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**Anchorage
International
Airport**

Phase I LOI Apron and Near-Term Capital Projects

**Exhibit
V-1**

The TRP includes extending the holdrooms in Concourse A behind the ticket counters 30 feet toward the airfield. The terminal apron replacement project will extend the concrete aprons at Gates A1 and A2 by 30 feet to maintain the existing 250-foot-deep concrete apron. Asphalt aprons at Gates A3 through A8 would be replaced with concrete out to 250 feet from the terminal. An area at the east end of Concourse A would be leveled (currently there is a grade drop) to allow for safer taxiing of aircraft and operation of Ground Service Equipment ("GSE") to Gates A7 and A8 and to the commuter gates on the inside of Concourse A. This will provide a second taxilane into the commuter positions on the east side of Concourse A. A former fire station in this area will be demolished as part of the project. This area will be converted to additional apron space for GSE storage or other uses.

Project Justification: The existing asphalt apron fronting the existing Concourse C and surrounding the parking positions at Concourses A and B is aged, cracked and in poor condition. Lack of immediate and effective repair will require rapidly escalating maintenance costs because of frequent patching and repair to preserve the use of this apron area for aircraft parking. Expanding the Concourse A concrete apron to maintain a 250-foot apron depth will help reduce apron maintenance costs, when compared to the alternative of an asphalt apron, and will ensure that the existing safety levels are maintained.

The development of a second taxilane access to the Concourse A gates will further enhance operational performance. Currently, if an aircraft is departing from one of the commuter positions on the inside of Concourse A at the same time an aircraft arrives for one of those gates, the arriving aircraft must hold outside the channel until the departure is clear, thereby incurring delay. Additionally, push back operations from the jet positions at the end of the Concourse A block the taxilane for both arriving and departing aircraft. The provision of a second taxilane into the area inside of Concourse A will reduce head-to-head operations, thereby enhancing safety and reducing congestion and delay.

b. RON/Cargo Apron Reconstruction

Project Description: As part of this project, three existing cargo refueling positions adjacent to the passenger terminal will be converted to joint use cargo hardstands/RON positions. The three 747-sized parking positions will be reconfigured to serve as many as five 757s. This project would involve replacing the existing asphalt pavement around the cargo positions with full-strength concrete pavement, which will lower maintenance costs and provide the added flexibility required for the RON parking. Additionally, approximately 800,000 square feet of existing, aging asphalt pavement will be replaced with new asphalt.

Project Justification: The terminal programming study² identified the need for at least five RON parking positions near the domestic terminal. Carriers now double- and triple-park aircraft at the terminal overnight because of lack of gate and remote parking positions. The condition of the 25-year-old terminal apron pavement is rapidly deteriorating and requires a high level of maintenance to preserve a safe operation. Double- and triple-parking overnight aircraft exacerbates the deterioration of the

² Anchorage International Airport Terminal Expansion Study, Domestic Terminal Facilities Requirements, Hirsch Associates, December 22, 1997

pavement and creates safety hazards to passengers walking between multiple aircraft to reach their aircraft. This practice also results in congestion and delay by blocking access to the terminal and to adjacent gates. The proposed RON positions are the closest available positions to the terminal gates, allowing for convenient towing of aircraft between the terminal and the pad. They can be used for cargo fueling and transfer during the daytime when they are not being used by passenger carriers.

c. Cargo Fueling Apron Expansion

Project Description: This multi-use project entails the construction of five new Design Group VI cargo fueling positions to replace the two lost during construction of the new Concourse C and the three temporarily lost during construction of the RON parking positions. Completion of all of the LOI Projects will result in a net increase of three cargo hardstands at the Airport. Access taxiways, tug road tie-ins and hydrant fueling would be included in the project. The cargo fueling positions would be relocated to the west side of the Airport at the proposed West Airpark. The new location will support and enhance a future third-party cargo development by providing some of the required taxiway access; in turn, the third-party developer would provide some of the ground support services for cargo carriers using the cargo apron.

Project Justification: International transit cargo operations have increased by nearly 50 percent in the last five years with the expansion of operations by most cargo airlines and new service by such airlines as Atlas, EVA, Cathay Pacific, Polar Air Cargo, Asiana, Air China, Singapore and Malaysia. The cargo airlines have been forced to refuel at available gates at the international terminal during peak periods because of insufficient capacity on the existing fueling apron. However, the international gates are already fully occupied with passenger flights during peak periods.

Furthermore, inadequate facilities cause cargo fueling at the international terminal to be inefficient and costly. The construction of the west cargo apron will enable international transit cargo airlines to continue to fuel quickly and conveniently, making ANC more attractive for these important customers.

In addition to providing relief during fueling operations, this apron will be used for other functions that will enhance air traffic control operational efficiency, reduce delay and maintain safety. When not needed for refueling, the apron could be used to stage departures awaiting air traffic control clearance without interfering with other inbound and outbound taxiing aircraft. The use of these new fueling positions will reduce congestion in the terminal area. Multiple uses of the expanded fueling area will provide added flexibility for air traffic controllers, thereby reducing workload and delay and enhancing efficiency and capacity.

The net result of these three Ramp/Apron LOI Projects will be an increase in the number of cargo fueling/transfer positions by three and a reduction in airside congestion, delay and operating and maintenance costs while maintaining high levels of safety. Construction of these projects will allow the Airport to effectively meet the rapidly growing demand for its apron facilities without adversely impacting the Airport's operational efficiency.

2. BCA METHODOLOGY AND ASSUMPTIONS

The benefits of the three Ramp/Apron LOI Projects were defined using a ramp chart analysis methodology. A ramp chart is a method of depicting the timing of passenger and freighter operations and their most likely assignment to available terminal gates or hardstand parking positions. For this analysis, passenger and freighter operations associated with a year 2000 level of design day activity were assigned to available aircraft parking positions for both the Preferred Alternative and the Base Case scenarios. Aircraft size limitations, airline gate assignments and anticipated gate scheduling procedures associated with both scenarios were considered to ensure that the appropriate aircraft were allocated to available parking positions. Given the LOI Projects' objective of efficiently serving forecast demand, all flights were assumed to be accommodated in both scenarios. However, because of insufficient parking positions and apron areas, certain flights in the Base Case would incur delay, added taxi time or additional operating costs relative to the Preferred Alternative. These impacts provide the foundation for quantifying an incremental operational benefit of the Preferred Alternative relative to the Base Case scenario.

It is recognized that the variability inherent in airfield performance may result in additional incremental benefits beyond those identified in this stochastic analysis. Experience at other major hub airports has demonstrated that average delay per operation increases exponentially as demand approaches capacity. Additionally, failure to reconstruct the terminal apron will result in increased gate closures for maintenance and repaving of the aging pavement. As a result, higher levels of delay are likely to be incurred under the Base Case, relative to the Preferred Alternative, than identified in this analysis. Quantification of such delays is the subject of an ongoing simulation analysis being conducted by the FAA System Capacity Office. Because this document must be submitted prior to the completion of the FAA's detailed delay study, it was determined that a stochastic approach would yield the most conservative results and still assure compatibility with the pending FAA analysis. In this case, "conservative" means that actual delay savings expected to result from the implementation of the LOI Projects will most likely be greater than those defined herein.

Key assumptions associated with the development of the year 2000 design day flight schedule and the ramp chart analysis are described in the following sections.

a. Forecast Activity

This analysis was conducted based on the revised TAF for Anchorage as described in Chapter II. While the enplanement forecast used herein is identical to the current TAF, the operations forecast was slightly adjusted to reflect current information about general aviation and freighter operations, as explained in Chapter II.

b. Future Design Day Flight Schedule

For purposes of defining aircraft delay for the Base Case and the Preferred Alternative, a future flight schedule was developed to represent a typical day in the year 2000. This flight schedule was prepared based on actual operating data for the passenger and cargo aprons in July and August 1997 and future activity projections from the revised TAF. The future flight schedule only includes passenger and freighter operations expected to operate on the terminal ramp and related hardstand positions. Airlines that utilize remote exclusive ramp areas will also accrue some benefits from the proposed projects. For example, Northwest Airlines occasionally uses the terminal hardstand positions as an

overflow during their peak periods. Nonetheless, to be conservative, these airlines were excluded from the analysis.

Many freight carriers rely on hardstand positions on the terminal ramp, as well as available gates at the international terminal, to refuel and to transfer cargo and service aircraft. Because the Ramp/Apron LOI Projects will have a significant impact on the freighter apron and terminal gates, this analysis reflects the expected activity levels and ramp use associated with both freighter and passenger aircraft.

Based on the revised TAF, passenger and freighter operations on the project ramp areas are expected to increase throughout the forecast period. It is assumed that design day activity levels will increase at a rate proportional to the annual forecast in the near term. Accordingly, 55 departures were added to the 249 departures of the year 1997 flight schedule to represent a year 2000 flight schedule. The additional flights were added in such a way that the future hourly departure profile remained proportional with the existing departure profile. This methodology recognized the marketing windows for aircraft at the origin and destination airports. However, some flights were added during non-peak periods to accurately portray airline scheduling techniques that maximize ramp utilization. Flights were added in a manner that complies with fleet mix and user mix projections. **Exhibit V-2** depicts the hourly departure profiles for both the baseline and future design day flight schedules.

The purpose of the LOI Projects is to efficiently serve forecast demand throughout the planning horizon while relieving apron congestion and maintaining the safe operation of the Airport. Therefore, the effective use of the proposed Ramp/Apron Projects will depend on their ability to serve aircraft demand on a design day or peak hour basis. The future design day flight schedule provides the basis for ascertaining how well demand would be served under both the Base Case and the Preferred Alternative.

c. Preferred Alternative Gate Allocation

The completion of the proposed terminal redevelopment and the LOI Projects will result in additional aircraft parking positions and operating flexibility. **Exhibit V-3** depicts the aircraft parking plan expected to be available under the Preferred Alternative. Although the actual airline use agreements have not yet been finalized, this parking plan represents one likely scenario and provides a reasonable basis for evaluating the benefits of completing the proposed Ramp/Apron Projects. The likely aircraft capability of each parking position is summarized in **Table V-1**.

Historically, the hardstand positions adjacent to the terminal have been used primarily for cargo transfers and technical fuel stops. As part of the Preferred Alternative, the apron areas around positions R2 through R4 will be repaved to form a continuous concrete pad so that the area can be used to accommodate the RON needs for up to five Boeing 757s (without the reconstruction, only three aircraft can be accommodated, regardless of size). As traffic demand increases, it is assumed that other hardstand positions could be used to meet additional overnight parking needs for the passenger airlines and as temporary holding positions during the day for passenger flights awaiting gate availability.

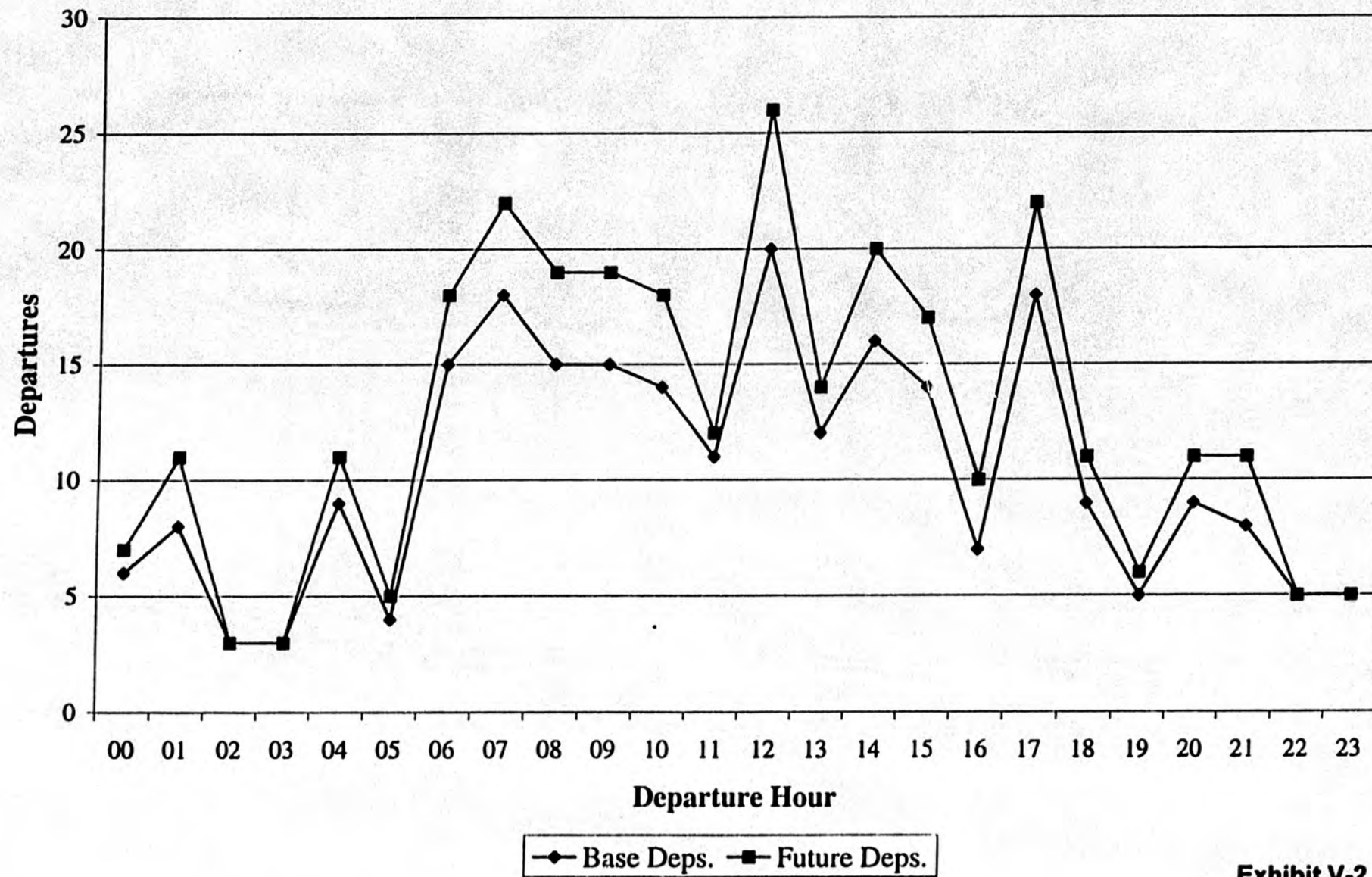
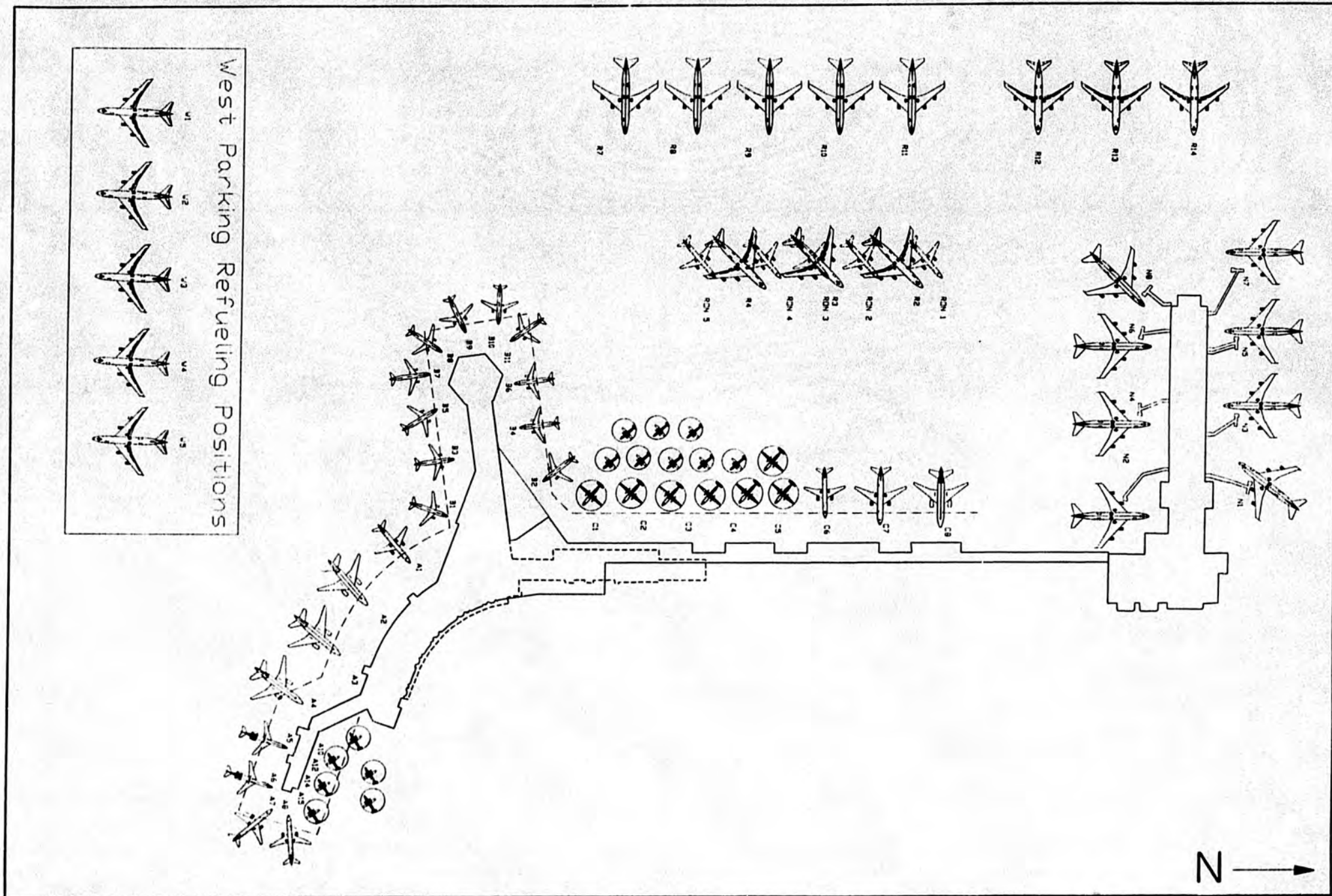


Exhibit V-2



**Anchorage
International
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Preferred Alternative Gate Allocation

**Exhibit
V-3**

Table V-1
Anchorage International Airport
Preferred Alternative Gate Allocation

Gate	Maximum Aircraft	Gate Use	Gate	Maximum Aircraft	Gate Use
A1	757	Passenger	N1	747-300 1/	PAX, Cargo
A2	DC10-40	Passenger	N2	747-300 1/	PAX, Cargo
A3	DC10-40	Passenger	N3	747-300 1/	PAX, Cargo
A4	DC10-40	Passenger	N4	747-300 1/	PAX, Cargo
A5	727-200	Passenger	N5	747-300 1/	PAX, Cargo
A6	727-200	Passenger	N6	747-300 1/	PAX, Cargo
A7	757	Passenger	N7	747-300 1/	PAX, Cargo
A8	757	Passenger	N8	747-300 1/	PAX, Cargo
A10	2 Small Commuter	Passenger	R2	747-400	Cargo, Fuel
A11	Not Available		R3	747-400	Cargo, Fuel
A12	2 Small Commuter	Passenger	R4	747-400	Cargo, Fuel
A13	Not Available				
A14	1 Small Commuter	Passenger	RON 1	757	RON
A15	1 Small Commuter	Passenger	RON 2	757	RON
B1	A320	Passenger	RON 3	757	RON
B2	A320	Passenger	RON 4	757	RON
B3	A320	Passenger	RON 5	757	RON
B4	A320	Passenger			
B5	A320	Passenger	R5	Not Available	
B6	A320	Passenger	R6	Not Available	
B7	A320	Passenger			
B8	A320	Passenger	R7	747-300	Cargo, Fuel
B9	A320	Passenger	R8	747-300	Cargo, Fuel
B10	A320	Passenger	R9	747-300	Cargo, Fuel
B11	A320	Passenger	R10	747-300	Cargo, Fuel
C1	3 Large Commuter	Passenger	R11	747-300	Cargo, Fuel
C2	1 Small Commuter	Passenger	R12	747-400	Cargo, Fuel
C3	3 Large Commuter	Passenger	R13	747-400	Cargo, Fuel
C4	3 Small 1 Large	Passenger	R14	747-400	Cargo, Fuel
C5	4 Small Commuter	Passenger			
C6	757	Passenger	W1	747-400	Fuel
C7	767-300	Passenger	W2	747-400	Fuel
C8	DC10-40	Passenger	W3	747-400	Fuel
			W4	747-400	Fuel
			W5	747-400	Fuel

1/ Gates Can accommodate 747-400's but the adjacent gate would be restricted to 747-300

d. Base Case Gate Allocation

The following Base Case assumptions reflect a likely course of action that results in the maximum utilization of available aircraft parking positions in the event the LOI is not issued and the projects are subsequently not constructed as planned. For the Base Case gate allocation, it was assumed that the utilization of the terminal gate and hardstand positions would remain similar to that currently available at the Airport, with some minor modifications. Because of the age and condition of Concourse, this concourse will be taken out of service and demolished this winter. Therefore, for purposes of the Base Case analysis, Concourse C is demolished, and the commuter gates are relocated to Concourse B. To accommodate this shift, Delta Air Lines would be relocated from its existing gates in Concourse A to the International Terminal. The Delta gates on Concourse A would then be redeveloped and used by Alaska Airlines. This gate transfer will replace the gates Alaska Airlines would lose on Concourse B, as well as provide Alaska Airlines with a small increase in gate capacity.

