines per year maximum of 80.5 km (50 mi.)/berth
	• Pipe-laying	15/barge (all goods except pipe)[3] 16/barge for anchor handling		
	• Pipe-burying	12/barge		
C. Production	1. Resupply	4/platform	Year-round	10 platforms/berth

Notes: (1) Based on one berth accommodating a maximum of 40 trips/month.
(2) Berth requirements for development drilling based on comparison of well depth and number of wells drilled per year for exploration and development wells.
(3) Assumes that all pipe will be delivered directly from barges to pipe-laying barges and will not pass through supply bases. This assumption is invalid for the Northern Gulf of Alaska development scenarios.

Source: Alaska Consultants, 1976,

the number of monthly supply boat round-trips that will use each supply base. Once total round-trips have been developed for Lower Cook Inlet and Shelikof Strait activities, percentage breakdowns for each supply base shown in Table A-3 and discussed in Section 1.6.2.1 are applied.

1.6.3 CATEGORY 4: PASSENGER MOVEMENTS

1.6.3.1 Description of Terms

The generation of OCS employment-related transportation demands, which includes passenger movements, requires information from the scenarios and both regional and local studies. The information needed is summarized in Table A-6. The rotation factor and job duration are derived directly from the scenarios. Different rotation factors and residency breakdowns exist for onshore activities on the Kenai Peninsula and on Afognak Island. *On* Table A-6, the figures in parentheses refer to Afognak Island and the other figures to activities in either Homer or Kenai. 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 dis-aggregate by community into local, non-local Alaskan, and non-Alaskan employees. The latter breaks down employment into Alaskan and non-Alaskan segments, and the former breaks down employment into local and non-local segments.

Table A-6

Characteristics of OCS Employment Trip-Making by Task

Employment Sectors For Petroleum Operations	Development	Rotation Factor(1)	Duration	Residency(3)(4)	Round-Trips per Month(5)	Estimated Share of Employment to Alaskan Residents Year 1979-84	1985-89	1990 +
ONSHORE								
1. Service Base	Exploration	1	P	L	NA	1.0	1.0	1.0
	Development	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1,0	1.0	1.0
2. Helicopter Service	Exploration	2	P	0.5L/0.5NL	0.717	0.75	0.75	0.75
	Development	1.5	P	L	NA	1.0	1.0	1.0
	Production	1	P	L	NA	1.0	1.0	1.0
3. Service Base Const.	Development	(1.11)	T	(0.1L/0.9NL)	(0.430)	.5	.525	.578
4. Pipe Coating	Development	1.11	T	NL	0.430	.2	.21	.231
5. "Onshore Pipeline Const.	Development	(1.11)	T	(0.1 L/0.9NL)	(0.430)	.2	.21	.231
6. Oil Terminal Const.	Development	(1.11)	T	(0.05L/0.95NL)	(0.430)	.5	.525	.578
7. LNG Plant Const.	Development	(1.11)	T	(0.05L/0.95NL	(0.430)	.5	.525	.578
8. Concrete Plat. Const.	Development		-					
9. Oil Terminal Operations	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
10. LNG Plant Operations	Production	1(2)	P	L(0.8L/0.2NL)	NA(0.717)	1.0	1.0	1.0
OFFSHORE								
11. Surveys	Exploration	1	T	NL	0.717	.2	.21	.231
12. Rigs	Exploration	2	T	0.1L/0.9NL	0.717	.2	.21	.231
13. Platforms	Development	2	P	0. 3L/0. 7NL	0.717	.1	.3	.33
	Production	1	P	0.7L/0.3NL	0.717	1.0	1.0	1.0
14. Platform Installation	Development	2	T	0.1L/0.9NL	0.717	.1	.105	.116
15. Offshore Pipeline Const.	Development	2	T	0.1L/0.9NL	0.717	.1	.105	.116
16. Supply-Anchor-Tugboats	Exploration	1.5	T	0.2L/0.8NL	0.717	.4	.42	.462
	Development	1.5	T	0.3L/0.7NL	0.717	.8	.88	.968
	Production	1.5	P	0.8L/0.2NL	0.717	.8	.88	.968

Notes: (See following page.)

Table A-6

Characteristic 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). For offshore activities and onshore Afognak activities, local is considered to be Kenai and Homer and surrounding area. For other onshore activities local is the community and surrounding area at which the activity is located.

