RESOLUTION NO. 3212, AS AMENDED

A RESOLUTION of the Port Commission of the Port of Seattle, King County, Washington, adopting a Master Plan Update for Seattle-Tacoma International Airport, approving development of a new dependent air carrier runway, authorizing certain actions relating to the new runway and other improvements in the Master Plan Update, and committing to fulfill additional noise reduction measures in accordance with Puget Sound Regional Council Resolution A-96-02.

WHEREAS, the number of passengers served by Seattle-Tacoma International Airport (STIA) increased from approximately 4.7 million in 1970 to approximately 22.8 million in 1995, an increase of 385%, and the Master Plan Update forecast prepared in 1994 projects that the number of passengers will continue to increase significantly in the future; and

WHEREAS, the number of aircraft operations and the amount of cargo tonnage at STIA increased from 150,676 operations in 1970 to 386,500 operations in 1995 and from 130,171 metric tons of cargo in 1970 to 408,200 metric tons in 1995, and the Master Plan Update Forecast prepared in 1994 projects that the number of aircraft operations and the amount of cargo tonnage will increase significantly in the future; and

WHEREAS, in the mid-1980's, the Port completed the Airport Comprehensive Planning Review & Airspace Update Study which concluded that the existing runway system at STIA would not be capable of serving efficiently the increasing demand past the year 2000, and the Federal Aviation Administration (FAA) initiated an Airport Capacity Enhancement Study which concluded that there was extensive delay primarily in poor weather conditions as a result of the close spacing of the two existing runways; and, in 1995, the FAA conducted a Capacity Enhancement Update Study which confirmed the results of the earlier capacity study; and

WHEREAS, in 1989, the Port of Seattle and the Puget Sound Council of Governments — forerunner to the Puget Sound Regional Council (PSRC) — appointed the Puget Sound Air Transportation Committee (PSATC) and initiated the Flight Plan Project to study a wide range of alternatives for resolving air traffic capacity problems in the Puget Sound area, including use of new technologies, demand management, high-speed ground transportation, development of a replacement airport, development of a multiple airport system, and expansion of STIA; and

WHEREAS, in 1992, at the conclusion of its studies and following extensive public involvement, the PSATC issued its final report, recommendations, and programmatic environmental impact statement, in which the PSATC concluded that there is a pressing need for additional airfield capacity in the Puget Sound region to meet the increasing demand for aircraft operations, and the PSATC recommended implementation of a multiple airport system including the addition of a new dependent air carrier runway at STIA located 2500 feet west of existing runway 16L/34R; and

WHEREAS, in November 1992, the Port Commission enacted Resolution 3125, As Amended, taking the following actions, among others, subject to certain conditions: (a) adopted those portions of the PSATC recommendations relating to the addition of a third runway at STIA and recommended further study of other regional solutions to address the growing air travel demand; and (b) directed Port staff to prepare studies, plans, and a site-specific environmental impact statement for constructing a third runway, and to work with the PSRC and other jurisdictions to prepare a facility plan; and

WHEREAS, in April 1993, in response to the PSATC recommendations in the Flight Plan study and additional analysis, the PSRC General Assembly adopted Resolution A-93-03, amending the

Regional Airport System Plan to authorize development of a third runway at STIA (1) unless a supplemental airport site is proven to be feasible to eliminate the need for a new runway at STIA, (2) after demand management and system management programs are achieved or proven not to be feasible, and (3) when noise reduction performance objectives are scheduled, pursued, and achieved based on independent evaluation and measurement of noise impacts; and

WHEREAS, pursuant to Resolution A-93-03, the PSRC undertook the Major Supplemental Airport Study, in which the PSRC conducted an exhaustive search for a new airport site, resulting in PSRC Executive Board Resolution EB-94-01 in which the PSRC concluded that "there are no feasible sites for a major supplemental airport within the four-county region", and affirmed the General Assembly's approval of a third runway at STIA, provided the project meets the demand management and noise conditions of Resolution A-93-03 and the environmental impact review process; and