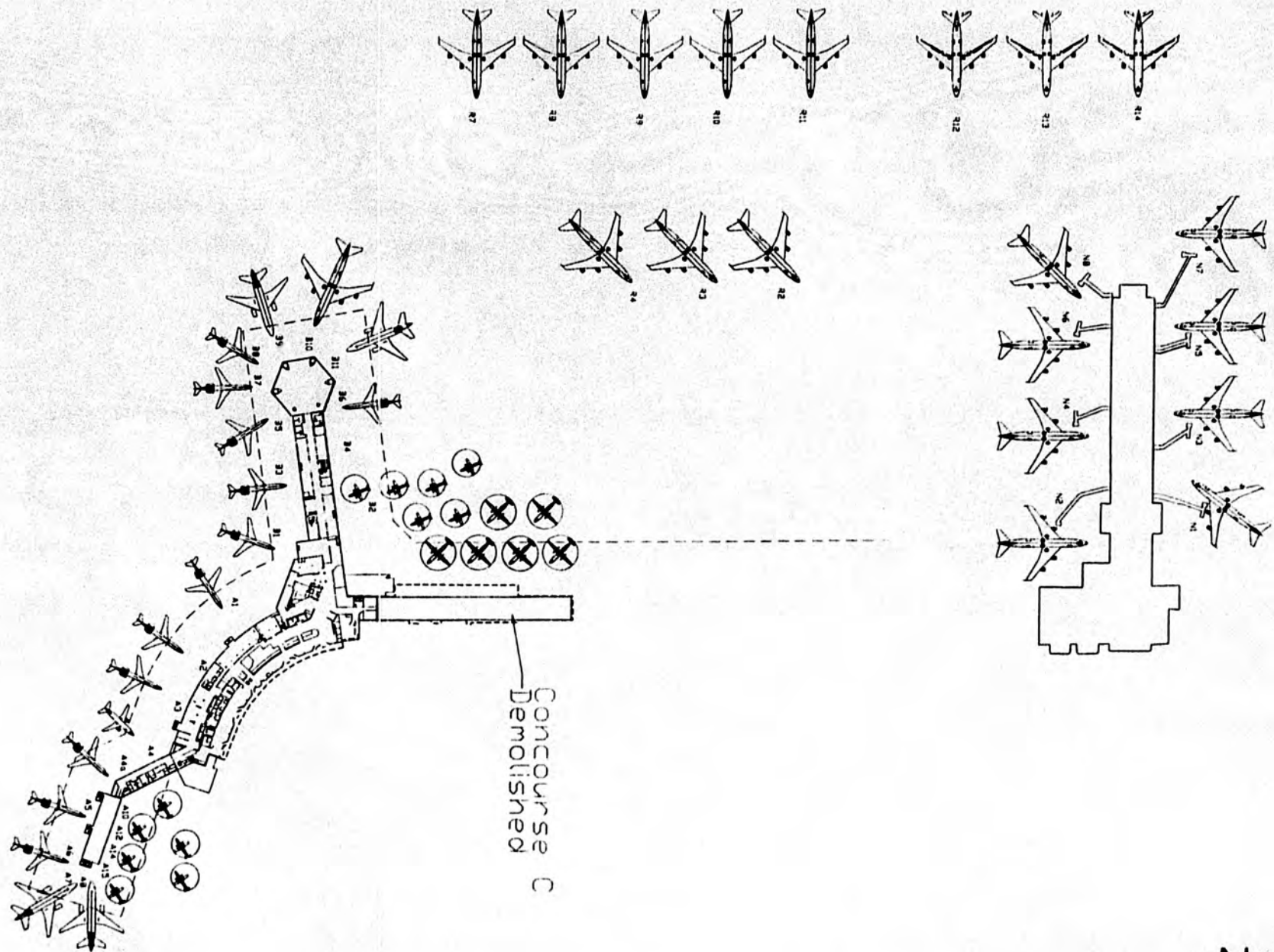
The existing freighter hardstands would remain available in the Base Case, with the exception of the two positions at the end of Concourse C, which will be lost because of pavement construction. Three new hardstand positions north of R2, which are already programmed and scheduled for construction in 1998, would also be available. Additionally, as with the Preferred Alternative, it was assumed that, as passenger demand increases, the hardstands will be used for airline RON parking and as temporary holding positions for aircraft awaiting a terminal gate assignment. **Exhibit V-4** depicts the aircraft parking positions included in the Base Case gate allocation, and **Table V-2** summarizes the aircraft capability of each existing position positions scheduled to be built in 1998.

To maximize use of available ramp in the Base Case, it is assumed that cargo flights would continue to use positions in the North Terminal for cargo transload operations. Domestic passenger flights, however, would not be able to use the North Terminal gates because of security requirements and the need to prevent the mixing of domestic and international passengers. Domestic passenger flights would therefore incur delays while waiting the availability of a domestic gate. (Special accommodations would be made to serve domestic flights on gates N2 and N4 during construction.)

e. Project Phasing

The phasing and sequencing of the projects is designed to minimize the operational impacts and passenger disruptions during construction and maximize economies of scale in construction costs. The construction phasing schedule allows the Airport to maintain operations during construction and brings airside improvements on-line with the TRP phasing plan. Construction of the airside projects will occur during Alaska's summer construction season.

- Construction of the Terminal Apron Replacement is scheduled to coincide with the TRP beginning in 1998 and ending in 2004. The aircraft parking apron adjacent to the terminal will accommodate the new gate configuration under the TRP and be sequenced with the TRP.



**Anchorage
International
Airport**

Baseline Gate Allocation

**Exhibit
V-4**

Table V-2
Anchorage International Airport
Base Case Gate Allocation

Gate	Maximum Aircraft	Gate Use
A1	727-200	Passenger
A2	727-200	Passenger
A3	727-200	Passenger
A4	737	Passenger
A4a	727-200	Passenger
A5	727-200	Passenger
A6	727-200	Passenger
A7	757	Passenger
A8	757	Passenger
A10	2 Small Commuter	Passenger
A11	Not Available	
A12	2 Small Commuter	Passenger
A13	Not Available	
A14	1 Small Commuter	Passenger
A15	1 Small Commuter	Passenger
B1	727-200	Passenger
B2	6 Small Commuter	Passenger
B3	727-200	Passenger
B4	6 Large Commuter	Passenger
B5	727-200	Passenger
B6	727-200	Passenger
B7	727-200	Passenger
B8	727-200	Passenger
B9	DC10-40	Passenger
B10	DC10-40	Passenger
B11	DC10-40	Passenger
C1		
C2		
C3 (A-D)		
C4 (A-D)		
C5 (A-D)		

Gate	Maximum Aircraft	Gate Use
N1	747-300 1/	PAX, Cargo
N2	747-300 1/	PAX, Cargo
N3	747-300 1/	PAX, Cargo
N4	747-300 1/	PAX, Cargo
N5	747-300 1/	PAX, Cargo
N6	747-300 1/	PAX, Cargo
N7	747-300 1/	PAX, Cargo
N8	747-300 1/	PAX, Cargo
R2	747-300	Cargo, Fuel
R3	747-300	Cargo, Fuel
R4	747-300	Cargo, Fuel
R5	Unavailable	
R6	Unavailable	
R7	747-300	Cargo, Fuel
R8	747-300	Cargo, Fuel
R9	747-300	Cargo, Fuel
R10	747-300	Cargo, Fuel
R11	747-300	Cargo, Fuel
R12 2/	747-400	Cargo, Fuel
R13 2/	747-400	Cargo, Fuel
R14 2/	747-400	Cargo, Fuel

1/ Gates Can accommodate 747-400's but the adjacent gate would be restricted to 747-300

2/ Currently programmed positions assumed to be part of the baseline

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- The RON/Cargo Apron Reconstruction is expected to be constructed in 2000, because the practice of double and triple parking at the terminal gate aprons cannot continue under the new terminal configuration.
- To replace fueling positions lost under the TRP and provide for continuing the operations during construction, the Cargo Fueling Apron Expansion construction is planned at the beginning of the program in 1999 and to be completed in 2000.

f. Evaluation Period

The physical life of the LOI Projects is likely to be more than 20 years, assuming routine maintenance continues to occur as required. Based on FAA guidelines and industry standards, a 20-year evaluation period is considered appropriate and was therefore applied in this analysis.

3. BASE CASE AND PREFERRED ALTERNATIVES

The BCA was performed by evaluating the benefits and costs of the LOI Projects relative to a Base Case Alternative. The Base Case is not defined as a "do-nothing" scenario, but rather as a scenario representing a course of action that might occur if the LOI Projects are not constructed. Other alternatives that might meet the LOI Projects' purposes and needs were considered, but were not considered in detail during the BCA because they would likely result in greater cost and/or less benefit than the Preferred Alternative. These alternatives include the construction of additional ramp elsewhere on the Airport, such as the north ramp area. The Base Case and LOI Project alternatives are described below.

a. Identification of the Base Case

The Base Case for this analysis assumes that the FAA does not approve the LOI Application and, as a result, the LOI Projects are not implemented as planned. Because the apron pavement is in dire need of repair and because the Airport must still achieve its objective of serving forecast demand, a "do nothing" scenario is not considered to be a prudent or reasonable option. It is assumed that the Airport would not allow the apron pavement to fail, nor would it refuse to serve passenger and cargo demand. Accordingly, in the Base Case, it is assumed that the Airport would continue to maintain the existing ramp pavement in a safe operating condition through a process of annual patching, joint sealing, crack sealing and semi-annual resurfacing. While this technique would be more costly than the Preferred Alternative and would require more frequent closures of limited aircraft parking positions, it would enable the Airport to continue its mission, albeit at a higher cost and lower level of service.

It is assumed in the Base Case that Concourse C would be demolished, but not replaced, and Delta Air Lines would be relocated to the International Terminal. Instead of reconstructing the ramp pavement, semi-annual asphalt overlays would be performed to prevent the pavement from failing. While some elements of the terminal program would likely still be constructed as expected to meet passenger demand, the lack of adequate airside apron/ramp facilities would jeopardize the full realization of terminal benefits. Specifically, because of insufficient parking positions and the lack of flexibility to dynamically accommodate the anticipated aircraft fleet mix, certain passenger and cargo

operations would be assigned to sub-optimal locations and, as a result, airlines and passengers would incur additional costs including, but not limited to, the following:

- Added taxi time and congestion for using more distant hardstand positions;
- Added capital costs for rehabilitating/constructing additional remote parking positions;
- Added opportunity costs for missing departure windows necessary to serve certain markets; and
- Added passenger delays because of longer airfield travel times and congestion.

The ability to avoid these Base Case costs is defined as a benefit of implementing the preferred alternative.

The Base Case is assumed to include the construction of three Group VI aircraft hardstand parking positions north of the existing positions. This project is not one of the LOI Projects because it already is programmed and funded and therefore assumed to be available in both the Base Case and the Preferred Alternative. Construction of these positions is scheduled to begin this summer.

b. Overview of Alternatives

Alternatives to constructing the LOI Projects that are capable of meeting their purpose and need were considered in this analysis. The option of doing nothing was discarded from further analysis because it would not meet the objective of efficiently serving forecast demand and minimizing pavement maintenance costs. Similarly, demand management strategies are not a viable option because they would not allow forecast demand to be served and they do not recognize the limited windows of operation required to serve major markets in the Pacific Rim, Europe and North America.

Other locations for constructing remote aircraft parking positions are available within the Airport's boundaries, including the north area ramp. However, all such sites would require greater operational costs because of greater taxi distances, would require greater capital costs for ramp construction and would have a greater potential environmental impact. It was further determined that no "excess" ramp space is available for passenger or cargo aircraft parking because all available existing ramp is fully utilized for general aviation, maintenance, cargo or other aviation functions. As a result, the Preferred Alternative represents the optimal course of action that would accomplish the LOI Projects' objectives and that would result in the greatest benefit-cost relationship. As an alternative, the Base Case as defined herein represents the most likely course of action if the Preferred Alternative is not adequately funded. All other alternatives would result in a lower net present value and therefore were discarded from more detailed analysis.

4. PROJECT COSTS

The total cost of the three Ramp/Apron LOI Projects consists of the initial capital investment and the ongoing O&M expenses, as discussed below.

a. Capital Costs

The capital investment required for the three Ramp/Apron Projects is \$42.4 million, of which \$38.7 million is included in the LOI Application. The capital cost of each project is shown below:

• Terminal Apron Replacement	\$23.0 million
• RON/Cargo Apron Reconstruction	\$ 6.0 million
• Cargo Fueling Apron Expansion	<u>\$13.4 million</u>
Total	<u>\$42.4 million</u>

These costs are presented in 1997 dollars and include design costs and other contingencies. Capital investments represent total construction costs and a \$400,000 capital expenditure for a snow loader required to service the additional surface of the cargo fueling apron expansion.

The present value for the capital costs of these projects is:

• Terminal Apron Replacement	\$17.3 million
• RON/Cargo Apron Reconstruction	\$ 4.9 million
• Cargo Fueling Apron Expansion	<u>\$11.3 million</u>
Total Present Value	<u>\$33.5 million</u>

b. O&M Costs

The Terminal Apron Replacement, RON/Cargo Apron Expansion and Cargo Fueling Apron Expansion projects for which funding is sought under this LOI Application collectively represent an O&M cost increase of \$91,350 in pavement maintenance over the Base Case on a present value basis discounted at the FAA-specified rate of 7.0 percent. This is because the significant O&M savings of the Terminal Apron Replacement and RON/Cargo Apron Reconstruction are offset by the additional O&M expenses from the Cargo Fueling Apron Expansion with its additional labor cost of \$100,000 per year for snow removal.

Project 1—Terminal Apron Replacement

This project involves replacing 730,000 square feet of asphalt apron around Concourses A, B and C with concrete surfaces, which will reduce annual O&M expenses by approximately \$217,000 per year (in 1997 dollars). Over the 20-year life of the concrete structure, this produces a present value savings of \$1,886,246. These savings result from both a lower annual initial O&M cost per square foot for concrete (\$.21) versus asphalt (\$.54) and a longer life cycle for concrete (20 years) versus asphalt (seven years). For asphalt, the O&M expenses increase at a compounded rate of 5.0 percent per year over the seven-year life cycle, representing the increased maintenance associated with the deterioration of the surface.

Concrete has a significant advantage over asphalt in that the surface is more durable and the annual per square foot O&M expenses do not escalate for the first six years. After the initial six years of the surface life, the marginal deterioration of the surface increases O&M expenses by less than 2.0 percent during the second five-year period and 5.2 percent for the third five-year period. In the final six-year period in the concrete surface

life cycle, annual O&M expenses are 10.0 percent above those in the first. Accordingly, the O&M savings from concrete as opposed to asphalt are significant.

Project 2--RON/Cargo Apron Reconstruction

This project involves replacing and expanding the current asphalt and concrete base cargo RON apron with 250,000 square feet of concrete. The present value of the discounted cash flow of O&M savings is \$829,239 for the 20-year life of the project.

As with the first project, the savings are the result of both a lower annual O&M cost per square foot for concrete (\$.21) versus asphalt (\$.54) and a longer life cycle for concrete (20 years) versus asphalt (seven years).

Project 3--Cargo Fueling Apron Expansion

This project involves construction of a new surface of 1.162 million square feet of concrete to serve as a cargo fueling apron. Because this is a new facility, there are no O&M expense savings over similar existing facilities. Construction of this facility represents an additional O&M cost whose present value is \$2,806,835, which includes a marginal cost of \$100,000 per year for additional labor costs for snow removal.

Summary

The present value of the discounted cash flows (discounted at the 7.0 percent mandatory FAA rate) for O&M expenses from these three projects are:

Terminal Apron Replacement Savings	\$1,886,246
RON/Cargo Apron Reconstruction Savings	\$ 829,239
Cargo Fueling Apron Expansion Cost	<u>(\$2,806,835)</u>
Total Present Value of O&M Cost	(\$ 91,350)

5. PROJECT BENEFITS

a. Gate Delay Savings per Operation

Development of the LOI Projects will result in an overall reduction in average gate delay per operation when compared to the Base Case. The Ramp/Apron Projects will increase the number and capability of aircraft parking positions at the Airport, both at the terminal building for passenger processing and at hardstands used by freight carriers to transfer cargo and service transiting aircraft. A ramp chart analysis was used to evaluate the benefit of these additional parking positions.

A ramp chart analysis is a process whereby a design day flight schedule is matched to the capabilities of a gate system to determine the ability of a gate system to accommodate the schedule. In this evaluation, the ramp chart analysis was used to allocate flights in the future design day schedule to both the Preferred Alternative and Base Case terminal gate and hardstand parking positions. The analysis considered the airline and aircraft gate allocation constraints, gating procedures and physical gate characteristics, which are discussed in Sections 2b and 2c of this chapter. The evaluation resulted in a ramp chart for each gate allocation scenario that illustrates how the parking positions might be used throughout the day. The ramp chart also identified the flights that could not be accommodated as scheduled at a gate or hardstand position.

Exhibits V-5 and V-6 depict the ramp charts for the Preferred Alternative and Base Case, respectively. The left side of the ramp chart indicates the individual terminal gates and the remote hardstand positions. The time of day is indicated along the top of the chart. The individual bars on the inside of the ramp chart depict the time periods that an aircraft is occupying each gate. Information identifying each particular flight is shown within the bars. The flight bars have been color-coded to represent passenger and freighter operations. In both ramp charts, the flight bars for the freighter operations are green and the passenger flights are red. The color behind the gate numbers indicate the

gate use. Yellow indicates the domestic passenger gates and red indicates the cargo hardstands that would be restricted by use of the new RON positions.

The red flight bars on gates marked R2 through R14 represent passenger flights that could not be accommodated at a passenger gate. The passengers on these flights could be served in one of two ways. They could either be delayed until a terminal gate becomes available or they could be transferred from the hardstand to the terminal by a passenger bus. For purposes of this analysis, it was assumed that the passenger flights would be delayed until a terminal gate became available. Although the busing operation might be considered a reasonable option, it would require additional capital costs for the construction of a passenger bus dock and holdroom and for the acquisition of buses. It also would result in incremental O&M costs for labor, maintenance and fuel. Moreover, the buses on the ramp would result in added ramp congestion and passenger inconvenience. Because the marginal costs of a busing operation are expected to be higher than the marginal cost of incurring additional aircraft delay, the busing option was not evaluated.

Instead, the amount of time that individual flights would have to wait for a terminal gate was considered to be the gate delay. The combined gate delay of all the ungated flights was determined for each alternative, which represents the total gate delay in the design day for each alternative. The total gate delay for each alternative was allocated among all passenger operations in the 2000 design day flight schedule to determine the average delay per operation in the design day. The difference between the gate delay for the Base Case and the Preferred Alternative is the total gate delay savings in the design day. Applying this total delay over all of the passenger operations in the design day determines the average delay savings per passenger operation that will result from the project. Table V-3 summarizes the calculation of average gate delay and overall gate delay savings per passenger operation.

Table V-3
Summary of Average Delay per Operation - Year 2000 Design Day

Passenger Air Carrier Operations	Minutes of Gate Delay		Total Daily Gate Delay Savings (Minutes)	Gate Delay Savings Per Operation (Minutes)
	Base Case	Alternative		
374	621	240	381	1.0

Average delay per passenger operation typically increases exponentially as demand increases relative to capacity. For purposes of this analysis, however, it is assumed that the average delay per operation will increase at a rate proportional to the increase in operations, which tends to understate the likely delay savings.

b. Taxiing/Maneuvering Delay Savings per Operation

The airport cargo/terminal ramp redevelopment project will provide a second taxilane into the commuter parking positions on the east side of Concourse A (Gates A10 through A15). Under the Base Case, the single taxilane access to the Concourse A ramp occasionally results in head-to-head operations during peak periods. Specifically, when an arriving aircraft and a departing aircraft enter the channel at the same time, the arrival is forced to hold outside of the channel until the departing aircraft has left the gate area.

OPERATIONS
FREIGHTER OPS
PASSENGER OPS

GATE	2000																							
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
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Anchorage
International
Airport

Baseline Ramp Chart

OPERATIONS
FREIGHTER OPS
PASSENGER OPS

Exhibit
V-6

Development of the second taxilane will reduce taxi and maneuvering delay by allowing bi-directional traffic into the parking positions.

To evaluate the delay reduction benefits of the additional taxilane, the ramp chart for the Base Case was evaluated to determine how many times in the design day opposing traffic would be encountered on the taxilane. Two operations were deemed to be opposing if the scheduled departure time of any flight at gates A10 through A15 occurred within 7.5 minutes either before or after the scheduled arrival time of a flight at one of these gates. The 15-minute window around the scheduled arrival time will allow for variation in on-time performance for either the arrival or departure.

It was estimated that it would take a typical aircraft 1.1 minutes to exit the channel, assuming a 10-knot taxi speed, before the arriving aircraft can enter. Therefore, it was assumed that each aircraft experiencing a head-to-head operation would incur 1.1 minutes of delay. If multiple aircraft were to arrive or depart at the same time, the delay would increase correspondingly.

Based on the 2000 design day flight schedule, a total of 22 flights would be delayed in the design day because of the single taxilane for a total of 23.5 minutes. Using a conservative estimated annual to design day operations ratio of 300, 117.3 hours of delay would be experienced in 2000 because of the single taxilane. On average, this represents the opportunity to reduce delay per operation by .05 minutes per operation. Development of the second taxilane will eliminate this delay. Table V-4 below summarizes the average taxi/maneuvering delay savings in the year 2000 resulting from the addition of the second taxilane.

Table V-4
Summary of Concourse A Taxi/Maneuvering Delay Savings

Design Day Delayed Flights	Design Day Minutes Per Delay	Design Day Delay (Minutes)	Annual Delay (Minutes)	2000 Annual Passenger Operations	Average Annual Delay Per Operation
22	1.1	23.5	7,037	145,388	0.05

As was the case with average gate delay, the average maneuvering delay savings will likely increase exponentially as demand increases. For purposes of this analysis, however, it is conservatively assumed that marginal delay increases proportionately to demand.

c. Aircraft Operating Cost per Operation

In the analysis of delay costs for aircraft operations, the appropriate base cost of aircraft operations must be determined. The cost of delay is defined as the marginal cost of operating the aircraft. These costs are variable and are the product of the number of hours of aircraft operation. Fixed costs (i.e., taxes, insurance, rentals) and accounting conventions (i.e., depreciation, amortization, allowances) are excluded from these calculations as they do not increase or decrease as a factor of hours of operation.