(4) Material in parentheses refers to onshore activities at Afognak Island. Onshore activities without parentheses refer to Homer and/or Kenai.

(5) 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

(6) No concrete platforms.

Source: Rotation factors - Dames & Moore, 1979; Sear factors - ISER, 1979; residency - Alaska Consultants, 1979; otherwise Peter Eakland and Associates, 1979.

"Local resident" has different meanings depending upon the location of the work site. For onshore tasks in Homer and Kenai, local means the community in which the activity occurs.' For offshore tasks and onshore tasks on Afognak Island, local refers to both the southern and central peninsula areas. Employment for these tasks is split between both areas. No intercity transportation is required for onshore tasks in Homer and Kenai, but for the other tasks those living in the central peninsula must travel to and from Homer, which is assumed to be the base for all helicopter operations.

Employee estimates for the southern and central peninsula areas are used rather than those for Homer and Kenai-Soldotna. For transportation assessments, the emphasis is on market areas rather than jurisdictional boundaries.

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).

1.6.3.2 Helicopter Operations

To obtain peak weekly helicopter operations, total offshore employment is first obtained for each service base. Employees for supply, anchor, and tug boats are 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, which are expected to provide most of the personnel movements to and from shore bases, have a capacity of 20-22 persons but the helicopters do not usually operate full. 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 both Lower Cook Inlet and Shelikof Strait are assumed to be based out of Homer.

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. Local trips involve persons residing in the Kenai-Soldotna area who are transported from work sites first to Homer by helicopter. The movement of non-Alaskans from the service base to and from points outside of the State constitute interstate trips. Both interstate and intrastate trips will use links within the State. The distinction between the two types of trips is based upon the final destination. Both categories are assumed to use existing scheduled carriers rather than chartered aircraft. Estimated distribution of trips north and south from the service bases is shown on Table A-7 and graphically on Figure A-3. 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 their trips to the south or east. Kenai-based non-Alaskan workers are presumed to prefer south-bound flights from Anchorage because of greater frequency of service. Only 25% are assumed to proceed south from Kenai to their final destinations.

The final step 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 flow chart showing the factors and intermediate results needed to develop the link volumes. Box number 11 is the final result, peak weekly outbound trip link volumes for each scenario. Numbers 1-9 require nine iterations, based on three scenarios (low, medium and high), each having three service bases (Homer, Nikiski, Afognak). The Roman numerals represent factors and data required for the step-by-step transformations eventually leading to link volumes. Trips on the "local" air link--Homer to Kenai--are not shown on this diagram but would be one-half the difference between figures 4B and 5B and figures 4A and 5A for Afognak onshore activities.