WHEREAS, also pursuant to Resolution A-93-03, the State Secretary of Transportation appointed an independent panel of experts (PSRC Expert Panel) which conducted an extensive review of demand/system management programs and noise reduction performance, and on July 27 and December 8, 1995, the panel concluded that demand/system management would not eliminate the need for a third runway; and

WHEREAS, on March 27, 1996, the PSRC Expert Panel issued its final determination on noise reduction performance in which the panel majority found that the noise reduction was not sufficient to satisfy the noise condition imposed by Resolution A-93-03 and suggested additional noise reduction measures, and subsequently the PSRC Executive Board determined that the region should continue to support a third runway at Sea-Tac, with additional noise reduction measures based on the panel's recommendations, and following several months of deliberations and public review and comment, including the issuance of an EIS Addendum, the PSRC General Assembly on July 11, 1996 passed Resolution A-96-02 to amend the Metropolitan Transportation Plan to include a third runway with additional noise reduction measures and to amend Resolution A-93-03 accordingly; and

WHEREAS, in 1993, the Port initiated an Airport Master Plan Update, which identified and studied alternate means of meeting the following needs at the airport: (1) improve the poor weather airfield operating capacity, (2) provide sufficient runway length to accommodate warm weather operations without restricting passenger load factors or payloads, (3) provide Runway Safety Areas that meet current FAA standards, and (4) provide efficient and flexible landside facilities to accommodate future aviation demand; and

WHEREAS, in 1993, pursuant to the National Environmental Policy Act (NEPA) and the State Environmental Policy Act (SEPA), the FAA and the Port initiated preparation of a joint environmental impact statement (EIS) thoroughly analyzing the alternatives to, environmental impacts of, and possible mitigating measures for the improvements identified in the Master Plan Update; and

WHEREAS, in 1995, the FAA and the Port issued a draft EIS for Proposed Master Plan Update Development Actions, conducted two public hearings, accepted and responded to voluminous written and oral comments, conducted additional studies and prepared project revisions in response to public comments, and on February 9, 1996, issued a final EIS; and

WHEREAS, the Commission has considered the potential environmental impacts and mitigating measures discussed in the EIS, and has weighed this information with other relevant considerations including the need for improved air transportation facilities to meet growing demand and reduce poor weather air traffic delay, all as described more fully in Attachment A to this resolution; and

WHEREAS, the Port has been a national leader in efforts to reduce noise impacts on residents surrounding the airport, including the Sea-Tac Communities Plan, the Part 150 Noise Compatibility Plans, and the innovative Noise Mediation Project, which have resulted in a series of measures expected to reduce aircraft noise by at least half by the year 2001; and

WHEREAS, there has been extensive public involvement in the decision-making process including, but not limited to, multiple public hearings conducted by the Puget Sound Air Transportation Committee in locations throughout the Puget Sound Region, the acceptance and review of extensive written comments on the draft Flight Plan EIS, review and public consideration by the Puget Sound Regional Council which consists of elected officials from throughout the Region, two public scoping meetings and two public hearings conducted by the FAA and the Port regarding the Master Plan Update Draft EIS, acceptance and review of extensive written comments on the Master Plan Update Draft EIS, and the Port's acceptance and consideration of public comments on draft Resolution 3212, As Amended.

NOW, THEREFORE, BE IT RESOLVED by the Port of Seattle Commission as follows:

Section 1. The Commission finds that the EIS for Proposed Master Plan Update Development Actions (including the PSRC-issued EIS Addendum) is adequate and meets the requirements of the State Environmental Policy Act, Ch. 43.21C RCW.

Section 2. The Commission hereby adopts the Airport Master Plan Update for Seattle-Tacoma International Airport as set forth in Master Plan Update Technical Reports No. 1-8, dated at various times from 1993 to 1996, copies of which are included as Attachment B to this resolution. The Commission also adopts the 1996 Airport Layout Plan (ALP), which consists of a set of drawings, copies of which are included as Attachment C to this resolution. The ALP shall be submitted to the Federal Aviation Administration (FAA) for review and approval.