The FAA collects information on aircraft operating expenses through Form 41 filings from air carriers and publishes it in the Economic Values for Evaluation of FAA and

Regulatory Programs. These values were used to determine hourly operating costs that are relevant to the aircraft fleet at ANC. The fleet mix at the Airport contains a large number of different types of aircraft, from large Boeing 747 passenger and freighter aircraft to the smallest general aviation aircraft. To determine an average operating cost for ANC, all of the aircraft operating at the Airport were grouped into one of the following categories based on aircraft type and engine configuration:

Turbofan 4-Engine – Narrowbody	Turbofan 4-Engine – Widebody
Turbofan 3-Engine – Narrowbody	Turbofan 3-Engine – Widebody
Turbofan 2-Engine – Narrowbody	Turbofan 2-Engine – Widebody
Turboprop 4-Engine	Turboprop 2-Engine
Piston	

The average aircraft operating cost used in this analysis was calculated based on a weighted average of the Form 41 variable operating cost ("VOC") and percentage of the ANC Fleet Mix for each of the aforementioned aircraft categories. This average was calculated for the existing (1996) fleet mix, as well as for projected fleet mixes in 2001 and 2016. The weighted average ground operating costs for aircraft operating at ANC is presented below:

	1996	2001	2016	2017
Departure Cost Per Delay (variable cost per minute)	\$14.47	\$15.01	\$16.50	\$16.60

This methodology is presented in greater detail in the report entitled "Benefit-Cost Estimate for Runway 6L/24R Reconstruction at Anchorage International Airport," dated November 20, 1997 by HNTB Corporation, which is attached as **Appendix A**.

d. Annual Aircraft Delay Savings

The annual savings in aircraft delay costs were calculated based on the average delay savings of 1.05 minutes per operation under the Preferred Alternative relative to the Base Case in 2000. This figure consists of the marginal savings in gate delay and maneuvering delay. While it is recognized that delay increases exponentially with demand, it is conservatively assumed in this analysis that average delay would increase proportionally with annual operations. Accordingly, this results in a savings of 1.15 minutes per operation in 2004. Because all phases of construction will not be completed until 2004, any incremental savings during the construction period would be deferred until completion of construction. Subsequently, this analysis did not realize any aircraft operations savings until 2004.

The annual delay savings are shown in the following **Table V-5**:

Table V-5
Annual Aircraft Delay Savings

Year	Delay Savings		Aircraft Cost	
	Per Minute of Operation	Air Carrier Operations	Per Minute of Delay	Delay Savings
2004	1.15	153,101	\$15.31	\$2,698,039
2005	1.17	155,123	\$15.41	\$2,787,757
2006	1.18	157,173	\$15.51	\$2,880,386
2007	1.20	159,316	\$15.61	\$2,978,400
2008	1.21	161,487	\$15.71	\$3,079,619
2009	1.23	163,688	\$15.81	\$3,184,152
2010	1.25	165,919	\$15.91	\$3,292,109
2011	1.26	168,184	\$16.01	\$3,403,733
2012	1.28	170,483	\$16.11	\$3,519,152
2013	1.30	172,818	\$16.21	\$3,638,496
2014	1.32	175,188	\$16.30	\$3,761,902
2015	1.34	177,594	\$16.40	\$3,889,510
2016	1.35	180,037	\$16.50	\$4,021,465
2017	1.37	182,517	\$16.60	\$4,157,918
Total				\$47,292,639

The total savings over the period are \$47.3 million in 1997 dollars. In terms of Present Value, total aircraft delay savings are \$19.0 million.

e. Passenger Cost of Delay (per hour)

The passenger cost of delay used in this analysis is that determined by the FAA Office of Aviation Policy in the bulletin Treatment of Values of Passenger Time in Economic Analysis. This value is estimated at \$26.70 per hour (in 1997 dollars), which equates to \$.45 per minute.

f. Annual Passenger Delay Savings

The annual savings in passenger delay costs were calculated based on the marginal aircraft delay savings and the TAF annual passengers, as shown in the following **Table V-6**:

Table V-6
Annual Passenger Delay Savings

Year	Delay Savings		Passenger Cost	
	Per Minute of Operation	Passengers	Per Minute of Delay	Delay Savings
2004	1.15	5,087,054	\$0.45	\$2,605,474
2005	1.17	5,252,724	\$0.45	\$2,723,861
2006	1.18	5,423,774	\$0.45	\$2,851,826
2007	1.20	5,604,164	\$0.45	\$2,986,838
2008	1.21	5,790,288	\$0.45	\$3,128,096
2009	1.23	5,982,462	\$0.45	\$3,275,963
2010	1.25	6,180,348	\$0.45	\$3,430,454
2011	1.26	6,384,905	\$0.45	\$3,592,374
2012	1.28	6,596,361	\$0.45	\$3,762,089
2013	1.30	6,814,951	\$0.45	\$3,939,978
2014	1.32	7,040,919	\$0.45	\$4,126,443
2015	1.34	7,274,517	\$0.45	\$4,321,903
2016	1.35	7,516,005	\$0.45	\$4,526,800
2017	1.37	7,765,653	\$0.45	\$4,741,596
Total				\$50,015,695

The total passenger delay cost savings over the period are \$50.0 million in 1997 dollars. In terms of Present Value, total savings are \$19.8 million.

g. Freighter Cost of Delay

While the Airport has found little precedent for a methodology to document cargo savings, it nevertheless has been a focus of the Airport's investigation because of cargo's unique dominance at ANC, as compared to other airports. For example, for every minute an express cargo carrier is delayed during summer months, 75 to 100 packages averaging approximately 8 lbs. each miss their connections at a cost of approximately \$42 per pound. According to carrier representatives interviewed by Keiser & Associates, curfews and "slots" in limited access Asian airports, such as Narita, are extremely costly to miss, with downstream effects felt for flights in succeeding days. In fact, the cost of a cargo flight missing connections can be as high as \$80,000 according to air carrier information. Despite the expected cargo savings, the operational benefits expected to result from this project are conservatively defined based on aircraft and passenger savings alone.

h. Avoidable Capital Costs

There are two capital costs that would occur under the Base Case and not under the Preferred Alternative. If the Concourse C apron is not extended, commuters would have to be relocated from Concourse C because it will be demolished. Passengers would access aircraft parked on the C Concourse apron from new commuter gates and at Gates B2 and B4. The security screening area would be relocated, Gates B2 and B4 would be modified and a commuter walkway would be constructed at a cost of \$500,000 in 1997 dollars. Failure to implement the RON parking positions and cargo refueling apron projects would necessitate rehabilitation of additional remote parking positions at a cost

of \$700,000 in 1997 dollars. These avoidable costs have a present value of approximately \$1.0 million.

6. NET PRESENT VALUE ANALYSIS

The financial evaluation in this section is based upon determining the LOI Projects' Net Present Value ("NPV"), as required by the FAA. The NPV determines the present worth of future benefits and costs. The procedure converts the "opportunity cost" of money back to today's level. That is, a dollar today is worth more than a dollar received in 20 years. A positive NPV indicates that a project will return more in benefits than it will cost, while a negative NPV indicates the project costs are more than its savings. This NPV analysis, however, only considers the monetary impact; items such as safety, security and other difficult-to-quantify benefits or costs must be considered separately.

The following steps were taken to determine the NPV:

- The capital cost of the LOI Projects was determined and allocated over their planning and construction schedule. It is assumed that the total cost is stated in 1998 dollars and that the cost of construction will occur according to the phasing plan. The net present value of the total capital costs is \$32.5 million, which represents \$33.5 million in capital expenditures netted against \$1.0 million in avoidable capital costs (\$600,000 to rehab additional remote parking positions and \$400,000 in relocating commuters from Concourse C to B2 and B4).
- The marginal benefits were defined based on the annual delay savings and a slight increase in O&M expenses. The present value of O&M costs is \$91,350, and the present value of delay savings is \$19,796,198 for passengers and \$18,982,679 for aircraft operations.
- The evaluation period is 20 years because this is the economic life span most commonly assumed by the FAA.
- In order to convert future costs and benefits into today's dollars, a present value discount factor is used. In accordance with the BCA Guidance, a 7.0 percent annual discount factor is applied.
- The annual benefits and costs are summed over the 20-year period to determine a total cost and total benefit and then are discounted to arrive at their present values.

The difference between the total benefits and costs represents the NPV of the investment. A positive amount shows the project's benefits exceed its costs over time, while a negative figure would show the project's cost exceeds its benefits.

The net present value of the LOI Ramp/Apron LOI Projects, detailed in Table V-7, is \$6,250,609, indicating a net positive economical benefit for these projects.

Ramp/Apron LOI Projects Summary:

Capital Costs	(\$33,485,046)
Avoidable Costs	<u>1,048,126</u>
Net Capital Costs	(\$32,436,920)
O&M Costs	(\$91,350)
Delay Costs Savings - Operations	18,982,679
Delay Cost Savings - Passengers	<u>19,796,198</u>
Net Operating Savings	\$38,687,527
Net Present Value	\$6,250,607

Table V-7
Anchorage International Airport
Net Present Value Comparative Analysis - LOI Ramp/Apron Projects

	Marginal Costs				Marginal Benefits			
	Capital	Purchase of New	O&M	Total	Avoidable	Delay Cost Savings		Total
	Construction Costs	Snow Loader	Costs			Operations	Passenger	
1998	0	0	0	0	0	0	0	0
1999	(12,000,000)	0	0	(12,000,000)	1,200,000	0	0	1,200,000
2000	(18,000,000)	0	0	(18,000,000)	0	0	0	0
2001	0	(400,000)	(113,030)	(513,030)	0	0	0	0
2002	(3,000,000)	0	(95,622)	(3,095,622)	0	0	0	0
2003	(6,000,000)	0	(77,343)	(6,077,343)	0	0	0	0
2004	(3,000,000)	0	(65,374)	(3,065,374)	0	2,698,039	2,605,474	5,303,513
2005	0	0	(30,596)	(30,596)	0	2,787,757	2,725,861	5,513,618
2006	0	0	(4,185)	(4,185)	0	2,880,386	2,851,826	5,732,212
2007	0	0	23,546	23,546	0	2,978,400	2,986,838	5,965,238
2008	0	0	52,664	52,664	0	3,079,619	3,128,096	6,207,716
2009	0	0	69,744	69,744	0	3,184,152	3,275,963	6,460,115
2010	0	0	101,846	101,846	0	3,292,109	3,430,454	6,722,562
2011	0	0	135,554	135,554	0	3,403,733	3,592,374	6,996,108
2012	0	0	(44,091)	(44,091)	0	3,519,152	3,762,089	7,281,241
2013	0	0	(17,680)	(17,680)	0	3,638,496	3,939,978	7,578,475
2014	0	0	(12,439)	(12,439)	0	3,761,902	4,126,443	7,888,345
2015	0	0	16,679	16,679	0	3,889,510	4,321,903	8,211,413
2016	0	0	47,253	47,253	0	4,021,465	4,526,800	8,548,265
2017	0	0	79,355	79,355	0	4,157,918	4,741,596	8,899,514
Total	(42,000,000)	(400,000)	66,280	(42,333,720)	1,200,000	47,292,639	50,015,695	98,508,335
Total - PV (@ 7%)	(33,179,888)	(305,158)	(91,350)	(33,576,396)	1,048,126	18,982,679	19,796,198	39,827,004

NPV

LOI Ramp/Apron Projects

\$6,250,609

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VI. BENEFIT-COST ANALYSIS--RUNWAY 6L/24R RECONSTRUCTION

This chapter describes the objectives, methodology, assumptions, alternatives and results of the BCA for the reconstruction of Runway 6L/24R. The information in this chapter is based on information contained in HNTB's report in Appendix A. Certain sections of the analysis have been updated to reflect the revised TAF and to respond to previous FAA comments.³

1. PROJECT OBJECTIVES, DESCRIPTION AND JUSTIFICATION

a. Project Description

The project entails reconstruction of Runway 6L/24R to Aircraft Design Group V (Boeing 747-400) standards (see **Exhibit VI-1**). The project includes the following items:

- Reconstruct Runway 6L/24R, including excavation and replacement of the paved surfaces and subsurface of the runway, safety area and blast protection.
- Replace the runway lighting system with new edge, centerline and touchdown zone lights.
- Correct drainage problems.
- Widen taxiway fillets.

Phase I of the project already has been funded and will be performed in 1998. Phase II of the project is included in this LOI Application and is scheduled to occur in 1999.

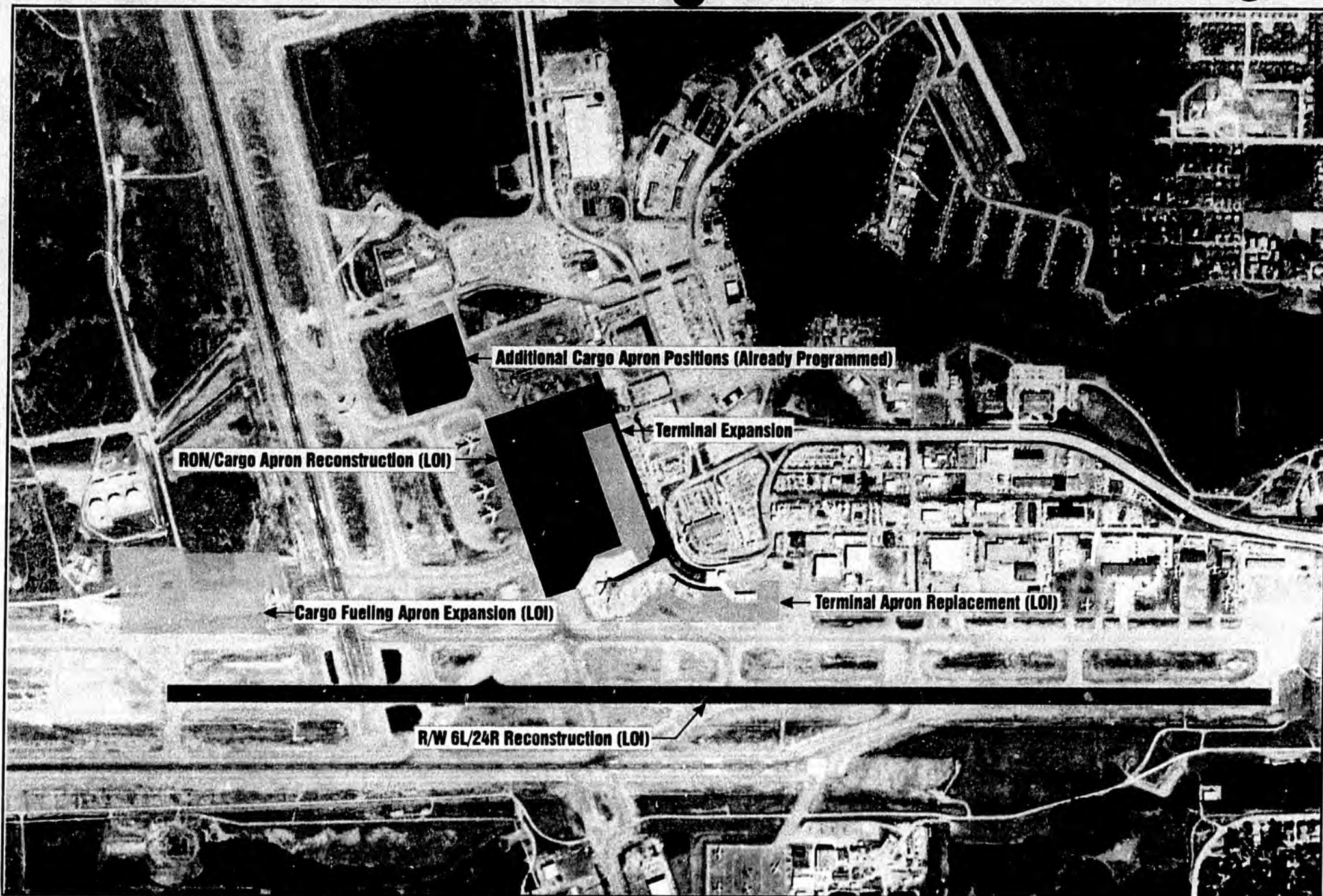
b. Project Justification

The purpose of this project is to maintain safety and capacity, to reduce maintenance and life cycle costs and to enhance operational efficiency. The reconstruction of this runway as planned will accomplish these objectives by minimizing runway downtime, reducing taxi time and delay and providing additional air traffic control and flexibility for accommodating Group VI aircraft.

Runway 6L/24R was originally constructed in 1951 for narrowbody aircraft and, because of its poor surface condition, it is weight-restricted to aircraft smaller than the Boeing 737. Even with the published weight restriction, it still must be used by widebody aircraft when one of the other two runways is closed for construction, maintenance, servicing of landing aids or snow removal. This regular use by heavy aircraft has hastened runway deterioration. Such operations cannot safely continue unless the runway is reconstructed.

The runway surface is cracking, breaking up and delaminating. The inadequate substructure is responsible for much of the pavement failure, as well as the frost heaving, which has produced irregularity in the runway surface. Sections of the runway blast protection and safety area's substructure are also heaving, cracking and breaking up. The runway surface is not grooved for traction, and the lighting system requires constant repair because it is over 25 years old. Risk to aircraft from FOD is high, and the runway is frequently closed for emergency repairs and clean up of broken pavement. In addition

³ January 28, 1997 memorandum from APP-500 to AAL-600 "Comments on Benefit-Cost Estimate Runway 6L/24R Reconstruction at Anchorage International Airport."



**Anchorage
International
Airport**

Phase I LOI and Near-Term Capital Projects

**Exhibit
VI-1**

to the pavement problems, the aged electrical system requires increasingly frequent and costly repairs and may fail earlier than the pavement.

2. BCA METHODOLOGY AND ASSUMPTIONS

The benefits expected to result from the reconstruction of Runway 6L/24R are twofold. First, this project will result in a reduction of O&M costs because of lower maintenance and life cycle costs. Second, the existing weight limitation will enhance air traffic control flexibility and result in reduced operational delay and taxi time. The reduction in delay and taxi time is defined based on the opportunity to improve runway use and to reduce the number of days in which the runway would otherwise be closed for maintenance. The assumptions related to this analysis are defined based on information in the HNTB report and are summarized as follows.

a. Forecast Activity

The BCA for the Runway 6L/24R Reconstruction Project was performed based on the revised TAF, as described in Chapter II. This analysis has been adjusted accordingly, in response to FAA comments.

b. Runway Downtime

One or more of the runways is frequently closed for snow removal, resurfacing or reconstruction or because of unsafe operating conditions at various times. Runway closure reduces capacity and increases aircraft and passenger delay. The following assumptions were used to determine such delay for each of the alternatives:

Base Case and Preferred Alternative

- Each runway is shut down for snow removal for approximately 69.5 hours per year.
- Runway 6R/24L is shut down for 75 days in 2007 and 2017 for repaving.
- Runway 14/32 is shut down for 75 days in 2006 and 2016 for repaving.

Preferred Alternative

- Runway 6L/24R is shut down for three months (91.25 days) in 1998 and five months (152 days) in 1999 for reconstruction.
- Runway 6L-24R is shut down for 75 days in 2009 and 2015 for repaving.

Base Case

- Runway 6L/24R is shut down for three months (91.25 days) in 1998 for Phase I and 75 days in 1999 for Phase II of resurfacing.
- Runway 6L/24R is shut down for 60 days in 2000 for Phase III of resurfacing and drainage and safety area improvements.
- Runway 6L/24R is shut down for three months (91.25 days) for blast protection improvements in 2002.
- Runway 6L/24R is shut down for 75 days for repaving in 2002, 2009 and 2015.

These assumptions are based on the most likely construction phasing requirements for the Base Case and for the Preferred Alternative.

c. **Project Phasing**

Phase I of this project is currently programmed and is scheduled to occur in 1998. The remainder of the project, Phase II, is part of this LOI Application and is scheduled to occur in 1999.

d. **Evaluation Period**

The physical life of the LOI Projects is likely to be more than 20 years, assuming routine maintenance continues to occur as required. Based on FAA guidelines and industry standards, a 20-year evaluation period is considered appropriate and was therefore applied in this analysis.

3. **BASE CASE AND PREFERRED ALTERNATIVES**

Two alternatives analyzed: the Base Case and the Preferred Alternative.

a. **Base Case**

According to the BCA Guidance, the Base Case represents "the best course of action that would be pursued in the absence of a major initiative to obtain the specified objectives." It is intended to represent a reference point against which both the incremental costs and incremental benefits of the proposed alternative are measured.

It was considered unrealistic that ANC would allow the runway to fail, even if FAA discretionary funds were not forthcoming. Previous analyses conducted on the Airport's behalf have demonstrated that the aircraft and passenger delay costs resulting from runway failure would be close to \$1 billion over the 20-year period of the analysis. Even after conversion to present value terms, the cost would be in excess of \$300 million.

Given the Airport's current financial constraints and obligations, the most likely Base Case would be reconstructing the runway only to Boeing 737 standards without centerline or touchdown lighting. Because of financial constraints, this resurfacing and associated drainage improvements would be phased over three years. This alternative would prohibit use of Runway 6L/24R by heavy aircraft, except when other runways are closed for maintenance, snow removal or other operational necessities.

If Runway 6L/24R were rebuilt to this lesser standard and runway capacity constraints made it necessary to operate heavy aircraft on it with the same frequency as today, progressive failure of the runway surface could be expected in less than 10 years. The runway would have to be repaved every five years to avoid progressive failure.

b. **Preferred Alternative**

The Preferred Alternative is the reconstruction of Runway 6L/24R to Aircraft Design Group V (Boeing 747-499) standards, as described above.

4. **PROJECT COSTS**

The total cost of the Runway 6L/24R Reconstruction Project consists of capital costs and O&M expenses. Capital, major repair and O&M costs were estimated by Airport staff and are represented in 1997 dollars.

a. Capital Costs

The capital cost is estimated to be \$22.5 million for the Base Case, as described below:

- \$4.0 million in 1998 for Phase I of resurfacing
- \$2.1 million in 1999 for Phase II of resurfacing
- \$2.9 million in 2000 for Phase III of resurfacing
- \$2.5 million in 2000 for safety/drainage area improvements
- \$3.5 million in 2002 for blast protection
- \$7.5 million in 2002, 2009 and 2015 for repaving and subsurface repair

The capital cost of the Preferred Alternative is \$19.0 million, including repaving costs, which is lower than the Base Case by \$3.5 million. The net present value of the Preferred Alternative is \$1.3 million lower than the present value of the Base Case. Capital costs were developed based on previous runway resurfacing projects completed within the past five years.

b. O&M Costs

Major repairs include periodic repaving at different frequencies for each alternative. The marginal reduction in pavement maintenance costs associated with the Preferred Alternative reflects a project benefit and therefore is documented in Section 5c. The repaving costs of Runway 6R/24L and 14/32 are not included because they would be the same under each alternative and therefore would not represent marginal costs. Similarly, other O&M costs, such as snow removal, also would be identified under both alternatives and therefore would not result in marginal costs.