Table A-7

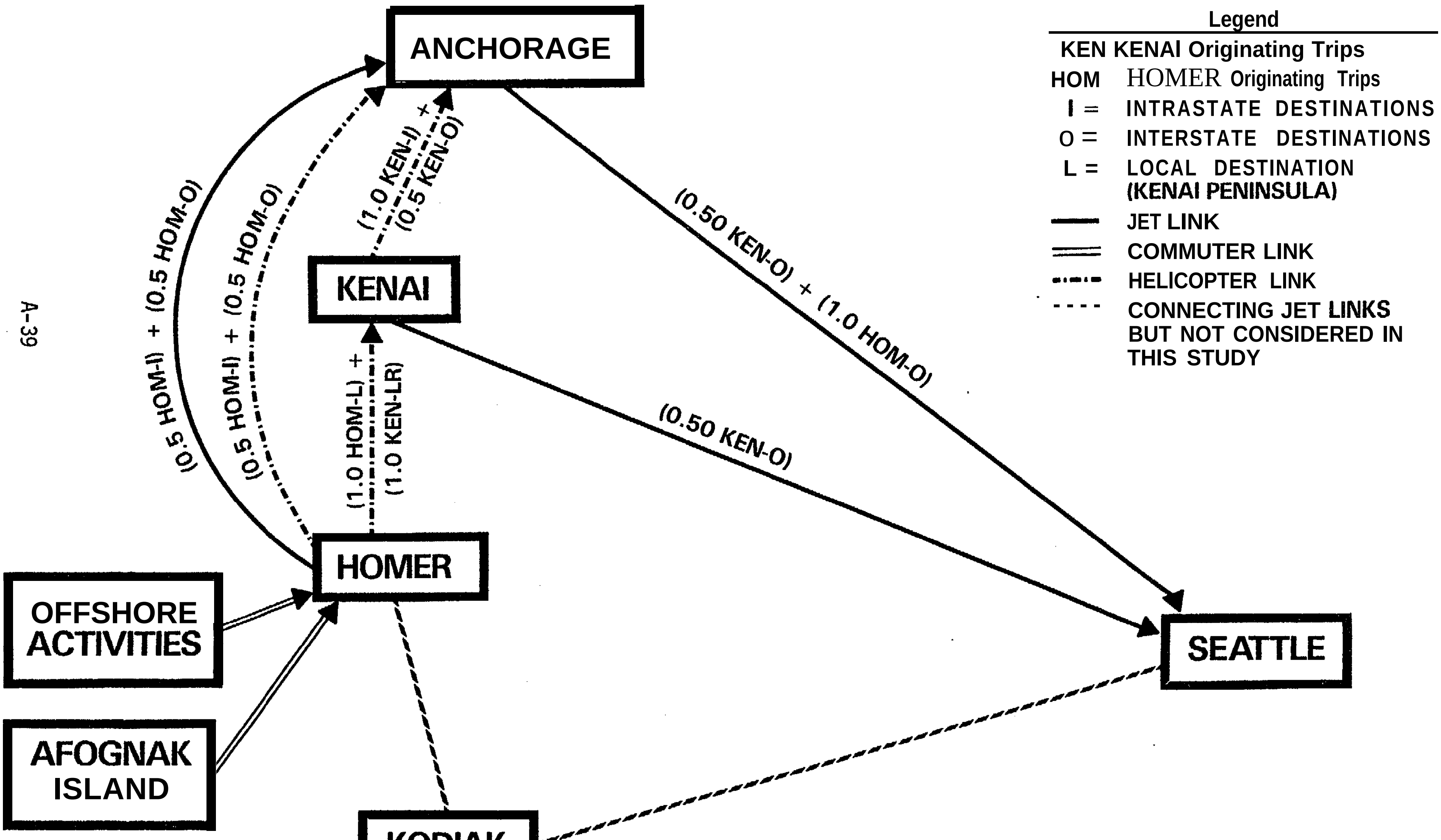
Intrastate and Interstate Air Passenger Distribution Factors

Air-Links	Homer-originating Local[1]	Homer-originating Intra-Alaska[2]	Homer-originating Interstate[3]	Kenai-originating Local	Kenai-originating Intrastate[2]	Kenai-originating Interstate[3]
Homer-Anchorage		0.5 (Jet) 0.5 (Commuter)	0.5 (Jet) 0.5 (Commuter)			
Homer-Kenai	1.0				1.0(R)	
Kenai-Seattle						0.50
Anchorage-Seattle				1.0		0.50
Kenai-Anchorage					1.0	

Notes: (1) Local trips are trips between Homer and Kenai. "Local" for offshore and Afognak Island onshore jobs includes both Homer and Kenai. Return trips are designated (R).
(2) Intrastate trips are those from either Kenai or Homer to designations beyond the Kenai Peninsula. All such trips are assumed to have an Anchorage destination.
(3) Interstate trips involve non-Alaskan employees and a Seattle destination is assumed although for most destinations further south and east will be involved.

Source: Peter Eakland and Associates, 1979.

FIGURE A-3. **Assignment to Air Links of Outbound Intrastate and Interstate Travel Lower Cook Inlet / Shelikof Strait Petroleum Scenarios**



Source: Peter Eakland and Associates. 1980.