Section 3. In accordance with the Master Plan Update, the Commission hereby grants approval for the development of a new 8500-foot dependent air carrier runway with its centerline located no further than 2500 feet west of the centerline of runway 16L/34R and development of taxiways, navigational aids, and other associated facilities (the "new runway") subject to future determinations following review of financing plans, final engineering plans, mitigation measures specified in cooperation with permitting agencies, and other relevant information including a review of fill transport options which minimize impacts to the local communities. The Executive Director and the Director, Aviation Division, are each authorized to take necessary and appropriate actions, within authorized budget limits, including but not limited to retaining professional services, preparing plans and specifications, accepting grants, advertising for bids, and executing contracts, for the following Phase I actions relating to the new runway:

a. Preparation of a detailed financing plan for construction of the new runway for the Commission's consideration, including federal grant funds, debt financing, and other appropriate funding sources.

b. Preparation of the final engineering design for the new runway within authorized budget limits.

c. Development and implementation of a program for the acquisition of necessary property interests for the new runway. The areas of acquisition are depicted in the ALP drawings at Attachment C. The Manager of Noise Remedy is authorized to retain one full-time-equivalent employee to oversee the acquisition program.

d. Acquisition of free or low-cost fill material and preparation of sites on existing airport property to place such fill.

e. Preparation of plans for and implementation of the mitigating measures included in Attachment D to this resolution.

f. Application for and processing of all necessary permits, approvals, and right-of-way vacations for construction of the new runway, including those necessary for the mitigation measures in Attachment D.

g. Execution of a reimbursable agreement with the FAA with regard to airfield improvements including relocation of navigational aids.

h. Continue to work with the FAA and other industry representatives on potential technological advances that could enhance the benefits of providing additional airfield capacity at Seattle-Tacoma International Airport.

Section 4. In accordance with PSRC Resolution A-96-02, the Port Commission hereby agrees to undertake the additional noise reduction measures called for by the PSRC which are listed in "Section I: The Port of Seattle" of Appendix G to the Metropolitan Transportation Plan (included as Attachment E to this Commission Resolution). Further, in accordance with "Section V: Monitoring Compliance" of Appendix G to the Metropolitan Transportation Plan, the Port commits to report to the PSRC twice yearly on progress toward the additional noise reduction measures. In addition, the Commission strongly endorses the Puget Sound Regional Council's commitment, as set forth in Appendix G, Section III, Item I of the Metropolitan Transportation Plan, to develop options to provide for the region's long range air capacity needs beyond those provided by improvements to Sea-Tac International Airport.

Section 5. The Executive Director and the Director, Aviation Division, are each authorized, within authorized budget limits, to retain professional services and prepare and implement an air quality monitoring plan to measure existing air pollutant conditions in the airport area, as recommended in Section IV.9 of the Final EIS for Proposed Master Plan Update Development Actions.

Section 6. The Executive Director, the Director, Aviation Division, or the Port SEPA responsible official, as appropriate, shall: (a) continue to monitor the volume of airport activity, new aviation activity forecasts, and new information regarding potential and actual environmental impacts of airport development; (b) conduct any additional environmental review pursuant to SEPA as deemed necessary in light of new information; and (c) recommend to the Port Commission any new mitigation measures, or revisions to ongoing mitigation measures, as deemed necessary to address the impacts of development contemplated in the Airport Master Plan Update.

Section 7. The Executive Director or the Director, Aviation Division, shall recommend actions to the Commission regarding improvements contemplated in the Master Plan Update in addition to the new runway as demand for these other facilities warrants.

Section 8. The adoption of this resolution constitutes a "final decision" by the Port of Seattle for purposes of appeal of the Port's compliance with SEPA, Ch. 43.21C RCW. Notice of the adoption of this resolution shall be provided in the manner specified in the Port's SEPA Appeal Resolution No. 3211. Any appeal must be brought within the time and in the manner specified in the Port's SEPA Resolution No. 3211.