5. PROJECT BENEFITS

Three general benefit categories were estimated: reduction in taxi time, reduction in delay and reduction of O&M costs. In accordance with the FAA BCA Guidelines, only the marginal benefits are included in the analysis--the difference in benefits between the Preferred Alternative and the Base Case.

a. Reduction in Taxi Time

Runway 6L/24R is one of two closely spaced parallel runways at the Airport. As noted earlier, use of Runway 6L/24R is normally restricted to aircraft smaller than the Boeing 737. The other parallel runway, Runway 6R/24L, is the primary air carrier departure runway. Most commonly, aircraft arrive on Runways 6R and 6L and depart on Runway 32. The second most common runway use configuration at ANC is to arrive on Runway 14 and to depart on Runways 24R and 24L. These runway use procedures are consistent with the Airport's noise abatement program and minimize overflights of adjacent noise-sensitive residential developments located east and south of the Airport.

The landing threshold for Runway 6R is approximately 4,700 feet east of the Runway 6L threshold. Similarly, the landing threshold for Runway 24R is approximately 4,300 feet east of the Runway 24L threshold. As a result of this runway stagger, taxi distances can differ substantially between the two parallel runways. When Runways 24R and 24L are used for landing, aircraft destined for any point on the Airport would experience significantly shorter taxi distances by landing on Runway 24R in lieu of Runway 24L.

Similarly, arriving air cargo aircraft destined for the East Airpark would experience reduced taxi distances by landing on Runway 6L in lieu of Runway 6R. On the other hand, air carrier and air cargo aircraft destined for the terminals and the north air cargo area would not benefit from landing on Runway 6L in lieu of Runway 6R.

The strengthening of Runway 6L/24R would allow more frequent use by heavy aircraft within the limits of noise abatement policies. Based on analysis of current Airport operations, this project would reduce annual average taxi times in the following instances:

1. When aircraft are arriving on Runways 6R and 6L, those aircraft based in the eastern end of East Airpark could reduce taxi times by approximately 2.25 minutes per landing by using Runway 6L in lieu of Runway 6R. On an annual average basis, this reduction would save 8.10 minutes per day.
2. During the relatively rare periods when Runways 6R and 6L must be used for departures, aircraft that do not require the longer runway could reduce taxi time by 2.73 minutes by departing on Runway 6L in lieu of 6R. On an annual average basis, this reduction would save 1.72 minutes per day.
3. Although arrivals on Runways 24R and 24L do not occur frequently, virtually all aircraft would reduce taxi times by 1.27 minutes by landing on Runway 24R in lieu of Runway 24L. On an annual average basis, this reduction would save 2.86 minutes per day.
4. Aircraft in the East Airpark that do not require the longest available runway would reduce taxi times by 0.52 minutes for departure using Runway 24R in lieu of Runway 24L. On an annual average basis, this reduction would save 0.03 minutes per day.
5. Taxi times savings were reduced by 12.3 percent (45 downtime days/365 days) in years where the reconstructed runway is scheduled for repaving

Collectively, these efficiencies would decrease taxi times at the Airport by an annual average of 12.71 minutes per day. Because the taxi time savings represent an annual average (as opposed to a peak day average), it can be multiplied by 365 to yield the annual total delay savings of 77 hours. This taxi time savings would increase each year as operation demand increases, assuming runway use remains equivalent to expected conditions.

Based on the direct aircraft operating cost described in Chapter V, the present value of the taxi time saving is \$1.7 million for aircraft operations. Similarly, this project will result in a passenger savings, based on the value of passengers' time, as described in Chapter V. The present value of passenger savings is \$800,000.

b. Delay Benefits

Average delays for the Base Case and the Preferred Alternative were estimated using the FAA's methodology in Chapter 2 of Advisory Circular AC No. 150/5060-5, Airport Capacity and Delay manual. The application of this methodology provides a basis for estimating aircraft delays based on fleet mix, demand level and runway use. Detailed assumptions used in this analysis are consistent with the information presented in the

HNTB Report (see Appendix A). The data was adjusted to reflect the revised TAF as described in Chapter II.

The present value of the marginal aircraft operational delay savings is \$7,321,223, and the present value of the marginal passenger savings is \$2,781,771. These present value calculations reflect the required 7.0 percent discount rate and the value of aircraft delay and passenger delay.

c. O&M Savings

O&M costs were defined for the Base Case and the Preferred Alternative based on existing Airport experience for each existing runway. Currently, runways 6R/24L and 14/32 are strengthened for Boeing 747 standards and are in significantly better condition than Runway 6L/24R. The O&M cost estimates for Runway 6L/24R reflect the following assumptions:

- Under the Preferred Alternative, a marginal reduction in pavement maintenance would occur because of the superior condition of the runway.
- The higher O&M costs under the Base Case reflect the increased repairs that would be required as a result of the occasional use by aircraft heavier than the Boeing 737 with the continued inadequate sub-base.

The following steps were applied to calculate the annual O&M costs for each alternative:

- Recent annual runway O&M costs were obtained for the Airport's three runways.
- New maintenance levels for each alternative were estimated based on recent maintenance levels.
- Estimates were partially based on field maintenance system records.
- Future O&M costs were projected based on HNTB's past maintenance project experience at the Airport.

Under the Preferred Alternative, repaving would be required every 10 years at a cost of \$2.0 million for each repaving. Under the Base Case, repaving and subsurface repair would be required every five years at a cost of \$2.5 million for each repaving. In summary, the reduction in O&M costs represents a present value savings of \$1,628,830.

6. NET PRESENT VALUE ANALYSIS

The financial evaluation is based upon determining the Runway 6L/24R Reconstruction Project's net present value, as required by the FAA, by taking the following steps:

- The capital cost of the Runway 6L/24R Reconstruction Project was determined and allocated over its planning and construction schedule. It is assumed that the total cost is stated in 1997 dollars and that the cost of construction will occur according to the phasing plan. The present value of total capital costs is \$14,807,210.
- The avoidable capital costs, which represent the capital expense of the Base Case, has a present value of \$16,108,154.
- The annual total taxi time, delay savings and O&M savings are based on the assumptions discussed earlier. In summary, the present value of the project's benefits is \$30,399,359.

- To convert future benefits and costs into current dollars, a present value discount factor is used. In accordance with FAA policy, a 7.0 percent annual discount factor is applied.
- The present value of the benefits and costs are presented in **Table VI-1**. The annual benefits and costs are summarized over the 20-year period to determine the total benefits and costs.

The net present value of the Runway 6L/24R Reconstruction Project, as detailed in **Table VI-2**, is \$15,592,149.

Summary:

Present Value Capital Costs	(\$14,807,210)
Present Value Avoidable Capital Costs (Base Case)	\$16,108,154
Present Value Taxiing Efficiency Savings	2,559,381
Present Value Delay Cost Savings	10,102,994
Present Value O&M Savings	1,628,830
Net Operating Savings	\$30,399,359
Net Present Value	\$15,592,149

7. NET PRESENT VALUE LOI PROJECTS

Table VI-2 presents the net present value of the LOI Projects for the period 1998 - 2017. The total net present value is \$21,842,758, which demonstrates the significant benefits the Airport, the airlines and their passengers will realize upon implementation of these projects. When completed, these projects will continue to strengthen the Airport's competitive position in the global cargo hub market.

8. SYSTEM BENEFITS

Collectively, the LOI projects will result in benefits to the overall national airspace system above and beyond the specific benefits defined in proceeding sections. Given the Airport's critical role as a connecting and transfer station for cargo and passengers and as the major cargo gateway to Asia, savings in delays incurred because of increased efficiency at Anchorage will result in additional savings at downline airports elsewhere in the system. The LOI airside project will result in a marginal reduction in missed connections. Since inbound freighters from Asia and Europe routinely connect with flights to airports throughout the U.S., each missed connection in Anchorage results in delays, throughout the system. The reduction in missed connections resulting from the LOI projects, therefore, will enhance overall system efficiency. This savings would be incurred through a reduction in delay, congestion and controller workload, as well as a direct reduction in the cost to cargo airlines, freight forwarders and other business throughout the U.S. that depend on an efficient national airspace system.

Table VI-1
Anchorage International Airport
Net Present Value Comparative Analysis - Runway 6L/24 R Reconstruction

	Marginal Costs		Marginal Benefits					
	Capital Construction Costs	Avoidable Costs	Taxi Time Cost Savings		Delay Cost Savings		O&M Savings	Total
			Operations	Passenger	Operations	Passenger		
1998	0	4,000,000	0	0	0	0	0	4,000,000
1999	(6,600,000)	2,100,000	0	0	(2,414,000)	(896,000)	0	(1,210,000)
2000	(10,400,000)	5,400,000	159,552	72,061	2,225,000	819,000	0	8,675,613
2001	0	0	164,229	74,944	0	0	317,340	556,512
2002	0	6,000,000	170,205	78,150	2,875,000	1,055,000	(49,620)	10,128,735
2003	0	0	176,181	81,415	0	0	248,420	506,016
2004	0	0	182,158	84,792	4,341,000	1,604,000	(91,940)	6,120,010
2005	0	0	188,134	88,296	0	0	232,700	509,130
2006	0	0	194,110	91,901	0	0	264,740	550,751
2007	0	0	200,087	95,637	0	0	296,780	592,503
2008	0	0	206,063	99,478	0	0	328,820	634,361
2009	0	2,500,000	168,470	82,178	0	0	136,000	2,886,647
2010	0	0	218,016	107,486	0	0	272,000	597,502
2011	0	0	223,992	111,660	0	0	304,040	639,692
2012	0	0	229,969	115,953	0	0	336,080	682,002
2013	0	0	235,945	120,371	0	0	368,120	724,436
2014	0	0	241,921	124,915	9,035,000	3,616,000	(91,940)	12,925,896
2015	0	2,500,000	247,898	129,588	0	0	232,700	3,110,186
2016	(2,000,000)	0	253,874	134,395	0	0	264,740	653,009
2017	0	0	259,850	139,338	0	0	296,780	695,968
Total	(19,000,000)	22,500,000	3,720,655	1,832,556	16,062,000	6,198,000	3,665,760	53,978,971
Total - PV (@ 7%)	(14,807,210)	16,108,154	1,725,105	834,276	7,321,223	2,781,771	1,628,830	30,399,360

NPV
 6L/24R Reconstruction

15,592,149

Table VI-2
Anchorage International Airport
Net Present Value Comparative Analysis - LOI Projects

	Ramp/Apron Projects		6L/24R Reconstruction		Combined LOI Projects	
	Costs	Benefits	Costs	Benefits	Costs	Benefits
1998	0	0	0	4,000,000	0	4,000,000
1999	(12,000,000)	1,200,000	(6,600,000)	(1,210,000)	(18,600,000)	(10,000)
2000	(18,000,000)	0	(10,400,000)	8,675,613	(28,400,000)	8,675,613
2001	(513,030)	0	0	556,512	(513,030)	556,512
2002	(3,095,622)	0	0	10,128,735	(3,095,622)	10,128,735
2003	(6,077,343)	0	0	506,016	(6,077,343)	506,016
2004	(3,065,374)	5,303,513	0	6,120,010	(3,065,374)	11,423,523
2005	(30,596)	5,513,618	0	509,130	(30,596)	6,022,748
2006	(4,185)	5,732,212	0	550,751	(4,185)	6,282,963
2007	23,546	5,965,238	0	592,503	23,546	6,557,742
2008	52,664	6,207,716	0	634,361	52,664	6,842,077
2009	69,744	6,460,115	0	2,886,647	69,744	9,346,763
2010	101,846	6,722,562	0	597,502	101,846	7,320,065
2011	135,554	6,996,108	0	639,692	135,554	7,635,799
2012	(44,091)	7,281,241	0	682,002	(44,091)	7,963,243
2013	(17,680)	7,578,475	0	724,436	(17,680)	8,302,910
2014	(12,439)	7,888,345	0	12,925,896	(12,439)	20,814,241
2015	16,679	8,211,413	0	3,110,186	16,679	11,321,599
2016	47,253	8,548,265	(2,000,000)	653,009	(1,952,747)	9,201,274
2017	79,355	8,899,514	0	695,968	79,355	9,595,482
Total	(42,333,720)	98,508,335	(19,000,000)	53,978,971	(61,333,720)	152,487,305
Total - PV (@ 7%)	(33,576,396)	39,827,004	(14,807,210)	30,399,360	(48,383,606)	70,226,364
NPV						
LOI Projects - Combined		\$6,250,609		\$15,592,149		\$21,842,758



Appendix A

**BENEFIT-COST ESTIMATE FOR RUNWAY 6L-24R
RECONSTRUCTION AT
ANCHORAGE INTERNATIONAL AIRPORT**

**SUBMITTED IN ACCORDANCE WITH THE REQUIREMENTS OF THE FAA
BENEFIT COST GUIDANCE OF JUNE 1997**

**Prepared for the State of Alaska Department of Transportation and Public
Facilities, Anchorage International Airport**

By

**HNTB Corporation
99 Canal Center Plaza, Alexandria, VA**



**Anchorage
International
Airport**

State of Alaska DOT & PF
P.O. Box 196960
Anchorage, Alaska
USA 99519-6960
(907) 266-2525
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November 20, 1997

Re: **Benefit Cost Analysis for Runway 6L/24R
Reconstruction Project**

Mr. Ronnie Simpson, Manager
Federal Aviation Administration
Airports Division
222 W. 7th Avenue, #14 (AAL-600)
Anchorage, AK 99513-7587

Dear Mr. Simpson:

Under FAA's Airport Capital Improvement Program, Anchorage International Airport (Airport) requested discretionary funding for reconstruction of Runway 6L/24R. In addition to the information previously submitted under our Innovative Finance Application, we submit the enclosed Benefit-Cost Estimate for reconstruction of Runway 6L/24R.

We urge your support for reconstruction of Runway 6L/24R for Boeing 747 and smaller aircraft operations for the following reasons:

- Produces life cycle costs savings - Reconstruction is significantly less expensive than frequent resurfacing with high annual maintenance costs.
- Enhances the National Aviation System capacity through traffic efficiency and delay reductions.
- Provides runway use flexibility and support of the Airport's growing air cargo operations. Rate of growth was 13% and 17% in the last two years.
- Supports the Air Traffic Control Tower's and the Airport's high priority to operate two full strength runways at all times, even when one runway is closed for maintenance or snow removal.
- Consistent with the Congressional intent language to give priority consideration for discretionary funding requests by Anchorage International Airport.

Thank you for considering funding this important project. We would be pleased to answer any questions or provide any further information required to assist FAA's review of this request.

Sincerely,

Morton V. Plumb, Jr.
Director

cc: Jane Mehrtens, APP-520
Airports Financial Assistance Division
Federal Aviation Administration
U.S. Department of Transportation
800 Independence Avenue, S.W.
Washington, D.C. 20591

Richard G. Wilson, Airport Development Manager
Tom Middendorf, Airport Planning Manager

FAA-LTR.DOC

**Benefit Cost Estimate for Runway 6L-24R Reconstruction
at Anchorage International Airport**

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**Benefit-Cost Estimate for Runway 6L-24R Reconstruction
at Anchorage International Airport**

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**Benefit-Cost Estimate for Runway 6L-24R Reconstruction
at Anchorage International Airport**

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EXECUTIVE SUMMARY

Benefit-Cost Estimate for Runway 6L-24R Reconstruction at Anchorage International Airport

This executive summary outlines the findings of the benefit-cost analysis performed for the proposed reconstruction of Runway 6L-24R at Anchorage International Airport (AIA). The analysis was conducted in accordance with the FAA Airport Benefit-Cost Guidance published June 2, 1997.

The analysis contained herein demonstrates that the proposed runway reconstruction project has a **net present value of \$14.7 million** over the twenty year period of analysis. These net benefits are broken out as follows:

- \$9.5 million in aircraft and passenger delay savings;
- \$2.7 million in more efficient airside traffic flows; and
- \$2.5 million in reduced life cycle costs.

Additional benefits that could not be rigorously quantified include:

- Air freight and express package delivery delay benefits;
- System benefits to the airlines as a result of reduced interruptions due to more frequent runway closures in future years; and
- Operational improvements due to improved lighting.
- Delay and traffic efficiency benefits for AIA's current cargo growth in excess of forecast levels

The benefits may be understated because they are measured against an ambitious base case scenario which includes a complete resurfacing of Runway 6L-24R. The base case scenario recognizes that the capacity provided by the runway is so important that AIA will not allow the runway to fail even if Federal funds are not forthcoming. Previous analyses have demonstrated that the runway would fail within five years without reconstruction, resurfacing, or excessive maintenance and aircraft operating weight restrictions. Without Runway 6L-24R, aircraft and passengers using the Airport would incur delay costs in excess of \$300 million over the next twenty years. Those analyses did not consider the recent double-digit growth in cargo operations which would also be jeopardized by a major reduction in capacity.

Financial constraints will prevent the Airport from reconstructing Runway 6L-24R unless FAA discretionary funds are forthcoming.

Benefit-Cost Estimate for Runway 6L-24R Reconstruction at Anchorage International Airport

This report discusses the benefit-cost analysis conducted for the proposed reconstruction of Runway 6L-24R at Anchorage International Airport (AIA). The analysis was conducted in accordance with the FAA Airport Benefit-Cost Guidance published June 2, 1997.

The analysis begins with a description of the project and its purpose. It continues with a discussion of the assumptions used in the benefit-cost analysis including the definition of alternatives, the period of analysis and forecast, runway downtime, aircraft and passenger delay costs, traffic flow efficiency and delay assumptions. Incremental benefits and costs are then presented on a year-by-year basis. The stream of benefits and costs is then converted to present value terms using the FAA methodology.

1. Project Description

The project assumes reconstruction of Runway 6L-24R to Aircraft Design Group V (Boeing 747-400) standards. The project includes the following items:

- Reconstruct Runway 6L-24R including excavation and replacement of the paved surfaces and subsurface of the runway, safety area, and blast protection;
- Replace the runway lighting system with new edge, centerline and touchdown zone lights;
- Correct drainage problems;
- Widen taxiway fillets;

2. Project Purpose

Runway 6L-24R was originally constructed for narrow-body aircraft, and currently it is weight restricted to aircraft smaller than the Boeing 737 because of design standards and its deteriorating surface condition. Even with the published weight restriction it still must be used by wide-body aircraft when any other runway is closed for construction, maintenance, servicing of landing aids, and snow removal. This regular use by heavy aircraft has hastened runway deterioration, and it cannot continue unless the runway is reconstructed.

The runway surface is cracking, breaking up, and delaminating. The inadequate substructure is responsible for much of the pavement failure as well as the frost heaving which has produced irregularity in the runway surface. Sections of the runway blast protection and safety area's substructure are also heaving, cracking, and breaking up. The runway surface is not grooved for traction, and the lighting system requires constant repairs because it is over 25 years old. Risk to aircraft from FOD is increasing and the runway is frequently closed for emergency repairs and clean up of broken pavement. In addition to the

pavement problems, the aged electrical system requires increasingly frequent and costly repairs, and may fail earlier than the pavement.

3. Assumptions

This subsection includes the critical assumptions that are required for the benefit-cost analysis, including the definition of the base case and alternative, future airport operating environment, aircraft variable operating costs and passenger value of time, and traffic flow efficiency and delay assumptions.

3.1 Alternatives

Two alternatives were analyzed, the runway reconstruction alternative (project) and the base case alternative. The project alternative has been described above.

3.1.1 Base Case

According to the FAA Benefit-Cost Guidelines, the base case represents "the best course of action that would be pursued in the absence of a major initiative to obtain the specified objectives." It is intended to represent a reference point against which both the incremental costs and incremental benefits of the proposed alternative are measured.

Again, it was considered unrealistic that AIA would allow the runway to fail, even if FAA discretionary funds were not forthcoming. Previous analyses conducted on behalf of AIA have demonstrated that the aircraft and passenger delay costs resulting from runway failure would be close to \$1.0 billion over the twenty year period of analysis. Even after conversion to present value terms, the cost would be in excess of \$300 million.

Given AIA's current financial constraints and obligations, the most likely base case would be reconstructing only to Boeing 737 aircraft standards without centerline or touchdown zone lighting. Because of financial constraints, this resurfacing and associated drainage improvements would be phased over three years. This alternative would prohibit use of Runway 6L-24R by heavy aircraft except when other runways are closed for maintenance or snow removal or for other operational necessity.

If Runway 6L-24R were rebuilt to this lesser standard, and runway capacity constraints made it necessary to operate heavy aircraft on it with the same frequency as today, progressive failure of the runway could be expected in less than 10 years. The runway would have to be repaved every five years to avoid progressive failure.

3.2 Period of Analysis

The period of analysis was assumed to be 20 years dating from the completion of the project, consistent with industry standards and FAA guidance.

3.3 Forecast

Table 1 presents the forecast assumptions used in the benefit-cost analysis. Forecasts by weight category, aircraft operations by type and passengers are required for the delay analysis.