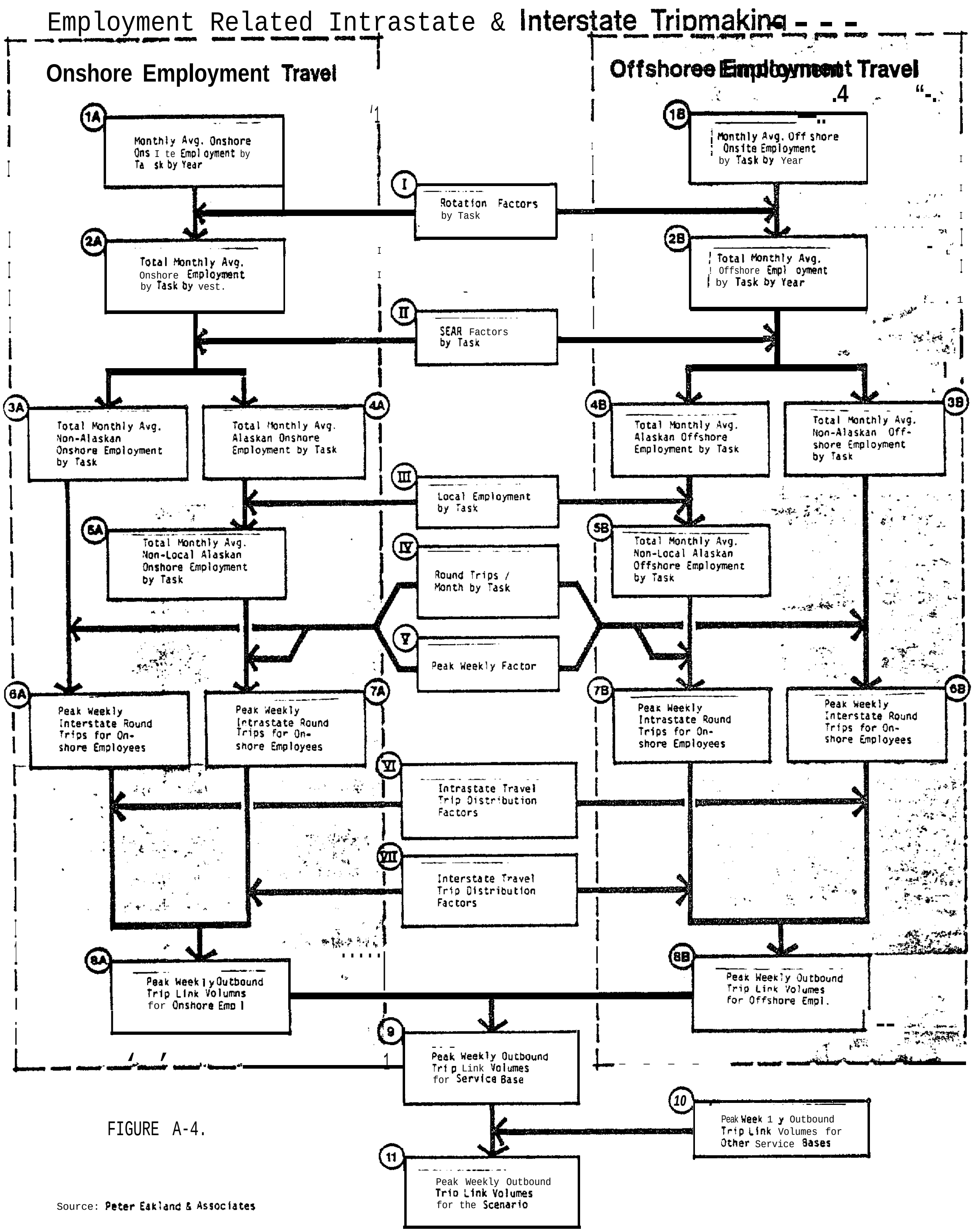


FIGURE A-4.

Source: Peter Eakland & Associates

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 conversion factors 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 for continuity purposes is carried 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, employment by task is maintained until step 6. Total employment (Box 2) is computed by multiplying onsite employment (Box 1) by the appropriate rotation factors (Box I). SEAR factors (Box II) then are used to allocate employment into Alaskan (Box 4) and non-Alaskan (Box 3) categories. Subtracting local employment (Box III) from the Alaskan employment for each task produces non-local Alaskan employment (Box 5).

Once average monthly employment has been broken down into non-Alaskan and non-local Alaskan figures, they are then converted into peak weekly intrastate (Box 7) and interstate trips (Box 6). The combined factor used is as follows: (round-trips/month by task) (1 .5) / (4.3 weeks/month).

The peak factor, 1.5, was determined by comparing average monthly employment with July employment for the same year. A week is used as the time unit for traffic demand to facilitate comparison with existing services which publish weekly schedules.

Distribution factors (Boxes VI and VII), which have already been described, are used to assign the trips to specific links (Box 8). 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 foodstuffs 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,. Those in the latter category are primarily involved in construction. The employment figure used to compute consumable requirements is the sum of three intermediate results shown in Figure A-5--2A, 3B, and 5B. It is multiplied by a suggested daily consumption of 4.54 kg (10 lbs.) per person (ADH, 1976). Consumables most likely will travel by established marine services in containers.