Section 9. If any provision of this resolution is held invalid, the remainder of this resolution remains in effect.

ADOPTED by the Port Commission of the Port of Seattle this 1st day of August, 1996, and duly authenticated

in open session by the signatures of the Commissioners voting in favor thereof and the seal of the Commission duly affixed.

PAIGE MILLER

GARY GRANT

PAUL SCHELL

PATRICIA DAVIS

Port Commission

ATTACHMENT A TO PORT RESOLUTION 3212, AS AMENDED

Summary of Port's Decisionmaking Relating to Adoption of Sea-Tac International Airport Master Plan Update and Development of a New Dependent Air Carrier Runway

The purpose of this document is to summarize (i) the region's air transportation facility shortage as it currently exists and as forecast for the future; (ii) the extensive public process followed by the Port of Seattle and other governmental agencies in addressing the region's air transportation facility shortage; (iii) the comprehensive analysis of a wide range of alternative courses of action; (iv) the potential environmental impacts and mitigating measures relating to the Sea-Tac Airport Master Plan Update development actions including the new runway; and (v) the balancing judgment made by the Port Commission in adopting the Sea-Tac Airport Master Plan Update and authorizing the new runway.

1. **Air travel demand, increasing delay, and needed airport improvements**

Air travel demand growth

The rate of air passenger growth at Sea-Tac International Airport has outpaced the national rate over the last four decades. In the last five years, the number of Sea-Tac passengers has grown at nearly triple the rate of the U.S. as a whole (4.6% vs. 1.7%). In 1995, the Airport served a record 22.8 million annual passengers - double the level of ten years ago. 38.2 million annual passengers are forecast for the year 2020. Cargo volumes have also been increasing, especially in the international markets. 408,000 metric tons of cargo were accommodated in 1995. 880,000 metric tons per year are projected in 2020. In response to the growing passenger and cargo demands, aircraft operations have also been increasing. 1995 was a record year for annual operations, reaching 386,500. About 442,000 annual operations are projected for 2020. A summary of the Airport Master Plan Update forecasts is shown in the Table below.

Airport Master Plan Update Demand Forecasts

	1993 (Base year actual)	1995 (actual)	2000	2010	2020
Air Passengers (millions)	18.8	22.8	23.8	30.6	38.2
Aircraft Operations (thousands)	339.5	386.5*	379.2	405.8	441.6
Air Cargo (thousand metric tons)	381	408	510	680	880

* *Exceeded year 2000 forecast*

Growth at Sea-Tac is being driven by strong regional population and economic growth, along with our region's increasing reliance on air travel. The Puget Sound Region's population nearly doubled between 1960 and 1990 and 1 million more people are projected to live here by the year 2020.

Existing poor weather delay problem and third runway

The close spacing - 800' - between Sea-Tac's existing two parallel runways does not allow for two arrival streams whenever cloud ceilings drop below 5,000' or whenever visibility is reduced below 5 miles. These conditions - which occur about 44% of the year - reduce the total number of arrivals that can be accommodated from 60 per hour to as low as 24, resulting in inefficient operations and aircraft delay. This situation is anticipated to become increasingly severe as air traffic increases. Because pilots cannot maintain visual separation in these conditions, Federal Aviation Administration (FAA) air traffic control rules require at least 2,500' between parallel runways for two staggered (dependent) arrival streams in such "poor weather." Over 85% of total Sea-Tac delays are during arrival.

While Sea-Tac currently has sufficient operating capability during good weather conditions, the existing runway system produces extensive arrival delays during poor weather. For instance, when weather worsens from VFR1 to VFR2, average arrival delay increases more than ten-fold (from 1.0 minutes to 11.4 minutes). Delays further worsen when IFR1/2/3 conditions occur. In these cases, arrival delay increases more than twenty-fold over VFR1 (21.7 minutes vs. 1.0 minutes). Because these figures are averages, some flights experience less delay, while others experience substantially higher delay. (In the National Plan of Integrated Airport Systems, the FAA concluded that when average annual delays exceed 9 minutes an airport is experiencing severe delay.) Using average aircraft operating costs developed by the FAA from U.S. Department of Transportation records, Sea-Tac aircraft delays cost the airlines about $42 million annually under 1992 demand. When annual aircraft operations reach 425,000 (forecast for 2015), delay costs are anticipated to exceed $176 million annually if a new runway is not added.