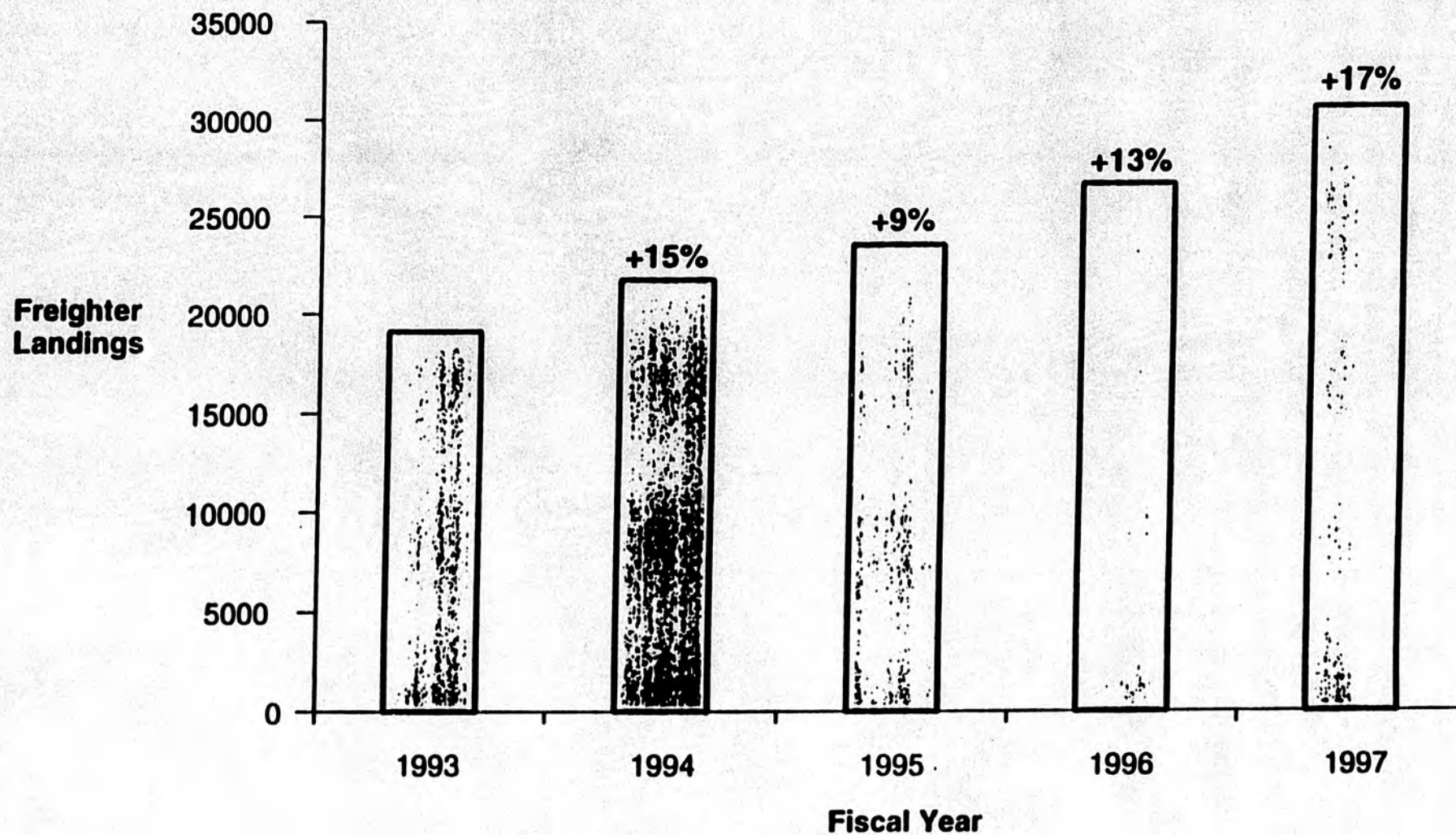
Projections of the Airport fleet mix for 1996, 2001 and 2016 were obtained from the Part 150 study currently being conducted for the Airport. Other years were linearly interpolated or extrapolated. The Aircraft Weight Categories used in this analysis correspond to the FAA categories used for capacity analysis in FAA AC No: 150/5060-5, Airport Capacity and Delay. These categories are; A&B (less than 12,500 lbs.), C (12,500 to 300,000 lbs.), and D (300,000+ lbs. and 757's) weight categories

The passenger forecasts were estimated by applying the growth rates for enplaned and transfer passengers in the 1993 forecast developed by the Airport Master Plan consultant to 1996 base year passenger levels. The methodology and assumptions used to adjust the forecast are consistent with the methodology used to develop the Part 150 forecast.

Although no air freight and express package delivery benefits are quantified in this analysis, it should be noted that cargo is a rapidly growing sector of AIA aviation activity, and is exceeding forecast levels. AIA's FY 1997 cargo landings grew 17%, 13% in 1996, and 9% in 1995. The 1993 Airport Master Plan forecast projected a growth of 1.7% and 19,800 cargo landings for FY 97 and actual cargo landings for FY 97 were 31,379 (see Figure 1).

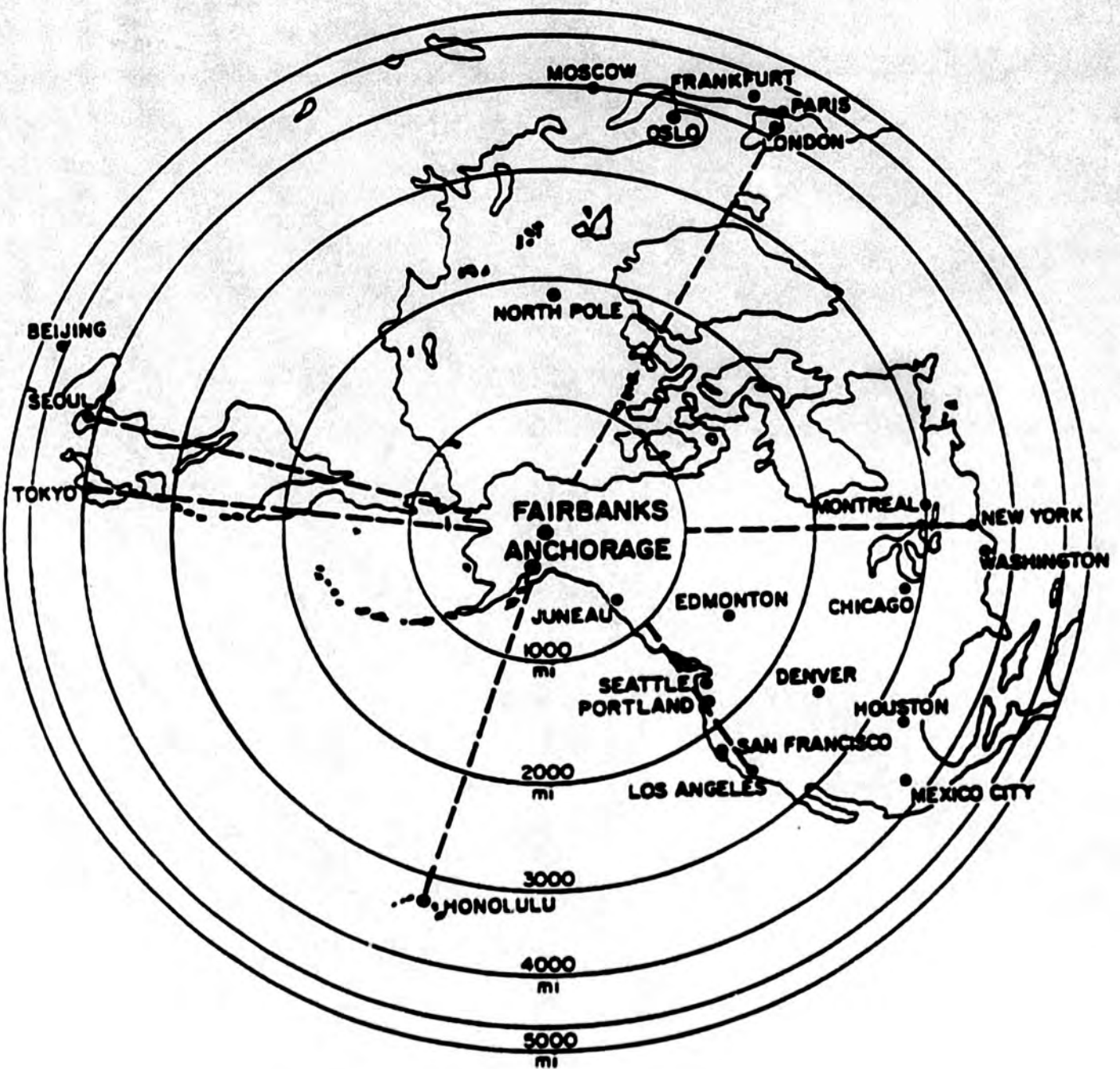
Several factors drive AIA's rapid cargo growth. These include geographic location, more goods moving by air, increased numbers of freighter operators, success of low cost freighter operators, growth of alliances to expand the frequency to more destinations, US/Japan and other bilateral improvements, and increased service between South Asia and North America. Figure 2 shows AIA's position as a logical transshipment point, in particular between North America and East Asia.

In November 1997, USDOT renewed the Expanded Cargo Transfer Flexibility Order for Alaskan airports. This unique order allows foreign carriers to conduct a variety of cargo transfer activities at AIA. This has stimulated carrier interest in establishing additional hubbing operations at AIA. United Airlines and Polar Air recently joined Federal Express, UPS, and Northwest in establishing cargo hubbing operations at the AIA.



AIA CARGO TRAFFIC
FY93 - FY97
FREIGHTER LANDINGS AND
YEAR-TO-YEAR PERCENTAGE INCREASES

FIGURE 1



GLOBAL PROJECTION CENTERED
ON ANCHORAGE AND
FAIRBANKS, ALASKA

FIGURE 2

Within the first six months after the order was issued, several carriers began planning with airport management at AIA to determine how and where cargo transfer/interlining operations can be carried out. Three nationally known air cargo facility developers applied for land leases at AIA to construct multi-tenant cargo facilities. One of the developers plans to construct a major facility in 1998.

3.4 Runway Downtime

One or more of the runways is frequently closed for snow removal, resurfacing, reconstruction, or unsafe operating conditions at various times. When runways are shut down they reduce capacity and increase aircraft and passenger delay, and in turn affect the estimates of delay benefits. The following assumptions were used for each of the alternatives:

All Alternatives

- Each runway shut down for snow removal approximately 69.5 hours per year.
- Runway 6R-24L shut down 75 days in 2007 and 2017 for re-paving.
- Runway 14-32 shut down 75 days in 2006 and 2016 for re-paving.

Boeing 747-400 Reconstruction (Project) Alternative

- Runway 6L-24R shut down 3 months (91.25 days) in 1998 and 5 months (152 days) in 1999 for reconstruction.
- Runway 6L-24R shut down 75 days in 2009 and 2019 for re-paving.

Base Case (Resurfacing) Alternative

- Runway 6L-24R shut down for 3 months (91.25 days) in 1998 for Phase 1, and 75 days in 1999 for Phase 2 of resurfacing.
- Runway 6L-24R shut down for 60 days in 2000, for Phase 3 of resurfacing and drainage and safety area improvements.
- Runway 6L-24R shut down for 3 months (91.25 days) for blast protection improvements in 2002.
- Runway 6L-24R shut down for 75 days for re-paving in 2004, 2009, 2014 and 2019.

3.5 Aircraft and Passenger Costs

Table 2 shows the variable operating cost (VOC) assumptions for aircraft at AIA. Aircraft block hour costs were obtained from the FAA's Economic Values for Evaluation of Federal Aviation Administration and Regulatory Programs and converted to 1997 dollars. VOC fuel and oil and maintenance costs were reduced 50 percent for taxiing aircraft, since engines are not run at full power under those circumstances. The VOC costs for the individual aircraft categories were weighted by the fleet mix developed for the Part 150 Study to produce an average aircraft VOC for the Airport for 1996, 2001 and 2016.

The average value of passenger time was obtained from the FAA's Office of Aviation Policy and Plans' Bulletin, Treatment of Values of Passenger Time in Economic Analysis. The value is estimated at \$26.70 per hour or \$0.45 per minute.

3.6 Traffic Flow Efficiency Assumptions

The strengthening of Runway 6L-24R would allow more frequent use by heavy aircraft within the limits of noise abatement policies. Based on analysis of current Airport operations, it would permit increased taxiing efficiencies (decreased taxi time and cost) in the following four instances:

1. When aircraft are arriving on Runways 6R and 6L, those aircraft based in the eastern end of East Airpark could reduce taxi times by approximately 2.25 minutes per landing by using Runway 6L in lieu of Runway 6R. On an annual average basis, this reduction would save a total of 8.1 minutes per day.
2. During the relatively rare periods when Runways 6R and 6L must be used for departures, aircraft which do not require the longer runway could reduce taxi time by 2.73 minutes by departing on Runway 6L in lieu of Runway 6R. On an annual average basis, this reduction would save 1.72 minutes per day.
3. Although arrivals on Runways 24R and 24L do not occur frequently, virtually all aircraft would reduce taxi times by 1.27 minutes by landing on Runway 24R in lieu of Runway 24L. On an annual average basis, this reduction would save 2.86 minutes per day.
4. Aircraft in the East Airpark which do not require the longest available runway would reduce taxi times by 0.52 minutes for departure by using Runway 24R in lieu of Runway 24L. On an annual average basis, this reduction would save 0.03 minutes per day.

Collectively, these efficiencies would decrease taxi times at AIA by 12.71 minutes per day, or roughly 77 hours per year.

3.7 Delay Assumptions

Table 3 shows the estimates of average aircraft delay per operation for Anchorage under alternative runway use configurations for 1996, 2001, and 2016. Average delays were estimated using the FAA's methodology in Chapter 2 of Advisory Circular AC no: 150/5060-5, Airport Capacity and Delay manual. For the three runway configuration it was assumed the conditions prevailing for FAA Figure 16 in Figure 2-1 of the Capacity and Delay manual would occur 70 percent of the time and those prevailing for FAA Figure 17 in Figure 2-1 of the Capacity and Delay manual would occur 30 percent of the time. The fleet mix and fleet mix index for each year was obtained from the forecasts presented in Table 1.

4. Estimate of Benefits

Three general benefit categories were estimated, improved traffic flow efficiency, delay benefits, and other benefits. In accordance with the FAA Benefit-Cost guidance, these estimates are incremental benefits - the difference in benefits between the project alternative and the base case.

4.1 Traffic Flow Efficiency

The runway layout at AIA is shown in Figure 3. Runway 6L-24R is one of two closely spaced parallel runways at AIA. As noted earlier, use of Runway 6L-24R is normally restricted to aircraft smaller than the Boeing 737. The other parallel runway, Runway 6R-24L is the primary air carrier aircraft arrival runway. Runway 32, the crosswind runway is the primary air carrier departure runway. Most commonly, aircraft arrive on Runways 6R and 6L and depart on Runway 32. The second most common runway use configuration at AIA is to arrive on Runway 14 and depart on Runways 24R and 24L. These runway use strategies are consistent with the Airport's noise abatement program. These strategies minimize overflights of adjacent noise sensitive residential development located to the east and south of AIA (see Figure 4).

As shown in Figure 3, the landing threshold for Runway 6R is located approximately 4,700 feet to the west of the Runway 6L threshold. Similarly, the landing threshold for Runway 24R is located approximately 4,300 feet east of the Runway 24L threshold. As a result of this runway stagger, taxi distances can differ substantially between the two parallel runways. When Runways 24R and 24L are used for landing, aircraft destined for any point on the airport would experience significantly shorter taxi distances by landing on Runway 24R in lieu of Runway 24L. Similarly, arriving air cargo aircraft destined for the East Airpark would experience reduced taxi distances by landing on Runway 6L in lieu of Runway 6R. On the other hand, air carrier and air cargo aircraft destined for the terminals and the north air cargo area would not benefit from landing on Runway 6L in lieu of Runway 6R.

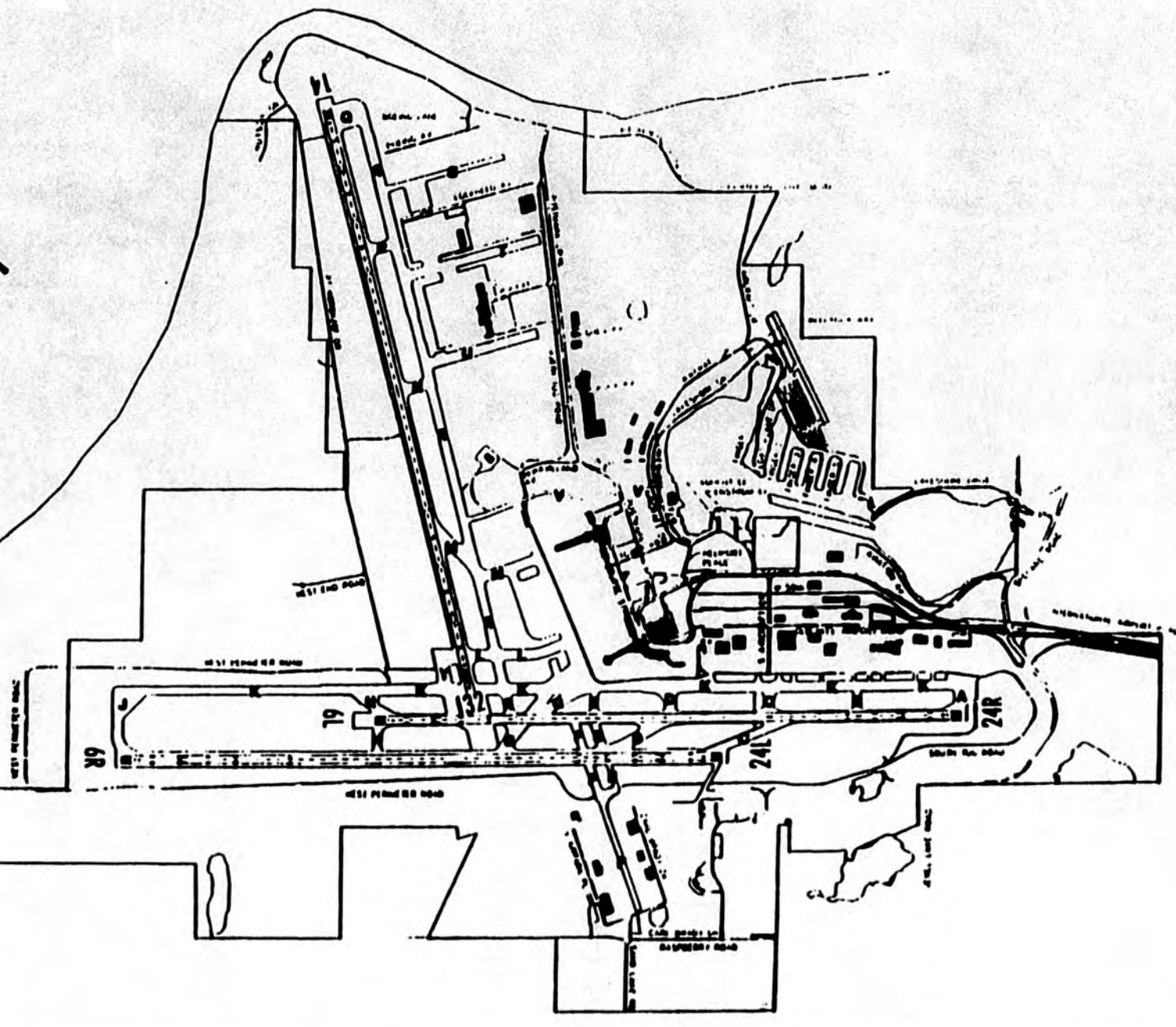
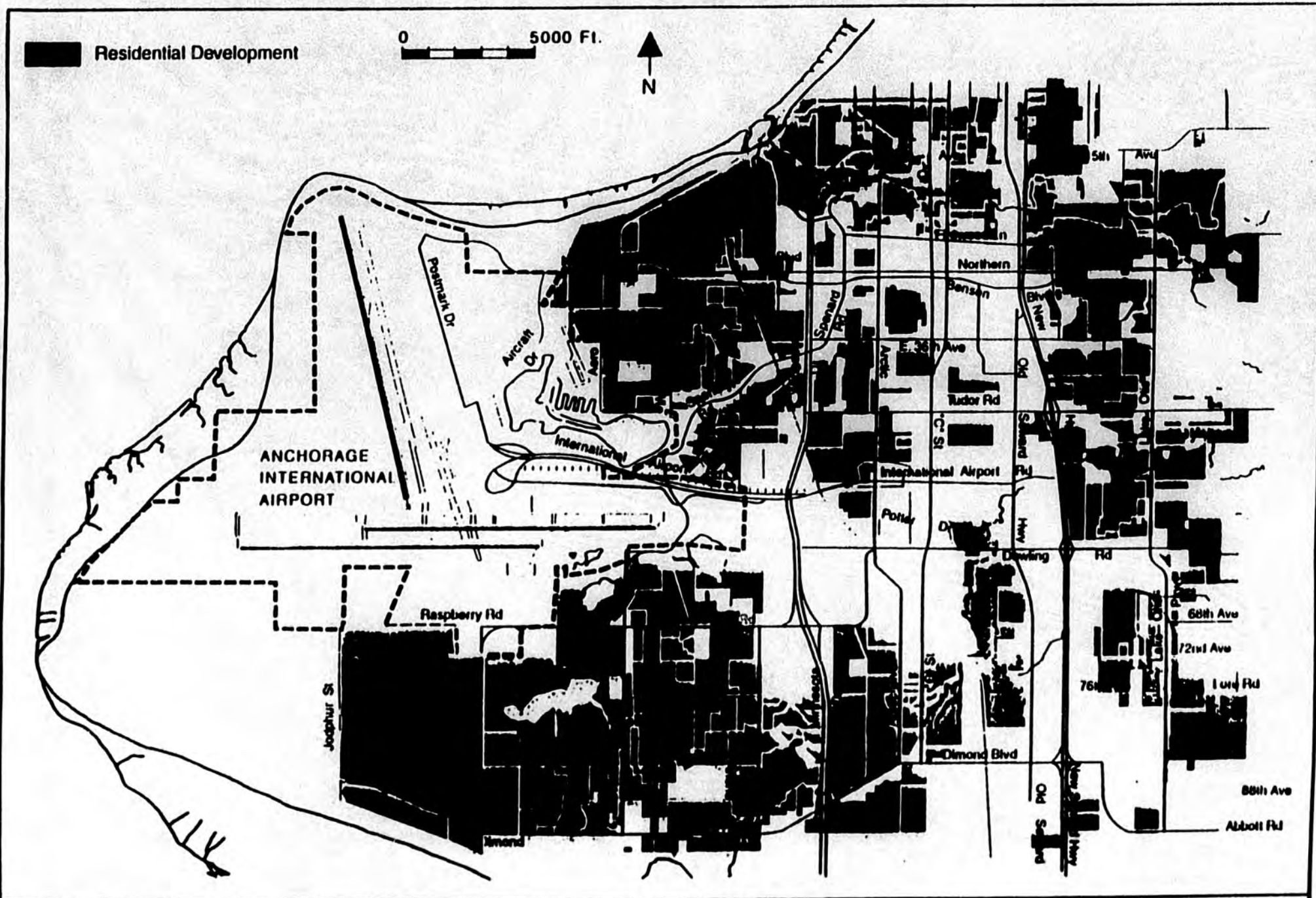


FIGURE 3



ANCHORAGE INTERNATIONAL AIRPORT

FIGURE 4

Table 4 shows the estimates of improved traffic flow efficiency resulting from the shorter taxi times for large aircraft able to use Runway 6L-24R after reconstruction. These benefits only apply to the runway reconstruction scenario. The number and type of affected operations and the travel time savings were estimated in Section 3.6. The daily minutes of delay were assumed to increase at the same rate as aircraft operations in that category.