1.6.5 CATEGORY 6: OIL AND GAS PRODUCTION

Multiple areas of oil and gas production as well as multiple means of processing the production will exist in Lower Cook Inlet during impact period. The oil and gas supplies will be discussed in this section and the processing facilities under thresholds and impacts in a later section.

Oil production in the base case and the exploration-only OCS case occurs in the Upper Cook Inlet fields which are already under development and in those fields which have been forecast for development in the medium scenario of Lower Cook Inlet Sale No. CI. Oil production in the medium and high Sale No. 60 scenarios consists of base case production and production in the medium and high OCS cases, respectively.

Three sources of natural gas production are considered in the base case, as follows: (1) existing Upper Cook Inlet production, (2) new fields on the western side of Cook Inlet that will provide natural gas to the proposed Pacific-Alaska LNG plant, and (3) natural gas resulting from the medium scenario of Sale No. CI. No additional gas reserves are economic in either the low or the medium OCS case for Sale No. 60 (Dames & Moore, 1979). For the high OCS case, gas production in Lower Cook Inlet and Shelikof Strait is added to gas production for Sale No. CI. No estimates were available for the other two sources of base case production.

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 based on the 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 THRESHOLDS

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. (Frederic R. Harris, 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, and the corresponding ratio for the "low capacity was 0.10. A single capacity was computed for Homer based on a waiting time to service time of 0.25 for short sea vessels carrying bulk general and special cargo (Frederic R. Harris, 1979). At Kenai, the single capacity used was approximately the low value computed for neobulk cargo. 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 for Anchorage bulk fuel. The capacity of the pipeline from Nikiski to Anchorage 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. For Homer and Kenai, capacities were not computed for the more efficient handling categories because the small flow of freight across public docks has not been sufficient to justify the acquisition of adequate cargo handling equipment. Capacities computed by Frederic Harris (Frederic Harris, ?979) assume the existence of adequate manpower and equipment. Medium-sized ships occasionally carry their own loading and unloading equipment which reduce shoreside requirements for small ports. The elevator system of the M.V. Tustumena, for example, enables vehicles to be loaded and unloaded without special dockside ramps or cranes. Also, the Aleutian Developer, a Sea-Land vessel, has a movable crane.

Homer and Kenai are connected by road or a combination of rail and road to the major ports of entry to central Alaska--Anchorage, Whittier, and Seward. Consequently, they depend less on the marine mode for population-related freight than land-locked communities such as Kodiak and Cordova or even transshipment ports such as Seward. Facilities could be upgraded and general freight rates possibly reduced if adequate tonnage could be generated.

Third, a second distribution of capacities was required at Homer where fuel or dry freight shipments must compete for space with each other or with other users, and where dry freight and liquid bulk vessels share the same dock space. Figures were chosen to provide a reasonable mix.

Adjustments could be made if one of the capacities was reached before the other. Table A-8 shows the resulting capacities for the ports and the base year throughput tonnages.

The current ratio of *volume* to capacity for primary commodities at each port are shown, as well as threshold growth factors, which are their reciprocal. The latter represent the amount of growth that can occur before capacity constants 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 above 1977 tonnage figures of 92% is possible.

For the Kenai Peninsula, two types of thresholds can be addressed. The first is that of existing facilities. The second is the amount of throughput tonnage that would be required to justify stops by deep-draft ships of the two major carriers serving Anchorage, TOTE and Sea-Land. The traffic would come from increases in population but also from diversions to marine traffic from the truck mode. Discussions with carriers have suggested that a minimum demand of 50 containers per trip would have to exist for service by TOTE or Sea-Land to be economically feasible. A detailed examination of possible scenarios leading to expanded port facilities in the Kenai Peninsula is beyond the scope of this study. The possibility of such scenarios points out the difficulty of using existing capacities as guidelines for future port problems.

Table A-8

Development of Threshold Growth Factors for Lower Cook Inlet Port Facilities

Facility	Critical Handling Category(1)	Pet. of Capacity Available(2)	Base Value Throughput Tonnage (Metric Tons (Tons))	High Capacity(4) (Metric Tons (Tons))	Low Capacity(4) (Metric Tons (Tons))	Base Year Volume/Capacity(5) High Capacity	Base Year Volume/Capacity(5) Low Capacity	Threshold Growth Factors(6) High Capacity	Threshold Growth Factors(6) Low Capacity
Port of Anchorage	Containerizable	100%	905,366 (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)	5,802,756 (6,396,477)	3,670,883 (4,046,477)(3)	0.28(3)	0.45(3)	3.54(3)	2.24(3)
Port of Homer	General Cargo	67%	13,683 (15,083)	31,751 (35,000)		0.43		2.32	
	Liquid Bulk	33%	31,203 (34,396)	77,110 (85,000)		0.40		2.47	
Port of Kenai	Neobulk/Special	100%	26,597 (29,318)	45,359 (50,000)		0.59		1.71	

Kites: (See following page.)