Sea-Tac Weather Categories, Arrival Acceptance Rates, and Average Arrival Delay

Weather condition	Maximum arrivals	1993 average arrival delay (min)	% of occurrence
Good weather			
VFR1	60	1.0	56.1%
Poor weather			
VFR2	48	11.4	19.7%
IFR1	36	21.7	17.0%
IFR2/3	24	21.7	7.2%

Without additional airfield capacity, by 2015 average VFR2 arrival delays will exceed 40 minutes, IFR1 arrival delays will exceed 70 minutes, and IFR2/3 arrival delays will exceed one hour and forty minutes, based on the forecast demand.

A new runway separated by 2,500 feet from the existing east runway (16L/34R) would permit staggered dual stream arrivals in poor weather conditions. It would decrease average arrival delays in 2015 by about 80% over doing nothing - resulting in aircraft delay savings estimated at $132 million annually under year 2015 projected demand.

Other airfield and landside improvements

In addition to the proposed new runway, the Airport Master Plan Update recommends a range of other airfield improvements including, but not limited to, upgrading the existing runway safety areas (RSAs) to meet current FAA standards; developing dual parallel taxiways the full length of the east runway (16L/34R) to facilitate on-ground movement of aircraft; and lengthening of the east runway by 600' to accommodate the heaviest aircraft serving long-haul routes from Sea-Tac.

The Airport Master Plan Update also anticipates a range of landside improvements needed by the year 2020 to meet the growing air travel demand. These include approximately 25 additional aircraft gates (100 total); an additional 1 - 1.5 million square feet of new terminal area beyond the existing 2 million square feet; additional terminal curb space; and approximately 5,400 additional parking spaces (14,850 total). A range of potential improvements to the access roadways have also been identified, including development of the proposed SR 509 extension/South Access Roadway in conjunction with local and state agencies.

Other landside improvements envisioned in the Master Plan Update include, but are not limited to, redevelopment of the existing cargo area on the northeast portion of the airfield to improve its efficiency and capacity; eventual development of the South Aviation Support Area (SASA) for a mix of air cargo, aircraft maintenance, and other potential aviation uses; addition of the proposed on-airport hotel; and FAA development of a new air traffic control tower.

2. **Extensive studies and public process to address air transportation capacity issues**

The Port Commission's decision to adopt the Sea-Tac Airport Master Plan Update and authorize development of a new runway at Sea-Tac Airport is based on more than ten years of extensive air transportation planning conducted by the Port, the Puget Sound Regional Council (PSRC), Washington State, and the Federal Aviation Administration (FAA).

In 1984, the Port began a significant period of airport planning activity which culminated in the Commission's adoption of Resolution 3212, As Amended, and the Master Plan Update. The last Sea-Tac Airport Master Plan was completed in 1985 and many of the Plan's recommendations were implemented through the 1980's and early 1990's.

In light of rapid air travel growth at Sea-Tac, the Port completed the Comprehensive Planning Review & Airspace Update Study in 1988 to assess the validity of previous plans for the Airport. A major finding of the study was that actual growth surpassed that predicted in previous plans and that the existing runway system would not be capable of efficiently serving increased demand beyond the year 2000. At the same time, the Puget Sound Council of Governments (PSCOG, now Puget Sound Regional Council -- PSRC) was preparing the Regional Airport System Plan (RASP) element of the Metropolitan Transportation Plan, which also concluded that the existing Sea-Tac airfield would not be adequate to meet regional air travel needs past 2000.