Most of the affected aircraft would be cargo aircraft. Passenger delay for affected passenger jets was estimated by assuming a 150 seat narrow-body jet (larger than a Boeing 737) at a 60 percent load factor (90 passengers per affected passenger aircraft operation).

Traffic flow efficiency benefits were reduced by 12.33 percent (45 downtime days/365 days) in years where the reconstructed runway is scheduled for re-paving.

4.2 Delay Benefits

Table 5 presents the estimated delay costs for each alternative. The average aircraft delay under each alternative is a function of the average delay by alternative estimated in Table 3 and the percentage of time the Airport operates under each configuration under each alternative. The percentage of time under each use configuration is determined by the runway downtime assumptions presented in Section 3.4.

In 1999, the base case alternative has a lower level of average delay than the project alternative because the runway is down for 75 days rather than 5 months. In 2000, 2002, 2004 and 2014, the project alternative creates lower delays than the base case because of reduced downtime. The resurfacing alternative has lower downtimes towards the beginning but more frequent downtimes later because more frequent re-paving is required.

Each of the alternatives has delay spikes in 2006, 2007, 2009, 2016, 2017, and 2019 because of the required re-paving of the runways.

The incremental delay benefit for the project alternative is equal to the difference in delay costs compared to the base case.

4.3 Other Benefits

Other benefits that are more difficult to quantify are:

- Air freight/express package delivery delay benefits from the more efficient transportation of cargo and reduced delays to cargo shipments. Although the benefits are difficult to measure the relative distribution among alternatives should be similar to the traffic flow and delay benefits.

- System benefits should accrue to the airlines as a result of reduced interruptions due to runway closure in the later years. If delays resulting from runway closure become too frequent, airlines may choose to route through another US or foreign airport. The impact of AIA delays on international passenger or cargo service can be significant. For example, if outbound flights to Asia miss Asian airport curfews, the carrier might be required to use an alternate airport, pay a punitive landing fee, or purchase substitute services in the case of package delivery. AIA delays could create a domino effect on arrival and departure schedules, requiring three to four days to recover. These costs are estimated by one cargo hub carrier at \$2-3 million per incident.
- The project alternative would also include Centerline Lighting and Touchdown Zone Lighting which would improve operational efficiencies and safety.
- Traffic efficiency and delay benefits from the current cargo growth level at AIA which was not included in the 1993 Master Plan projections.

5. Costs

Table 6 summarizes the incremental benefits by year and also includes gross and incremental costs in 1997 dollars. Capital, major repair, and O&M costs were estimated by Airport staff.

5.1 Capital Costs

Capital costs are estimated as follows:

- **Base Case**
 - \$4.0 million in 1998 for Phase 1 of resurfacing
 - \$2.1 million in 1999 for Phase 2 of resurfacing
 - \$2.9 million in 2000 for Phase 3 of resurfacing
 - \$2.5 million in 2000 for safety area/drainage improvements
 - \$3.5 million in 2002 for blast protection
- **Project Alternative**
 - \$14.2 million in 1998 for Phase 1 of reconstruction
 - \$2.8 million in 1999 for Phase 2 of reconstruction

Capital cost estimates were based on previous runway resurfacing projects completed within the past five years.

5.2 Major Repairs

Major repairs include periodic re-paving required at different frequencies for each alternative. The re-paving costs of Runway 6R-24L and 14-32 are not included because they would be the same under each alternative.

Under the project alternative, re-paving would be required every ten years and would cost \$2 million each time. Under the resurfacing alternative, re-paving and subsurface repair would be required every five years and would cost \$2.5 million each time.

5.3 O&M Costs

O&M costs are based on existing Airport experience for each of the existing runways. Currently, runways 6R-24L and 14-32 are strengthened for Boeing 747 standards and are in significantly better condition than Runway 6L-24R. The O&M cost estimates in Table 6 are for Runway 6L-24R and reflect the following assumptions:

- Under the reconstruction (project) alternative, they include the reduced repairs that would be incurred because of the superior condition of the runway.
- The higher O & M costs under the base case (resurfacing) alternative reflect the increased repairs that would be required as a result of the occasional use by aircraft heavier than the Boeing 737 with the continued inadequate sub-base.

The annual runway 6L-24R maintenance and operating costs provided by AIA are based on the annual expenditures for field and equipment maintenance. This is a conservative annual cost estimate in that it excludes costs for utilities, equipment storage and maintenance facilities, equipment amortization, management/oversight, and State of Alaska, Department of Transportation support functions such as payroll, personnel, etc.

The following steps were applied to calculate the annual maintenance and operating costs for each alternative:

- Recent annual runway maintenance and operating costs were obtained for the Airport's three 10,000+ foot runways.
- Maintenance levels for each alternative were estimated by adjusting the recent maintenance levels.
- Estimates were partially based on field maintenance management system records.
- Future maintenance and operating costs were projected based on past maintenance project experience at AIA.

6. Summary

Table 7 converts the results of Table 6 to present value terms using a discount rate of 7.0 percent as stated in the FAA Airport Benefit-Cost Guidance. Table 8 summarizes the results of Table 7.

The analysis demonstrates that the proposed runway reconstruction project, as compared to the base case, has a net present value of \$14.7 million over the twenty year period of analysis. These net benefits are broken out as follows:

- \$9.5 million in aircraft and passenger delay savings;
- \$2.7 million in more efficient airside traffic flows; and
- \$2.5 million in reduced life cycle costs.

Additional benefits that could not be rigorously quantified include:

- Air freight/express package delivery delay benefits;
- System benefits to the airlines as a result of reduced interruptions due to more frequent runway closures in future years;
- Operational improvements due to improved lighting; and
- Delay and traffic efficiency benefits for AIA's current cargo growth in excess of forecast levels.

The benefits may be understated because they are measured against a base case scenario which includes a complete resurfacing of Runway 6L-24R. The base case scenario recognizes that the capacity provided by the runway is so important that AIA will not allow it to fail even if Federal funds are not forthcoming. Previous analyses have demonstrated that the runway would fail within five years without reconstruction, resurfacing, or excessive maintenance and aircraft operating weight restrictions. Without Runway 6L-24R, aircraft and passengers using the Airport would incur delay costs in excess of \$300 million over the next twenty years. Those analyses did not consider the recent double-digit growth in cargo operations, which would also be jeopardized by a major reduction in capacity.

The results of the analysis show that, from an economic standpoint, the project alternative is superior to the resurfacing alternative by approximately \$14.7 million. Either alternative would be vastly superior to allowing runway 6L-24R to be permanently closed.

A benefit-cost ratio could not be calculated because the life cycle costs of the reconstruction (project) alternative are lower than for the resurfacing (base case) alternative. This results in a negative incremental cost which would cause the benefit-cost ratio to be negative. Table A-1 in Appendix A shows an alternative case in which the reductions in future maintenance and repair costs are portrayed as benefits rather than reductions in project cost. This produces a benefit-cost ratio of 5.55 with an identical net present value of \$14.7 million.

As noted earlier, financial constraints would prevent the Airport from completing the resurfacing (base case) alternative in a single phase without FAA discretionary funds, and therefore prevents the alternative from being developed as efficiently and cost-effectively as possible. Table A-2 in Appendix A shows an alternative in which FAA discretionary funding allows the resurfacing to be conducted in one phase. This revised base case would lower the net present value of the reconstruction alternative from \$14.7 million to slightly under \$12.0 million. In conclusion, the proposed reconstruction provides substantial economic benefits over any potential resurfacing alternative.

Table 1
Anchorage International Airport
Forecast Assumptions Used in Analysis

	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Daily Aircraft Departures By Mix Index (a)																							
Passenger Carrier																							
A&B	7.59	7.73	7.81	7.88	7.95	8.03	8.10	8.18	8.26	8.33	8.41	8.49	8.56	8.64	8.72	8.79	8.87	8.95	9.02	9.10	9.18	9.25	9.33
C	148.86	155.12	158.26	161.39	164.52	168.36	172.19	176.03	179.86	183.70	187.54	191.37	195.21	199.04	202.88	206.72	210.55	214.39	218.22	222.06	225.90	229.73	233.57
D	12.03	12.92	13.37	13.81	14.26	15.00	15.74	16.48	17.23	17.97	18.71	19.45	20.19	20.93	21.67	22.41	23.16	23.90	24.64	25.38	26.12	26.86	27.60
Subtotal	168.48	175.78	179.43	183.08	186.73	191.384	196.038	200.692	205.346	210	214.654	219.308	223.962	228.616	233.27	237.924	242.578	247.232	251.886	256.54	261.194	265.848	270.502
Cargo																							
A&B	6.22	6.68	6.91	7.14	7.37	7.66	7.95	8.25	8.54	8.83	9.12	9.41	9.71	10.00	10.29	10.58	10.87	11.17	11.46	11.75	12.04	12.33	12.63
C	12.08	12.98	13.43	13.88	14.33	14.70	15.07	15.44	15.81	16.18	16.55	16.92	17.29	17.66	18.03	18.40	18.77	19.14	19.51	19.88	20.25	20.62	20.99
D	44.87	48.36	50.11	51.85	53.60	55.88	58.16	60.44	62.72	65.00	67.28	69.56	71.84	74.12	76.40	78.68	80.96	83.24	85.52	87.80	90.08	92.36	94.64
Subtotal	63.17	68.022	70.448	72.874	75.3	78.242	81.184	84.126	87.068	90.01	92.952	95.894	98.836	101.778	104.72	107.662	110.604	113.546	116.488	119.43	122.372	125.314	128.256
General Aviation																							
A&B	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57	62.57
C	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12	3.12
D	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69	65.69
Military																							
A&B	2	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00	2.00
C	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93	2.93
D	0	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Subtotal	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93	4.93
Total																							
A&B	78.38	78.98	79.29	79.59	79.89	80.26	80.63	81.00	81.36	81.73	82.10	82.47	82.84	83.21	83.58	83.95	84.31	84.68	85.05	85.42	85.79	86.16	86.53
C	166.99	174.15	177.74	181.32	184.9	189.11	193.31	197.52	201.72	205.93	210.14	214.34	218.55	222.75	226.96	231.17	235.37	239.58	243.78	247.99	252.20	256.40	260.61
D	56.9	61.28	63.48	65.67	67.86	70.88	73.90	76.92	79.95	82.97	85.99	89.01	92.03	95.05	98.07	101.09	104.12	107.14	110.16	113.18	116.20	119.22	122.24
Subtotal	302.27	314.42	320.50	326.57	332.65	340.25	347.84	355.44	363.03	370.63	378.23	385.82	393.42	401.01	408.61	416.21	423.80	431.40	438.99	446.59	454.19	461.78	469.38
Total Percentage Mix																							
A&B	25.9%	25.1%	24.7%	24.4%	24.0%	23.6%	23.2%	22.8%	22.4%	22.1%	21.7%	21.4%	21.1%	20.7%	20.5%	20.2%	19.9%	19.6%	19.4%	19.1%	18.9%	18.7%	18.4%
C	55.2%	55.4%	55.5%	55.5%	55.6%	55.8%	55.8%	55.6%	55.6%	55.6%	55.6%	55.6%	55.6%	55.5%	55.5%	55.5%	55.5%	55.5%	55.5%	55.5%	55.5%	55.5%	55.5%
D	18.8%	19.5%	19.8%	20.1%	20.4%	20.8%	21.2%	21.6%	22.0%	22.4%	22.7%	23.1%	23.4%	23.7%	24.0%	24.3%	24.6%	24.8%	25.1%	25.3%	25.6%	25.8%	26.0%
Subtotal	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%
Annual Operations (b)																							
Passenger Carrier	123,000	128,300	131,000	133,600	136,300	139,700	143,100	146,500	149,900	153,300	156,700	160,100	163,500	166,900	170,300	173,700	177,100	180,500	183,900	187,300	190,700	194,100	197,500
Cargo Carrier	46,100	49,700	51,400	53,200	55,000	57,100	59,300	61,400	63,600	65,700	67,900	70,000	72,200	74,300	76,400	78,600	80,700	82,900	85,000	87,200	89,300	91,500	93,600
General Aviation	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000	48,000
Military	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600	3,600
Total	220,700	229,600	234,000	238,400	242,900	248,400	254,000	259,500	265,100	270,600	276,200	281,700	287,300	292,800	298,300	303,900	309,400	315,000	320,500	326,100	331,600	337,200	342,700
Annual Passengers (c)																							
Enplaned and Deplaned	4,084,775	4,422,000	4,599,000	4,783,000	4,974,000	5,148,000	5,328,000	5,514,000	5,707,000	5,907,000	6,114,000	6,328,000	6,549,000	6,778,000	7,015,000	7,261,000	7,515,000	7,778,000	8,050,000	8,332,000	8,624,000	8,926,000	9,238,000
Transit	678,508	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000	679,000
Total	4,763,283	5,101,000	5,278,000	5,462,000	5,653,000	5,827,000	6,007,000	6,193,000	6,386,000	6,586,000	6,793,000	7,007,000	7,228,000	7,457,000	7,694,000	7,940,000	8,194,000	8,457,000	8,729,000	9,011,000	9,303,000	9,605,000	9,917,000
Passengers/Passenger Op (d)																							
	33.2	34.5	35.1	35.8	36.5	36.9	37.2	37.6	38.1	38.5	39.0	39.5	40.1	40.6	41.2	41.8	42.4	43.1	43.8	44.5	45.2	46.0	46.8

(a) Part 150 Analysis, Appendix D, Operational Summary

(b) Daily departures times (2 operations/departure) times 365 days.

(c) 1996 annual enplaned and deplaned passengers projected to increase at Leigh Fisher Master Plan growth rates.

(d) Passengers divided by operations.

Sources: As noted and HNTB analysis.

Table 2

Anchorage International Airport
Aircraft Variable Operating Costs

Equipment Type	1 Turbine, 4- Engine Wingbody (B-747)	2 Turbine, 4- Engine Wingbody	3 Turbine, 3- Engine Wingbody	4 Turbine, 3- Engine Wingbody (B-737)	5 Turbine, 3- Engine Wingbody (B-737)	6 Turbine, 3- Engine Wingbody (B-737)	7 Turboprop, 4-Engine (DC-4)	8 Turboprop, 3-Engine Alaska	9 Propeller Alaska
Block Hour Costs									
Crew (a)	\$ 611.67	\$ 486.34	\$ 646.66	\$ 460.91	\$ 500.00	\$ 320.22	\$ 144.70	\$ 70.51	\$ 61.78
Fuel B. CD (a)	\$ 1,875.57	\$ 704.16	\$ 1,220.66	\$ 672.51	\$ 600.00	\$ 420.05	\$ 144.44	\$ 145.31	\$ 117.57
Maintenance (a)	\$ 708.64	\$ 332.46	\$ 615.65	\$ 221.42	\$ 200.31	\$ 187.26	\$ 247.74	\$ 156.52	\$ 66.12
Total	\$ 3,395.86	\$ 1,520.96	\$ 2,482.97	\$ 1,354.84	\$ 1,300.30	\$ 927.53	\$ 536.87	\$ 372.34	\$ 244.00
Price Adjustment (b)	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30
Total in 1987 Dollars (c)	\$ 4,718.26	\$ 2,126.81	\$ 3,460.26	\$ 1,843.31	\$ 2,347.10	\$ 1,231.82	\$ 694.17	\$ 517.35	\$ 322.76
Total in 1987 Minutes	\$ 78.64	\$ 35.63	\$ 57.67	\$ 31.30	\$ 39.12	\$ 22.08	\$ 15.17	\$ 8.67	\$ 6.36
Tax/Block (d)	50%	50%	50%	60%	60%	50%	50%	50%	50%
Estimated Tax Total	\$ 2,103.70	\$ 1,018.80	\$ 1,546.55	\$ 807.00	\$ 1,005.15	\$ 640.00	\$ 414.60	\$ 221.42	\$ 168.63
Price Adjustment (e)	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30	\$ 1.30
Tax Total in 1987 Dollars (e)	\$ 2,823.00	\$ 1,419.82	\$ 2,178.41	\$ 1,261.60	\$ 1,321.64	\$ 880.48	\$ 576.45	\$ 297.66	\$ 215.20
Tax Total in 1987 Minutes	\$ 48.72	\$ 23.60	\$ 36.32	\$ 21.63	\$ 25.36	\$ 14.64	\$ 9.61	\$ 5.13	\$ 3.91

Equipment Type

1986
Duty Days

Weights

VOC/

Duty Days

Weights

VOC/

Duty Days

Weights

VOC/

Minutes

Aircraft Delay Costs Per Minute (f)

1	34.13	11.3%	78.64	46.06	12.6%	78.64	63.35	16.0%	78.64
2	7.41	2.5%	35.65	7.66	2.3%	35.65	6.0	1.5%	35.65
3	10.63	3.5%	57.67	13.1	3.6%	57.67	23.66	3.3%	57.67
4	0.57	0.2%	0.57	0.62	0.2%	0.57	4.0	1.1%	31.30
5	1.45	0.5%	31.32	2.62	0.6%	31.32	7.36	1.7%	36.12
6	70.25	23.2%	22.08	77.70	23.4%	22.08	187.26	26.0%	22.08
7	21.66	7.2%	15.77	20.00	6.1%	15.77	38.01	8.7%	19.27
8	64.44	27.0%	8.62	61.66	37.6%	8.62	128.36	28.7%	8.62
9	63.73	21.1%	0.36	63.73	10.7%	0.36	63.73	16.3%	6.36
Aggregate	202.29		22.07	222.07		23.75	446.61		28.18

Departure Delay Costs Per Minute (g)

1	34.13	11.3%	48.72	46.06	12.6%	48.72	63.35	16.0%	48.72
2	7.41	2.5%	23.66	7.66	2.3%	23.66	6.0	1.5%	23.66
3	10.63	3.5%	36.32	13.1	3.6%	36.32	23.66	3.3%	36.32
4	0.57	0.2%	0.62	0.62	0.2%	0.57	4.0	1.1%	21.63
5	1.45	0.5%	25.36	2.62	0.6%	25.36	7.36	1.7%	25.36
6	70.25	23.2%	14.64	77.70	23.4%	14.64	187.26	26.0%	14.64
7	21.66	7.2%	8.61	20.00	6.1%	8.61	38.01	8.7%	8.61
8	64.44	27.0%	5.13	61.66	27.6%	5.13	128.36	28.7%	5.13
9	63.73	21.1%	3.01	63.73	10.7%	3.01	63.73	16.3%	3.01
Aggregate	202.29		14.67	222.07		19.01	446.61		18.50

(a) FAA, Economic Values for Evaluation of Federal Aviation Administration and Regulatory Programs, October 1989. Values expressed in 1987 dollars.

(b) U.S. Bureau of Economic Analysis, GDP Price Deflator.

(c) Total multiplied by price adjustment factor.

(d) Adjustment factor used to convert block hour costs for land and maintenance to aircraft operating costs for landing aircraft.

(e) Estimated land cost times price adjustment.

(f) Block hour costs weighted by duty days for 1986, 2001, and 2010.

(g) Total costs weighted by block hour for 1986, 2001, and 2010.

Source: As noted and 1987 B analysis.

Table 3

**Anchorage International Airport
Estimated Delay per Operation**

	Current R/W Configuration	R/W Configuration with 6L-24R or 6R-24L closed	R/W Configuration with 14-32 Closed	R/W Configuration with one R/W Open
Runway Use Configuration (a)	16 and 17	14 and 15	2	1
1996				
Fleet Mix (b)				
A&B	25.9%	25.9%	25.9%	25.9%
C	55.2%	55.2%	55.2%	55.2%
D	18.8%	18.8%	18.8%	18.8%
Mix Index (c)	1.116	1.116	1.116	1.116
Annual Operations (b)	220,700	220,700	220,700	220,700
Annual Service Volume (d)	295,500	225,000	285,000	210,000
Ratio (e)	0.75	0.98	0.77	1.05
Delay per Aircraft (min.) (f)	0.8	2.1	0.85	3.2
2001				
Fleet Mix (b)				
A&B	24.0%	24.0%	24.0%	24.0%
C	55.6%	55.6%	55.6%	55.6%
D	20.4%	20.4%	20.4%	20.4%
Mix Index (c)	1.168	1.168	1.168	1.168
Annual Operations (b)	242,900	242,900	242,900	242,900
Annual Service Volume (d)	295,500	225,000	285,000	210,000
Ratio (e)	0.82	1.08	0.85	1.16
Delay per Aircraft (min.) (f)	1	3.8	1.15	5.9
2016				
Fleet Mix (b)				
A&B	19.1%	19.1%	19.1%	19.1%
C	55.5%	55.5%	55.5%	55.5%
D	25.3%	25.3%	25.3%	25.3%
Mix Index (c)	1.314	1.314	1.314	1.314
Annual Operations (b)	326,100	326,100	326,100	326,100
Annual Service Volume (d)	350,500	265,000	340,000	240,000
Ratio (e)	0.93	1.23	0.96	1.36
Delay per Aircraft (min.) (f)	1.6	7.65	1.85	10.9

(a) Runway use configurations from Figure 2-1, FAA AC No: 150/5060-5, Airport Capacity and Delay.