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

Table A-8

Development of Threshold Growth Factors for
Lower Cook Inlet Port Facilities (Conrd)

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. 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.

The threshold growth factors will be used as guidelines only. The impact of key assumptions used in their development should be considered in assessing impacts. Containerized freight, because it can be handled most efficiently, has the highest capacity of dry freight handling categories. Its use as the basis for a port's capacity provides an upper limit, since other handling categories to some extent will always exist. This problem has been addressed by assuming a mix of categories where a significant amount of non-containerized traffic occurs. Nevertheless, an unforeseen arrival of large amounts of breakbulk cargo at a port, particularly during a short period of time, such as occurred at Seward in the summer of 1975, would create congestion problems that the threshold value would not prediet. Also, random arrival of vessels has been assumed. Where schedules exist and are adhered to by vessels, waiting can be reduced and capacity increased over what is shown. At present, this situation exists in Anchorage where both Sea-Land and TOTE operate on strict schedules to avoid shoaling areas at low tides.

1.7.1 .1.2 OCS Oil and Gas Transportation

As there are multiple sources of oil and gas in the Lower Cook Inlet-Shelikof Strait area, so also are there multiple options for processing the production. The only new processing facilities assumed are an oil terminal on Afognak Island and a 400 mmcfd Pacific-Alaska LNG plant to be constructed in two phases. Processing of oil can occur either at Nikiski where Tesoro and Chevron operate refineries or at Drift River, where oil is exported as crude. The two refineries with a combined capacity of 70,500 barrels per day are assumed to receive priority for produced oil. A' 1 production in excess of existing refineries is assumed to go to Drift R' ver. Of the oil refined at Nikiski, the oil pipeline to Anchorage with a capacity of 36,000 barrels per day is considered a priority use. The remainder will be exported in tankers, The average tanker sizes of 25,000 DWT and 40,000 DWT, respectively, for facilities at Nikiski and Drift River were obtained from information compiled by ERCO/Frankel (1978). For Afognak, the average tanker size is assumed to be 120,000 DWT, and the tankers export crude oil southward. Drift River and Nikiski are considered to be a single producing unit. The final distribution of oil to Nikiski and Drift River is assumed not to be affected by the location of pipelines chosen for the OCS scenarios. Adequate pipelines crossing Cook Inlet are assumed to exist. Whether or not these assumptions are realistic, the results create several thresholds. No exports occur from either Nikiski or Drift River until production exceeds the capacity of the Anchorage pipeline. The next threshold is the capacity of refining capacity in Nikiski, and until it is exceeded no exports occur from Drift River. Based on average tanker size, vessel movements are forecast for each production facility. Thresholds based on the number of berths and size of vessels have been computed (Eakland and Dooley, 1978). Table A-9 shows the number of 120,000 and 80,000 deadweight ton (DWT) tanker loadings that can be accommodated annually by one to five berths. An average turnaround time of 1.5 days is assumed for 120,000 DWT tankers and one day for 80,000 DWT tankers. The figures will be used to assess the onshore impacts of oil terminals for each resource level scenario.

Table A-9

Oil Tanker Movement Thresholds for Berths

Number of Berths	Berth Occupancy Factor	Oil Tankers/year (1) 120,000 DWT	80,000 DWT
1	27%	66	99
2	51%	249	373
3	62%	453	680
4	70%	682	1,023
5	74%	900	1,350

Note: (1) Assumes 1.5 day turnaround for 120,000 DWT tankers, 1 day for 80,000 DWT tankers.

Source: Dennis Dooley and Associates, 1978.

The length of a 152,408 metric ton (150,000 DWT) tanker, 298.7 m (980 ft.) will be used to assess berthing length requirements. The assumed depth requirement will be 21 m. (69 ft.), which is 1.05 the draft of a 254,012 metric ton (250,000 DWT) tanker, which has been estimated to be the largest oil tanker than could be accommodated in Ugak Bay (ECO, 1977).