(b) Table 1.

(c) $C + (3 \times D)$ from FAA AC No: 150/5060-5.

(d) From Figure 2-1, FAA AC No: 150/5060-5.

(e) Annual operations divided by annual service volume.

(f) From Figure 2-2, FAA AC No: 150/5060-5.

Sources: As noted and HNTB analysis.

Table 4
Anchorage International Airport
Estimate of Incremental Traffic Flow Efficiency
(Cost and Benefits in 1997 Dollars)

	1996	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Aircraft Operations																							
Boeing 747																							
Daily Minutes of Delay Savings(a)	5.33	5.74	5.95	6.16	6.37	6.64	6.91	7.18	7.45	7.72	7.99	8.26	8.53	8.80	9.08	9.35	9.62	9.89	10.16	10.43	10.70	10.97	11.24
Cost per Minute (b)	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72	\$ 48.72
Daily Savings (c)	\$ 259.67	\$ 279.88	\$ 289.98	\$ 300.08	\$ 310.19	\$ 323.38	\$ 336.58	\$ 349.77	\$ 362.97	\$ 376.16	\$ 389.36	\$ 402.55	\$ 415.74	\$ 428.94	\$ 442.13	\$ 455.33	\$ 468.52	\$ 481.72	\$ 494.91	\$ 508.11	\$ 521.30	\$ 534.50	\$ 547.69
Annual Savings (d)	\$ 94,778	\$ 102,154	\$ 105,843	\$ 109,531	\$ 113,219	\$ 118,035	\$ 122,851	\$ 127,667	\$ 132,483	\$ 137,299	\$ 142,115	\$ 146,931	\$ 151,747	\$ 156,563	\$ 161,379	\$ 166,195	\$ 171,011	\$ 175,827	\$ 180,643	\$ 185,459	\$ 190,275	\$ 195,091	\$ 199,907
Boeing 727																							
Daily Minutes of Delay Savings(a)	2.77	2.89	2.95	3.01	3.07	3.14	3.21	3.28	3.35	3.42	3.49	3.56	3.63	3.70	3.76	3.83	3.90	3.97	4.04	4.11	4.18	4.25	4.32
Cost per Minute (b)	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03	\$ 21.03
Daily Savings (c)	\$ 58.24	\$ 60.74	\$ 61.99	\$ 63.24	\$ 64.49	\$ 65.96	\$ 67.42	\$ 68.89	\$ 70.36	\$ 71.82	\$ 73.29	\$ 74.76	\$ 76.23	\$ 77.69	\$ 79.16	\$ 80.63	\$ 82.09	\$ 83.56	\$ 85.03	\$ 86.49	\$ 87.96	\$ 89.43	\$ 90.90
Annual Savings (d)	\$ 21,259	\$ 22,171	\$ 22,627	\$ 23,083	\$ 23,539	\$ 24,074	\$ 24,610	\$ 25,145	\$ 25,681	\$ 26,216	\$ 26,751	\$ 27,287	\$ 27,822	\$ 28,358	\$ 28,893	\$ 29,429	\$ 29,964	\$ 30,500	\$ 31,035	\$ 31,570	\$ 32,106	\$ 32,641	\$ 33,177
Narrowbody Jet (Twin Engine)																							
Daily Minutes of Delay Savings(a)	4.58	4.78	4.87	4.97	5.07	5.19	5.30	5.42	5.53	5.65	5.76	5.88	5.99	6.11	6.22	6.34	6.46	6.57	6.69	6.80	6.92	7.03	7.15
Cost per Minute (b)	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84	\$ 14.84
Daily Savings (c)	\$ 67.97	\$ 70.89	\$ 72.35	\$ 73.81	\$ 75.26	\$ 76.98	\$ 78.69	\$ 80.40	\$ 82.11	\$ 83.82	\$ 85.54	\$ 87.25	\$ 88.96	\$ 90.67	\$ 92.38	\$ 94.10	\$ 95.81	\$ 97.52	\$ 99.23	\$ 100.94	\$ 102.66	\$ 104.37	\$ 106.08
Annual Savings (d)	\$ 24,810	\$ 25,875	\$ 26,407	\$ 26,939	\$ 27,471	\$ 28,096	\$ 28,721	\$ 29,346	\$ 29,971	\$ 30,596	\$ 31,221	\$ 31,846	\$ 32,470	\$ 33,095	\$ 33,720	\$ 34,345	\$ 34,970	\$ 35,595	\$ 36,220	\$ 36,845	\$ 37,470	\$ 38,095	\$ 38,719
Total Unadjusted Savings	\$ 140,847	\$ 150,200	\$ 154,876	\$ 159,552	\$ 164,229	\$ 170,205	\$ 176,181	\$ 182,158	\$ 188,134	\$ 194,110	\$ 200,087	\$ 206,063	\$ 212,040	\$ 218,016	\$ 223,992	\$ 229,969	\$ 235,945	\$ 241,921	\$ 247,898	\$ 253,874	\$ 259,850	\$ 265,827	\$ 271,803
Downtime after Reconstruction (l)	n/a	n/a	n/a	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Adjusted Savings (m)	\$ -	\$ -	\$ -	\$ 159,552	\$ 164,229	\$ 170,205	\$ 176,181	\$ 182,158	\$ 188,134	\$ 194,110	\$ 200,087	\$ 206,063	\$ 188,470	\$ 218,016	\$ 223,992	\$ 229,969	\$ 235,945	\$ 241,921	\$ 247,898	\$ 253,874	\$ 259,850	\$ 265,827	\$ 215,953
Passengers																							
Daily Minutes of Delay Savings (Pax Ops) (a)	4.16	4.34	4.43	4.51	4.60	4.71	4.82	4.92	5.03	5.14	5.24	5.35	5.46	5.57	5.67	5.78	5.89	6.00	6.10	6.21	6.32	6.42	6.53
Passengers/Operation (f)	90	93.4	95.1	97.0	98.9	99.9	100.9	102.0	103.2	104.4	105.7	107.1	108.6	110.1	111.6	113.3	115.0	116.8	118.6	120.6	122.6	124.6	126.6
Minutes of Passenger Delay Savings (g)	374.7	405.2	421.1	437.9	455.1	470.2	485.9	502.2	519.0	536.5	554.6	573.3	592.6	612.7	633.4	654.9	677.2	700.2	724.0	748.7	774.3	800.7	828.0
Value of Time per Passenger Hour (h)	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70	\$ 26.70
Value of Time Per Passenger Minute (i)	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45	\$ 0.45
Daily Passenger Savings (j)	\$ 186.74	\$ 180.33	\$ 187.39	\$ 194.87	\$ 202.50	\$ 209.25	\$ 216.24	\$ 223.46	\$ 230.96	\$ 238.74	\$ 246.79	\$ 255.12	\$ 263.72	\$ 272.64	\$ 281.87	\$ 291.45	\$ 301.34	\$ 311.59	\$ 322.19	\$ 333.18	\$ 344.55	\$ 356.32	\$ 368.48
Annual Passenger Savings (k)	\$ 60,859	\$ 65,820	\$ 68,397	\$ 71,129	\$ 73,912	\$ 76,376	\$ 78,926	\$ 81,563	\$ 84,301	\$ 87,140	\$ 90,079	\$ 93,119	\$ 96,258	\$ 99,513	\$ 102,881	\$ 106,379	\$ 109,990	\$ 113,730	\$ 117,598	\$ 121,609	\$ 125,762	\$ 130,058	\$ 134,496
Downtime after Reconstruction (l)	n/a	n/a	n/a	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Adjusted Savings (n)	\$ -	\$ -	\$ -	\$ 71,129	\$ 73,912	\$ 76,376	\$ 78,926	\$ 81,563	\$ 84,301	\$ 87,140	\$ 90,079	\$ 93,119	\$ 76,479	\$ 99,513	\$ 102,881	\$ 106,379	\$ 109,990	\$ 113,730	\$ 117,598	\$ 121,609	\$ 125,762	\$ 130,058	\$ 106,859

- (a) HNTB analysis.
 (b) Taxi delay cost from Table 3.3.
 (c) Daily minutes of delay savings times cost per minute.
 (d) Daily savings times 365 days.
 (e) Daily minutes of delay savings for passenger aircraft from HNTB analysis.
 (f) Average passengers per narrowbody jet aircraft. Assumes 150 seat Boeing 737 at 60 percent load factor.
 (g) Minutes of passenger aircraft delay savings times passengers per aircraft.
 (h) FAA Office of Aviation and Plans' Bulletin, Treatment of Values of Passenger Time in Economic Analysis, June 1997.
 (i) Value of passenger time per hour divided by 60 minutes.
 (j) Daily minutes of passenger delay savings multiplied by value of time per minute.
 (k) Daily passenger savings times 365 days.
 (l) Amount of time reconstructed runway is down for repaving.
 (m) Unadjusted savings adjusted for times runway is not in operation.
 (n) Unadjusted passenger savings adjusted for times runway is not in operation.

Sources: As noted and HNTB analysis.

Table 8

Anchorage International Airport
Estimate of Delay Costs
(Cost and Benefits in 1997 Dollars)

Year	Avg. Delay/Operation by R/W Configuration (min.) (a)	Current	BL-24R or 6R-24L closed	14-32 closed & 2 R/W open	single runway open	A/C Arrival Cost per Min. of Delay (b)	A/C Delay Cost per Min. of Delay (c)	Alternate Operations (d)	Passenger Cost Per Minute of Delay (e)	Total Passenger Cost (f)	Base Case Alternative (Reconstruct)	Runway Configuration (Percent) (f)	Current	BL-24R or 6R-24L closed	14-32 closed & 2 R/W open	single runway open	Weighted Delay per Operation (g)	Annual Delay Costs	Passenger (h)	Subtotal	B-747 Reconfiguration Alternative	Runway Configuration (Percent) (i)	Current	BL-24R or 6R-24L closed	14-32 closed & 2 R/W open	single runway open	Weighted Delay per Operation (g)	Annual Delay Costs	Passenger (h)	Subtotal	Weighted Delay per Operation (g)	Annual Delay Costs	Passenger (i)	Subtotal	Investment Delay Benefits (Compared to Base Case) (j)	Passenger	Subtotal																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
1996	0.80	0.86	0.92	0.96	1.00	1.04	1.08	1.12	1.16	1.20	1.24	1.28	1.32	1.36	1.40	1.44	1.48	1.52	1.56	1.60	1.64	1.68	1.72	1.76	1.80	1.84	1.88	1.92	1.96	2.00	2.04	2.08	2.12	2.16	2.20	2.24	2.28	2.32	2.36	2.40	2.44	2.48	2.52	2.56	2.60	2.64	2.68	2.72	2.76	2.80	2.84	2.88	2.92	2.96	3.00	3.04	3.08	3.12	3.16	3.20	3.24	3.28	3.32	3.36	3.40	3.44	3.48	3.52	3.56	3.60	3.64	3.68	3.72	3.76	3.80	3.84	3.88	3.92	3.96	4.00	4.04	4.08	4.12	4.16	4.20	4.24	4.28	4.32	4.36	4.40	4.44	4.48	4.52	4.56	4.60	4.64	4.68	4.72	4.76	4.80	4.84	4.88	4.92	4.96	5.00	5.04	5.08	5.12	5.16	5.20	5.24	5.28	5.32	5.36	5.40	5.44	5.48	5.52	5.56	5.60	5.64	5.68	5.72	5.76	5.80	5.84	5.88	5.92	5.96	6.00	6.04	6.08	6.12	6.16	6.20	6.24	6.28	6.32	6.36	6.40	6.44	6.48	6.52	6.56	6.60	6.64	6.68	6.72	6.76	6.80	6.84	6.88	6.92	6.96	7.00	7.04	7.08	7.12	7.16	7.20	7.24	7.28	7.32	7.36	7.40	7.44	7.48	7.52	7.56	7.60	7.64	7.68	7.72	7.76	7.80	7.84	7.88	7.92	7.96	8.00	8.04	8.08	8.12	8.16	8.20	8.24	8.28	8.32	8.36	8.40	8.44	8.48	8.52	8.56	8.60	8.64	8.68	8.72	8.76	8.80	8.84	8.88	8.92	8.96	9.00	9.04	9.08	9.12	9.16	9.20	9.24	9.28	9.32	9.36	9.40	9.44	9.48	9.52	9.56	9.60	9.64	9.68	9.72	9.76	9.80	9.84	9.88	9.92	9.96	10.00	10.04	10.08	10.12	10.16	10.20	10.24	10.28	10.32	10.36	10.40	10.44	10.48	10.52	10.56	10.60	10.64	10.68	10.72	10.76	10.80	10.84	10.88	10.92	10.96	11.00	11.04	11.08	11.12	11.16	11.20	11.24	11.28	11.32	11.36	11.40	11.44	11.48	11.52	11.56	11.60	11.64	11.68	11.72	11.76	11.80	11.84	11.88	11.92	11.96	12.00	12.04	12.08	12.12	12.16	12.20	12.24	12.28	12.32	12.36	12.40	12.44	12.48	12.52	12.56	12.60	12.64	12.68	12.72	12.76	12.80	12.84	12.88	12.92	12.96	13.00	13.04	13.08	13.12	13.16	13.20	13.24	13.28	13.32	13.36	13.40	13.44	13.48	13.52	13.56	13.60	13.64	13.68	13.72	13.76	13.80	13.84	13.88	13.92	13.96	14.00	14.04	14.08	14.12	14.16	14.20	14.24	14.28	14.32	14.36	14.40	14.44	14.48	14.52	14.56	14.60	14.64	14.68	14.72	14.76	14.80	14.84	14.88	14.92	14.96	15.00	15.04	15.08	15.12	15.16	15.20	15.24	15.28	15.32	15.36	15.40	15.44	15.48	15.52	15.56	15.60	15.64	15.68	15.72	15.76	15.80	15.84	15.88	15.92	15.96	16.00	16.04	16.08	16.12	16.16	16.20	16.24	16.28	16.32	16.36	16.40	16.44	16.48	16.52	16.56	16.60	16.64	16.68	16.72	16.76	16.80	16.84	16.88	16.92	16.96	17.00	17.04	17.08	17.12	17.16	17.20	17.24	17.28	17.32	17.36	17.40	17.44	17.48	17.52	17.56	17.60	17.64	17.68	17.72	17.76	17.80	17.84	17.88	17.92	17.96	18.00	18.04	18.08	18.12	18.16	18.20	18.24	18.28	18.32	18.36	18.40	18.44	18.48	18.52	18.56	18.60	18.64	18.68	18.72	18.76	18.80	18.84	18.88	18.92	18.96	19.00	19.04	19.08	19.12	19.16	19.20	19.24	19.28	19.32	19.36	19.40	19.44	19.48	19.52	19.56	19.60	19.64	19.68	19.72	19.76	19.80	19.84	19.88	19.92	19.96	20.00	20.04	20.08	20.12	20.16	20.20	20.24	20.28	20.32	20.36	20.40	20.44	20.48	20.52	20.56	20.60	20.64	20.68	20.72	20.76	20.80	20.84	20.88	20.92	20.96	21.00	21.04	21.08	21.12	21.16	21.20	21.24	21.28	21.32	21.36	21.40	21.44	21.48	21.52	21.56	21.60	21.64	21.68	21.72	21.76	21.80	21.84	21.88	21.92	21.96	22.00	22.04	22.08	22.12	22.16	22.20	22.24	22.28	22.32	22.36	22.40	22.44	22.48	22.52	22.56	22.60	22.64	22.68	22.72	22.76	22.80	22.84	22.88	22.92	22.96	23.00	23.04	23.08	23.12	23.16	23.20	23.24	23.28	23.32	23.36	23.40	23.44	23.48	23.52	23.56	23.60	23.64	23.68	23.72	23.76	23.80	23.84	23.88	23.92	23.96	24.00	24.04	24.08	24.12	24.16	24.20	24.24	24.28	24.32	24.36	24.40	24.44	24.48	24.52	24.56	24.60	24.64	24.68	24.72	24.76	24.80	24.84	24.88	24.92	24.96	25.00	25.04	25.08	25.12	25.16	25.20	25.24	25.28	25.32	25.36	25.40	25.44	25.48	25.52	25.56	25.60	25.64	25.68	25.72	25.76	25.80	25.84	25.88	25.92	25.96	26.00	26.04	26.08	26.12	26.16	26.20	26.24	26.28	26.32	26.36	26.40	26.44	26.48	26.52	26.56	26.60	26.64	26.68	26.72	26.76	26.80	26.84	26.88	26.92	26.96	27.00	27.04	27.08	27.12	27.16	27.20	27.24	27.28	27.32	27.36	27.40	27.44	27.48	27.52	27.56	27.60	27.64	27.68	27.72	27.76	27.80	27.84	27.88	27.92	27.96	28.00	28.04	28.08	28.12	28.16	28.20	28.24	28.28	28.32	28.36	28.40	28.44	28.48	28.52	28.56	28.60	28.64	28.68	28.72	28.76	28.80	28.84	28.88	28.92	28.96	29.00	29.04	29.08	29.12	29.16	29.20	29.24	29.28	29.32	29.36	29.40	29.44	29.48	29.52	29.56	29.60	29.64	29.68	29.72	29.76	29.80	29.84	29.88	29.92	29.96	30.00	30.04	30.08	30.12	30.16	30.20	30.24	30.28	30.32	30.36	30.40	30.44	30.48	30.52	30.56	30.60	30.64	30.68	30.72	30.76	30.80	30.84	30.88	30.92	30.96	31.00	31.04	31.08	31.12	31.16	31.20	31.24	31.28	31.32	31.36	31.40	31.44	31.48	31.52	31.56	31.60	31.64	31.68	31.72	31.76	31.80	31.84	31.88	31.92	31.96	32.00	32.04	32.08	32.12	32.16	32.20	32.24	32.28	32.32	32.36	32.40	32.44	32.48	32.52	32.56	32.60	32.64	32.68	32.72	32.76	32.80	32.84	32.88	32.92	32.96	33.00	33.04	33.08	33.12	33.16	33.20	33.24	33.28	33.32	33.36	33.40	33.44	33.48	33.52	33.56	33.60	33.64	33.68	33.72	33.76	33.80	33.84	33.88	33.92	33.96	34.00	34.04	34.08	34.12	34.16	34.20	34.24	34.28	34.32	34.36	34.40	34.44	34.48	34.52	34.56	34.60	34.64	34.68	34.72	34.76	34.80	34.84	34.88	34.92	34.96	35.00	35.04	35.08	35.12	35.16	35.20	35.24	35.28	35.32	35.36	35.40	35.44	35.48	35.52	35.56	35.60	35.64	35.68	35.72	35.76	35.80	35.84	35.88	35.92	35.96	36.00	36.04	36.08	36.12	36.16	36.20	36.24	36.28	36.32	36.36	36.40	36.44	36.48	36.52	36.56	36.60	36.64	36.68	36.72	36.76	36.80	36.84	36.88	36.92	36.96	37.00	37.04	37.08	37.12	37.16	37.20	37.24	37.28	37.32	37.36	37.40	37.44	37.48	37.52	37.56	37.60	37.64	37.68	37.72	37.76	37.80	37.84	37.88	37.92	37.96	38.00	38.04	38.08	38.12	38.16	38.20	38.24	38.28	38.32	38.36	38.40	38.44	38.48	38.52	38.56	38.60	38.64	38.68	38.72	38.76	38.80	38.84	38.88	38.92	38.96	39.00	39.04	39.08	39.12	39.16	39.20	39.24	39.28	39.32	39.36	39.40	39.44	39.48	39.52	39.56	39.60	39.64	39.68	39.72	39.76	39.80	39.84	39.88	39.92	39.96	40.00	40.04	40.08	40.12	40.16	40.20	40.24	40.28	40.32	40.36	40.40	40.44	40.48	40.52	40.56	40.60	40.64	40.68	40.72	40.76	40.80	40.84	40.88	40.92	40.96	41.00	41.04	41.08	41.12	41.16	41.20	41.24	41.28	41.32	41.36	41.40	41.44	41.48	41.52	41.56	41.60	41.64	41.68	41.72	41.76	41.80	41.84	41.88	41.92	41.96	42.00	42.04	42.08	42.12	42.16	42.20	42.24	42.28	42.32	42.36	42.40	42.44	42.48	42.52	42.56	42.60	42.64	42.68	42.72	42.76	42.80	42.84	42.88	42.92	42.96	43.00	43.04	43.08	43.12	43.16	43.20	43.24	43.28	43.32	43.36	43.40	43.44	43.48	43.52	43.56	43.60	43.64	43.68	43.72	43.76	43.80	43.84	43.88	43.92	43.96	44.00	44.04	44.08	44.12	44.16	44.20	44.24	44.28	44.32	44.36	44.40	44.44	44.48	44.52	44.56	44.60	44.64	44.68	44.72	44.76	44.80	44.84	44.88	44.92	44.96	45.00	45.04	45.08	45.12	45.16	45.20	45.24	45.28	45.32	45.36	45.40	45.44	45.48	45.52	45.56	45.60	45.64	45.68	45.72	45.76	45.80	45.84	45.88	45.92	45.96	46.00	46.04	46.08	46.12	46.16	46.20	46.24	46.28	46.32	46.36	46.40	46.44	46.48	46.52	46.56	46.60	46.64	46.68	46.72	46.76	46.80	46.84	46.88	46.92	46.96	47.00	47.04	47.08	47.12	47.16	47.20	47.24	47.28	47.32	47.36	47.40	47.44	47.48	47.52	47.56	47.60	47.64	47.68	47.72	47.76	47.80	47.84	47.88	47.92	47.96	48.00	48.04	48.08	48.12	48.16	48.20	48.24	48.28	48.32	48.36	48.40	48.44	48.48	48.52	48.56	48.60	48.64	48.68	48.72	48.76	48.80	48.84	48.88	48.92	48.96	4

Table 6
Anchorage International Airport
Summary of Benefit Cost Analysis Before Discounting
(Cost and Benefits in 1997 Dollars)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	Total
Base Case Alternative (Resurfacing)																							
Incremental Benefits																							
More Efficient Traffic Flows (a)																							
Aircraft	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Passenger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Delay (b)																							
Aircraft	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Passenger	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Gross Costs (c)																							
Capital	4,000,000	2,100,000	5,400,000	-	3,500,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15,000,000
Major Repair	-	-	-	-	-	-	2,500,000	-	-	-	-	2,500,000	-	-	-	-	2,500,000	-	-	-	-	2,500,000	10,000,000
O&M	786,500	786,500	786,500	718,200	359,100	665,000	332,500	665,000	704,900	744,800	784,700	332,500	665,000	704,900	744,800	784,700	332,500	665,000	704,900	744,800	784,700	332,500	14,130,000
Total	4,786,500	2,886,500	6,186,500	718,200	3,859,100	665,000	2,832,500	665,000	704,900	744,800	784,700	2,832,500	665,000	704,900	744,800	784,700	2,832,500	665,000	704,900	744,800	784,700	2,832,500	39,130,000
B-747 Reconstruction Alternative																							
Incremental Benefits																							
More Efficient Traffic Flows (a)																							
Aircraft	-	-	159,552	164,229	170,205	176,181	182,158	188,134	194,110	200,087	206,063	168,470	218,016	223,992	229,969	235,945	241,921	247,896	253,874	259,850	265,827	215,953	4,202,435
Passenger	-	-	71,129	73,912	76,376	78,926	81,563	84,301	87,140	90,079	93,119	76,479	99,513	102,881	106,379	109,990	113,730	117,598	121,609	125,762	130,058	106,859	1,947,404
Delay (b)																							
Aircraft	-	(2,076,000)	1,885,000	-	2,404,000	-	3,638,000	-	-	-	-	-	-	-	-	-	7,663,000	-	-	-	-	-	13,514,000
Passenger	-	(1,091,000)	999,000	-	1,286,000	-	1,954,000	-	-	-	-	-	-	-	-	-	4,344,000	-	-	-	-	-	7,492,000
Total	-	(3,167,000)	3,114,682	238,140	3,936,581	255,106	5,855,721	272,435	281,250	290,166	299,182	244,949	317,528	326,873	336,347	345,935	12,362,651	365,496	375,483	385,613	395,885	322,813	27,155,838
Gross Costs (c)																							
Capital	14,200,000	2,800,000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	17,000,000
Major Repair	-	-	-	-	-	-	-	-	-	-	-	2,000,000	-	-	-	-	-	-	-	-	-	2,000,000	4,000,000
O&M	196,500	200,430	393,000	400,860	408,720	416,580	424,440	432,300	440,160	448,020	455,880	196,500	393,000	400,860	408,720	416,580	424,440	432,300	440,160	448,020	455,880	196,500	8,429,850
Total	14,396,500	3,000,430	393,000	400,860	408,720	416,580	424,440	432,300	440,160	448,020	455,880	2,196,500	393,000	400,860	408,720	416,580	424,440	432,300	440,160	448,020	455,880	2,196,500	29,429,850
Incremental Costs (d)																							
Capital	10,200,000	700,000	(5,400,000)	-	(3,500,000)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	2,000,000
Major Repair	-	-	-	-	-	-	(2,500,000)	-	-	-	-	(500,000)	-	-	-	-	(2,500,000)	-	-	-	-	(500,000)	(8,000,000)
O&M	(590,000)	(586,070)	(393,500)	(317,340)	49,620	(248,420)	91,940	(232,700)	(264,740)	(296,780)	(328,820)	(136,000)	(272,000)	(304,040)	(336,080)	(368,120)	91,940	(232,700)	(264,740)	(296,780)	(328,820)	(136,000)	(5,700,150)
Total	9,610,000	113,930	(5,793,500)	(317,340)	(3,450,380)	(248,420)	(2,408,060)	(232,700)	(264,740)	(296,780)	(328,820)	(836,000)	(272,000)	(304,040)	(336,080)	(368,120)	(2,408,060)	(232,700)	(264,740)	(296,780)	(328,820)	(636,000)	(9,700,150)
Net Benefit/Cost (e)	(14,396,500)	(6,167,430)	2,721,682	(162,720)	3,527,861	(161,472)	5,431,281	(159,865)	(158,910)	(157,854)	(156,698)	(1,951,551)	(75,472)	(73,987)	(72,373)	(70,645)	11,938,211	(66,804)	(64,677)	(62,407)	(59,995)	(1,873,687)	(2,274,012)

(a) Table 3.4.

(b) Table 3.5.

(c) Anchorage International Airport.

(d) B-747 Reconstruction Alternative costs less base case costs.

(e) B-747 Reconstruction Alternative incremental benefit less incremental costs.

Table 8
Anchorage International Airport
Summary of Benefit Cost Analysis: 1998-2019

747 Reconstruction Alternative

	Undiscounted (1997 Dollars) (a)	Discounted (b)
Incremental Benefits		
More Efficient Traffic Flows		
Aircraft	4,202,435	1,838,049
Passenger	1,947,404	842,201
Delay		
Aircraft	13,514,000	6,130,955
Passenger	7,492,000	3,371,512
Total	27,155,838	12,182,718
Incremental Costs		
Capital	2,000,000	3,240,657
Major Repair	(6,000,000)	(2,683,173)
O&M	(5,700,150)	(3,123,453)
Total	(9,700,150)	(2,565,969)
Net Benefit/Cost	36,855,988	14,748,686
Net Present Value Compared to Base Case		14,748,686
Benefit/Cost Ratio (c)		n/a

(a) Table 6.

(b) Table 7.

(c) Not applicable because total project costs are less than total base case costs.

Sources: As noted and HNTB analysis.

APPENDIX A

Appendix A-1

Anchorage International Airport Summary of Benefit Cost Analysis: 1998-2019 Repair and Maintenance Savings Redefined as Benefits

747 Reconstruction Alternative

	Undiscounted (1997 Dollars) (a)	Discounted (b)
Incremental Benefits		
More Efficient Traffic Flows		
Aircraft	4,202,435	1,838,049
Passenger	1,947,404	842,201
Delay		
Aircraft	13,514,000	6,130,955
Passenger	7,492,000	3,371,512
Maintenance/Repair Reductions		
Major Repair	6,000,000	2,683,173
O&M	5,700,150	3,123,453
Total	38,855,988	17,989,343
Incremental Costs		
Capital	2,000,000	3,240,657
Total	2,000,000	3,240,657
Net Benefit/Cost	36,855,988	14,748,686
Net Present Value Compared to Base Case		14,748,686
Benefit/Cost Ratio (c)		5.55

(a) Table 6.

(b) Table 7.

(c) Incremental benefit divided by incremental cost.

Sources: As noted and HNTB analysis.

Appendix A-2

Anchorage International Airport Summary of Benefit Cost Analysis: 1998-2019 Assumes Funding Available for Accelerated Base Case

747 Reconstruction Alternative

	Undiscounted (1997 Dollars) (a)	Discounted (b)
Incremental Benefits		
More Efficient Traffic Flows		
Aircraft	4,202,435	1,838,049
Passenger	1,947,404	842,201
Delay		
Aircraft	11,494,000	4,366,608
Passenger	6,430,000	2,443,920
Total	24,073,838	9,490,779
Incremental Costs		
Capital	2,500,000	3,236,535
Major Repair	(6,000,000)	(2,683,173)
O&M	(5,774,650)	(3,042,761)
Total	(9,274,650)	(2,489,399)
Net Benefit/Cost	33,348,488	11,980,178
Net Present Value Compared to Base Case		11,980,178
Benefit/Cost Ratio (c)		n/a

(a) Table 6. Adjusted for accelerated resurfacing schedule.

(b) Table 7. Adjusted for accelerated resurfacing schedule.

(c) Not applicable because total project costs are less than total base case costs.

Sources: As noted and HNTB analysis.

Appendix B

Anchorage International Airport

Preliminary Air Cargo Forecast

Prepared for

Anchorage International Airport
State of Alaska DOT & PF



February 16, 1998

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Anchorage International Airport
Preliminary Air Cargo Forecast

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1.0 INTRODUCTION

The forecast of aviation demand is a key element in both the short and long term development of Anchorage International Airport. Forecasts provide a basis for determining the type, size, and timing of airside and landside facilities development and consequently influence virtually all phases of the airport planning process.

The purpose of the air cargo forecast is to evaluate the historic, existing, and projected level of air cargo activity at Anchorage International Airport in order to provide decision makers with sufficient information with which to make important resource allocation choices.

The focus of this particular effort is to provide a preliminary estimate of air cargo volumes and freighter landing over the short term five year planning horizon. Information from this effort will be expanded to include derivative forecasts on air cargo peaking and fleet mix and will be included in the air cargo/airfield master plan currently underway in as a separate effort.

The base year for this forecast will be 1996 and the forecast years will include years 1997, 1998, 1999, 2000, and 2001. Demand elements will include domestic and international enplaned and deplaned freight and mail, and freighter landings.

2.0 THE AIR CARGO INDUSTRY

Air cargo is an increasingly significant portion of the overall activity that takes place at Anchorage International Airport. In 1996, air cargo carriers accounted for approximately 70 percent of the runway landing fees assessed at the airport. Air cargo is also a significant contributor to the Alaskan economy. According to a study prepared by the Institute of Social and Economic Research at the University of Anchorage (*The Economic Contribution of the Anchorage International Airport*, October 1995) the total economic impact of international cargo services at Anchorage in 1994 was approximately 2,700 jobs and \$78 million in payroll. This figure does not take into account either the cost savings which Alaskans receive from the presence of large cargo carriers in the state, or the potential benefits that the presence of these carriers have in influencing firms to locate in Anchorage because of the access to international trade destinations that these carriers provide.

Domestic air cargo carriers provide for the timely and economical delivery of goods between the lower forty-eight, Anchorage, and interior towns and villages. Often, air is the only link for many Alaskan towns and villages to the outside world. In 1996, over 100,000 tons of mail and freight were flown within the State of Alaska by Anchorage based carriers.

2.1 INDUSTRY BACKGROUND

In its simplest form, the air cargo market is made up of freight and mail. Air mail is contracted out by the U.S. Postal Service and travels in the lower deck baggage/cargo compartments of commercial passenger aircraft and on freighters operated by contractors. Air freight refers to all cargo other than mail and passenger baggage. Air freight activity can be divided into a number of components: that conducted by the passenger airlines, the traditional all-cargo carriers, and the service oriented integrated carriers. The passenger airlines and traditional all-cargo airlines provide similar types of service, that is, inexpensive transport and little through service, although at different scales. The passenger airlines, such as Alaska Airlines and Delta Air Lines, emphasize the use of "belly space" of their scheduled passenger aircraft, while the traditional air cargo airlines, such as Northern Air Cargo, Polar Air Cargo, and American International Freight, have entire fleets dedicated to air cargo and have few limits on cargo size or type (some passenger carriers, such as Alaska Airlines, also have aircraft dedicated to hauling freight or run "combis," e.g. aircraft that are designed to carry a combination of both cargo and passengers on the main deck). In addition, both passenger carriers and the all-cargo carriers are often dependent on an established support structure of freight forwarders and consolidators located near the airport. The traditional services provided by these two types of carriers are generally oriented to the needs of large-volume shippers, such as manufacturers who ship in large quantities.

The express and small-package carriers, are relatively new to the industry and, beginning in the mid 1970s, have been responsible for the exceptional growth in the air cargo industry. These integrated carriers use their own aircraft and ground transport, and essentially provide door-to-door service for both small package and heavy freight. The express services, formally geared to the smaller shippers, such as professional associations, retailers, and individuals, who require individual attention, are also attracting large scale shippers as clients by providing a full range of logistics services. Representative of this type of service are Federal Express, UPS, Emery Worldwide, and Airborne Express.

The growth patterns of the traditional airport-to-airport carrier compared to the integrated carriers are also very different. The real growth of the traditional air freight industry started over thirty years ago; today, its market is fairly stabilized. It is generally accepted that the prospects for growth of the traditional air freight industry are limited to the growth of the overall economy and to changes in transportation costs. Typically, if the economy is in a period of expansion, the volume of shipments is expected to increase and all transportation modes will experience an increased level of activity. Conversely, in a recession, the volume of air freight will be effected downwards. The volume of freight shipped by air will also be sensitive to the shipping tariffs of other modes of transportation.

Unlike the traditional air freight industry, however, the integrated express and small-package cargo industry is still in a period of rapid expansion. This industry represents an innovation that is challenging traditional freight, and is still very much in a rapid growth phase. This is the area where most of the growth in air cargo occurred over the last few years. Most recently, air-express market trends suggest that customers of traditional air freight want express for large shipments as well as small.

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2.2 MAJOR AIR CARGO CARRIERS

Exhibit 1 lists the top 25 world air freight carriers in terms of freight ton kilometers (FTKs). Over 50 percent of the world's air freight travels in the lower deck baggage/cargo compartments of passenger airlines. Of the top 25 airlines, only seven are all-cargo carriers with two integrated all-cargo carriers placing first and fourth among all carriers on the list.

Exhibit 2.1: Top 25 Airlines in Freight Ton Kilometers (1996)

<u>Rank</u>	<u>Carrier</u>	<u>Freight Ton Kilometers</u>
1	FedEx	8,148,999
2	Lufthansa	6,448,000
3	Korean Airlines	4,991,587
4	United Parcel Service	4,892,637
5	Air France	4,659,388
6	Japan Airlines	4,170,959
7	Singapore Airlines	4,115,582
8	KLM	3,783,956
9	British Airways	3,506,787
10	Northwest Airlines	3,279,621
11	Cathay Pacific	3,230,748
12	American Airlines	2,949,200
13	Alitalia	2,758,590
14	United Airlines	2,607,296
15	China Airlines	2,388,379
16	Cargolux	2,021,000
17	EVA	1,932,718
18	Delta Air Lines	1,724,260
19	Swissair	1,634,904
20	Nippon Air Cargo	1,611,221
21	Emery Worldwide	1,409,199
22	Thai International	1,320,300
23	Polar Air Cargo	1,274,555
24	Varig International	1,248,114
25	American International	1,191,756

Source: Air Transport World

* All-cargo airlines

FedEx continues to lead all airlines in the air cargo business, followed by Lufthansa German Airlines, which operates a separate cargo division with a fleet of 17 dedicated freighters. Six of the top ten airlines, and 15 of the 25 top airlines in the world, have scheduled operations at Anchorage International Airport.

2.3 TRENDS

Following a period of relatively slow growth that corresponded to the recessionary period of 1988-1993, world air cargo traffic increased more than 12 percent. This overall growth rate slowed

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somewhat in 1995, which showed a growth rate of 7.7 percent in schedule cargo traffic, but the growth in the international cargo market exceeded its 1994 level by 22 percent. For 1996, world air freight traffic grew at 6.93 percent, while preliminary International Air Transport Association (IATA) reports indicate that international cargo traffic for 1997 has increased 11 percent. Total international air express traffic has been reported to have grown 15.7 percent from 1996 to 1997. Domestic air cargo for the first 11 months of 1997 increased 5.6 percent above the same period in 1996, while international cargo volume was ahead by 15.8 percent, according to figures released by the Air Transport Association.

According to Boeing, worldwide air cargo is expected to rise 6.7 percent per year over the next 20 years. This growth relates to an improved world economy and accelerating rates of international trade, spurred by the rapid globalization of business and the spread of free trade agreements and open skies policies. Moreover, the increasing adoption by businesses of new manufacturing practices that use just-in-time (JIT) delivery of component parts and finished products to keep inventory costs low, as well as lower rates in the air cargo industry because of increased efficiencies and excess aircraft capacities, have prompted shippers to use air transport to deliver many products with relatively low value-to-weight ratios that previously were rarely shipped by air.

The increasing preference for using air transportation as a shipment mode is related less to the value of the commodity itself, and more to the value of having it exactly when needed, so as to quickly respond to emergencies and changing customer preferences, as well as to reduce inventory and warehousing costs. The speed and reliability of air transport is particularly suited to the needs of time sensitive industries that are willing to pay a high transport cost to avoid the even higher costs and competitive disadvantages of delayed or uncertain delivery. These include the toy and apparel industries, whose products are subject to demands that are highly seasonal, capricious, and unpredictable, and the agricultural produce industry, whose perishable products have a very limited shelf-life. It also includes the manufacturing of high tech products that are customized to order and/or have very short life cycles.

Now, small package express companies such as FedEx and to some extent, UPS, have expanded into the medium and heavyweight market and are focusing on providing second and third day "time-definite" deliveries rather than overnight service. These companies are also expanding into international markets and competing with traditional freight forwarders, who control approximately 80 percent of the market, to establish direct relationships with industrial shippers.

3.0 FACTORS AFFECTING INDUSTRY GROWTH

The air cargo industry, like most industrial groups, is dependent upon population growth, gains in the economy, and growth in international trade. The volume of freight shipped by air will also be sensitive to the shipping tariffs of other modes of transportation. In addition to the primary influence of economic activity, many other factors can influence the levels of world air cargo, particularly the express and small package carriers. These factors include changing inventory management techniques, deregulation and liberalization of trade, national development programs, and a never ending stream of air-eligible commodities.

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At the local level, many of these same factors apply. However, extreme change in freight volumes at a particular airport more often results from the initiation of new carriers or services than from overall industry growth or decline.

3.1 THE ECONOMIC CLIMATE

It is generally accepted that prospects for overall growth in the traditional air freight industry are limited to the growth of the overall economy and to changes in transportation costs. Typically, if the economy is in a period of expansion, the volume of shipments is expected to increase and all transportation modes will experience an increased level of activity. Conversely, in a recession, the volume of air freight will be affected downwards. The purpose of this section is to review some key components of the world, national, Asian, and local economic indicators and growth rates.

World Economy

Globally, world economic growth has averaged less than half that of the United States. Real gross domestic product -- the output of goods and services produced by labor and property, is an important measurement of the health of the world economy. Worldwide real gross domestic product (GDP) increased at an annual rate of only 0.9 percent during the 1990s, including an absolute decline of 0.4 percent in calendar year 1991. Growth in 1993 averaged 1.2 percent while growth in 1994 measured 2.2 percent. With the exception of Eastern Europe, Venezuela, and Turkey, whose economies are still experiencing structural problems, global economic activity was relatively strong in 1996. Economic growth in the Pacific Basin averaged 7.1 percent while the economies in Latin America countries averaged 3.0 percent. Canada is in the midst of a robust expansion phase (GDP up 3.8 percent) while economic recovery appears to be taking shape in Western Europe (GDP up 2.3 percent). Until recently, Japan, recovering from its longest recession in the post-war period, lagged all other OECD countries in terms of economic growth.

The Boeing Airplane Group projects that in mature economies, it is expected that GDP growth will average between 2 percent and 3 percent per year over the next decade, then decline slightly beyond

2006 as populations age. In contrast, Boeing predicts that GDP growth in developing regions may average more than 7 percent over the long term. According to Boeing, fast-developing economies may experience several years of high growth, followed by a pause as economic and social structures adjust to new levels of income.



Source: Boeing 1997 Current Market Outlook
Exhibit 3.1

Forecasts used by the FAA expect world economic growth to greatly exceed that of the United States, increasing at an annual rate of 3.4 percent. The FAA forecast

model expects growth to be greatest in the Far East/Pacific Rim and Latin America, expanding at annual rates of 4.7 percent. The FAA predicts that economic growth in Europe/Africa/Middle East will average 2.7 percent.

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United States Economy

In the United States real gross domestic product (GDP) has increased at an average annual rate of 2.6 percent in the years 1992-1996; private industries increased 3.2 percent, and government showed minimal growth. The real gross product of all private industry groups except agriculture, forestry, and fishing increased; the increases ranged from 8.2 percent in durable goods manufacturing to 2.3 percent in finance, insurance, and real estate (FIRE).

By detailed industry, two of the four fastest growing industries were in durable goods manufacturing: Electronic and other electric equipment increased 23.8 percent, and industrial machinery and equipment increased 13.1 percent. These two industries were also two of the four fastest growing industries in 1995. The two other fast-growing industries in 1996 were transportation by air (18.4 percent) and metal mining (14.8 percent). It should be noted that industries with the highest rates of air freight usage include electronic components and accessories, plastics, computers and computing devices, laboratory and diagnostic equipment, magnetic and optical recording media, automotive equipment and parts, refrigeration and service machinery, and miscellaneous apparel and accessories. All of these industries showed above average growth in 1996.

Contributions to real GDP growth.— Growth rates alone do not indicate the extent to which industries contribute to the growth of real GDP; the contribution also depends on the industry's relative size. In 1992-96, durable goods manufacturing was the largest contributor, 0.8 percentage point, to the 2.6-percent growth in real GDP; services was the next largest, 0.5 percentage point. For 1995, durable goods manufacturing contributed 0.9 percentage point to the growth in real GDP, and services contributed 0.7 percentage point. For 1996, durable goods manufacturing and services each contributed 0.7 percentage point.

Real gross domestic product (GDP) increased 3.3 percent in the third quarter of 1997, according to the "preliminary" estimates of the national income and product accounts (NIPA's). Consumer spending and business fixed investment were the major contributors to the third-quarter increase in GDP. Government spending and residential investment increased modestly, and the change in business inventories and net exports of goods and services decreased substantially.

According to a study conducted by an economic research firm for the American Trucking Associations (ATA), the U.S. transportation industry will carry 13.2 billion tons of freight and generate \$547.7 billion in revenue by the year 2006. The study predicts that a three- to five-percent annual rise in international trade will help drive a 30-percent increase over 1996 revenues of \$420.2 billion, and a 21-percent increase over 1996 volume of 10.9 billion tons. Air freight shipments, while accounting for 1.3 percent of the freight-transportation market, will see the greatest increases due to the faster growth in the commodities that are moved by containerized and intermodal shipments over bulk commodities, such as coal, primary metal products and crude oil.

The study also projected that revenues for air freight and rail intermodal shipments will jump by 121 percent (from \$13.3 billion to \$29.4 billion) and 55 percent (\$5.6 billion to \$8.7 billion) respectively as more high-valued commodities such as electrical equipment, food products and