Several alternatives will exist during the impact period for the processing of natural gas, all of which will first require transportation by pipeline to Nikiski. A gas pipeline serves Anchorage and has an annual capacity of 30 BCF. Collier's urea and ammonia production plants have a capacity of 43.8 BCF/year. Finally, Phillips-Marathon has an existing LNG facility with a 63.5 BCF/year *capacity,* and Pacific-Alaska has proposed two 200 mmcfd LNG units with an annual capacity of 146.0 BCF. It is assumed that supplies will be adequate in the base case to satisfy the capacities of both LNG plants. For the OCS cases, two thresholds are examined--first, the capacity of the LNG facilities and, second, the total capacity of all facilities processing natural gas. Assumed capacity of LNG ships is 2.8 BCF, which is the size of ships designed for the Pacific-Alaska LNG project. LNG ships are assumed to be approximately the same length as a 150,000 DWT tanker 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 upgraded to a traffic separation system at a later date.

Table A-10 compares navigational conditions in three areas of Alaska and three areas which have implemented safety fairways or separation schemes. In Puget Sound, the total width of lanes is 2.0 km (1.25 mi.) and in the Gulf of Mexico 3.2 km (2.0 mi .).

The traffic separation which is one component of the Prince William Sound Vessel Traffic Service, extends from Hinchinbrook Entrance to Rocky Point in Valdez Arm. The total width ranges from approximately 1.5 km (1 mi.) at Hinchinbrook Entrance to 0.9 km (0.57 mi.) at the other end.

An analysis of Alaskan shipping has concluded that even under the most optimistic development scenarios collision losses or enroute delays would have little or no relationship to traffic levels. "The capacity, when compared to expected uses, is practically infinite (ERCO, 1978)."

Major commercial fishing grounds are located in the vicinity of the proposed lease sale. The establishment of fairways would help minimize damage to fishing gear.

Table A-10

Comparison of Navigation Conditions for Sizing of Vessel Fairways

Basis for Comparison	Gulf of Mexico	Puget Sound	Strait of Juan de Fuca	Prince William Sound	Cook Inlet	Gulf of Alaska
Visibility (fog, rain, snow, etc.)[a]	1[f]	1	1	3	3	3
Current	1	1	2	2	3	2
Severity of Weather[b,c]	1/3	1	2	2/3	2/3	2/3
Ice	1	1	1	2	3	2
Aids to Navigation[d]	1	1	1	1	3	2
Radar Targets[e]	2	1	2	2	2/3	2/3
Totals	7/9	6	9	12/13	16/18	13/15

[a] The visibility in the Northern Gulf of Mexico is poor about 20 percent of the time on average.

[b] The weather in the GOM is generally good. However, during hurricanes, the wind and swells can be very great.

[c] During the winter and/or ice season, the weather conditions in Cook Inlet can become severe from a navigability point of view.

[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.

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-n shows the range assumed for each number of berths. The likelihood of a suPply boat finding an open berth increases with the number of berths for a 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 64m (210 ft.) long and must provide at least 5.5m (18 ft.) of water alongside atMLLW (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

Table A- 11

Relationship Between Supply Boat Round-trips and Berth Requirements

Round Trips/ Month	Required Berths (1)	Berth Occupancy
0 - 39	1	30%
40 - 79	2	30%
80- 179	3	50%
180 - 239	4	50%
240- 299	5	50%
300-359	6	50%
360-419	7	50%
420- 479	8	50%

Notes: (1) Based on 6 hr. docking time and berth occupancies as given. Thus, 1 and 2 berths can each handle up to 40 round-trips/month, and each additional berth up to 60 round-trips/month.

Source: Peter Eakland and Associates, 1979.

depend upon distance of offshore facilities from supply bases, proximity of a platform to other platforms, the extent to which logistics 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

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 will be on scheduled carriers. The passenger totals are converted into aircraft flights based on three variables, as follows, for each non-stop link: (1) distribution of passengers by aircraft type; (2) threshold load factors and (3) seats per plane. The appropriate information for each link is shown on Table A-2. The aircraft types are expected to remain similar to those used at present. Commuter aircraft operate exclusively on the Homer-Kenai and the Kenai-Anchorage links and jets on the links serving Seattle. Homer-Anchorage is served by both jets and commuter aircraft, and one-half of the passengers is assigned to each type of aircraft. A load factor of 0.8 is used on all flights, except for the Homer-Anchorage jet link for which 0.5 is used. Jet flights on this link originate in Kodiak, and the lower load factor reflects use by Kodiak-Anchorage travelers. Commuter aircraft are assumed to have 19 seats and jets 110 seats. For the Anchorage-Seattle. link, however, a weighted average of 128 seats per flight was used.

Table A-12 shows the equations used to forecast the number of peak scheduled flights per week. For the Homer-Kenai and Kenai-Anchorage links, the present level of Homer-Anchorage traffic using flights stopping in Kenai has been added to the figures for induced and OCS traffic. All forecasting was done on the basis of non-stop travel.

No thresholds have been established for passenger terminal facilities. Qualitative assessments of impacts will be made based on the forecasts of passenger loadings and unloading.

1.7.1.2.2 Airport Facilities

For runways, a length of 1,524 m (5,000 ft.) is adequate to serve both jets and Hercules C-130 freight aircraft. Weather minimums are based on local geography, navigational aids present at an airport, type of aircraft, and whether instrument approaches are possible.

The Federal Aviation Administration has established criteria for establishing and discontinuing facilities and services. For an airport to be considered for establishment of an airport traffic control tower, the sum of three ratios, which are computed as follows, must be one or greater:

Table A-12

Development of Induced Passenger Forecasts and Flights

Link	Population-Induced Link Passengers/Week[1]	Airplane Type	No. of Flights/Week[3]
Homer-Anchorage	(GF_{HOM}) (Base Level) - 164[2]	Jet	$\frac{1}{2}\left(\frac{\text{(Induced)} + \text{(OCS)}}{(0.50)(110)}\right)$
		Commuter	$\frac{1}{2}\left(\frac{\text{(Induced)} + \text{(OCS)}}{(0.80)(19)}\right)$
Homer-Kenai	(GF_{HOM})(Base Level)	Commuter	$\frac{\text{(Induced)} + \text{(OCS)} + 164^{(2)}}{0.80(19)}$
Kenai-Seattle	(GF_{KEN})(Base Level)	Jet	$\frac{\text{(Induced)} + \text{(OCS)}}{0.80(110)}$
Kenai-Anchorage	(GF_{KEN})(Base Level)	Commuter	$\frac{\text{(Induced)} + \text{(OCS)} + 164^{(2)}}{0.80(19)}$
Anchorage-Seattle	(GF_{ANC}) (Base Level)	Jet	$\frac{\text{(Induced)} + \text{(OCS)}}{0.80(128)}$

Notes: (1) GF = Population growth factor based on 1978 population.
(2) Only non-stop links are considered. The estimated existing patronage on Homer to Anchorage flights stopping in Kenai--164 passengers/week--is assumed to remain constant; and that growth will occur only on direct flights. The one-stop passenger traffic is subtracted from total forecast Homer-Anchorage trips to give non-stop passengers. The figure must be added to Homer-Kenai and Kenai-Anchorage link forecasts when computing flight requirements.
(3) The denominator consists of load factors and seats/plane as obtained from Table A-2.

Source: Peter Eakland and Associates, 1979.

(1) air carrier operations/15,000, (2) air taxi operations/ 25,000, and (3) general aviation and military operations (local plus itinerant)/200,000 (FAA, 1974). Of the four major airport facilities--Anchorage, Kenai, Homer, and Soldotna--only Anchorage and Kenai have control towers at the present time.

Capacities have been computed for airports at Kenai and Soldotna as part of master plans prepared within the past two years. The capacity at Homer is considered comparable to that at Soldotna. Threshold growth factors were computed on the basis of annual operations and capacity (Table A-13). An areawide factor was computed for the Kenai-Soldotna area. It is assumed that air taxi and general aviation operations, which make up approximately 80% of total operations, are directly related to the areawide population.

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.

Table A-13

Relationship of Existing Operations to Capacity
at Major Peninsula Airports

Location	Practical Annual Capacity (Operations)	Base Level Operations	Threshold Growth Factor	
Kenai [1]	210,800	78,344 (1976)	2.69	2.50 (areawide)
Soldotna [2]	150,000	66,000 (1978)	2.27	
Homer [3]	150,000 (est.)	36,618 (1977)	4.10	

Sources: (1) TRA/Farr; (2) Ted Forsi and Assoc., 1979; (3) T. McGuire, 1978.

Thresholds have not been established for the Alaskan 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 Tran-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.