Flight Plan Study and EIS

As a result of the Comprehensive Planning Review and the RASP, the Port and the PSCOG entered into an interlocal agreement to co-sponsor a process to identify a long-term solution to the Region's air transportation needs, with support from the Federal Aviation Administration (FAA). A 39-member panel with representatives from cities and counties throughout the Region, aviation industry experts, citizens, and the State - known as the Puget Sound Air Transportation Committee (PSATC) - was assembled and conducted the three-year long Flight Plan Study. The purpose of Flight Plan was to develop a regional solution that would meet the Region's commercial air travel needs to the year 2020 and beyond. The PSATC conducted a thorough review of a wide range of options including replacement airports, supplemental airports, new navigational technologies, demand management, and high-speed rail. The PSATC, Port and PSRC prepared, and issued for public review and comment, a programmatic environmental impact statement (EIS) examining the potential environmental impacts of the studied alternatives. Thousands of pages of written comments were received on the Flight Plan EIS, which were reviewed and responded to in the Final EIS. During its study process, the PSATC conducted a series of public hearings at locations throughout the Puget Sound Region. These hearings were well-attended and extensively covered by the local media. Following its deliberations, the PSATC recommended a multiple airport system that included a new air carrier runway at Sea-Tac Airport.

Concurrent with the Flight Plan Study, the FAA prepared the initial Sea-Tac Airport Capacity Enhancement Plan which examined in detail the existing poor weather capacity shortfall at Sea-Tac and estimated the delay savings benefits of a range of potential improvements, including a new runway.

As a result of Flight Plan, in November 1992, the Port of Seattle Commission adopted Resolution No. 3125, As Amended, which adopted the PSATC recommendations pertaining to adding a dependent air carrier runway at Sea-Tac Airport and directed Port staff to undertake the necessary detailed studies and a project-specific environmental impact statement (EIS).

The City of Federal Way filed an administrative appeal challenging the adequacy of the programmatic Flight Plan EIS that had been prepared

jointly by the PSRC and the Port. Following extensive review of this issue, an independent hearing examiner of the PSRC determined that the EIS was adequate. Also during this time, the Airport Communities Coalition (Cities of Burien, Des Moines, Normandy Park, and Tukwila), filed a lawsuit against the Port challenging the adequacy of the Flight Plan EIS. The ACC eventually withdrew this suit.

Master Plan Update and EIS

In order to fulfill the directions of Port Commission Resolution No. 3125, As Amended, a comprehensive update to the Sea-Tac Airport Master Plan was undertaken to evaluate the long-term facility needs at the Airport and to develop an array of possible improvements for efficiently meeting forecast regional air travel demand to the year 2020. The Master Plan Update built on planning work undertaken at the Airport during the previous several years and sought to balance the capacity of the airfield, terminal, roadways, and parking facilities and to maintain an efficient level of service for the growing passenger and operational demands.

To evaluate the potential environmental impacts and mitigation measures for proposed airport improvements -including a new runway - the FAA and the Port entered into a memorandum of understanding (MOU) to serve as joint-lead agencies for preparing an environmental impact statement (EIS) on the Airport Master Plan Update. The FAA and Port conducted two public meetings to solicit comments on the proposed scope of the Master Plan Update EIS -- one for interested public agencies including the cities surrounding the airport, and the other for any other members of the public. Following review of the extensive written and oral comments, the FAA and Port agreed on the EIS scope and prepared and issued a Draft EIS.

The EIS focused on the potential environmental impacts and mitigation measures of three Sea-Tac improvement alternatives and the "do nothing" option. Each of the three improvement alternatives include construction of a new parallel runway with a length up to 8,500' and development of a range of landside support facilities in either the central terminal area or through the addition of either a north unit terminal or south unit terminal. The Master Plan Update recommended development of a new two-concourse terminal building north of the existing terminal, including approximately 20-25 new gates and new parking facilities (the North Unit Terminal Option).

The FAA and Port conducted two public hearings on the Draft Master Plan Update EIS and solicited public comment on the EIS and the proposed Master Plan Update. The hearings were well-attended and extensively covered by the local media. Again, thousands of pages of written comments were received, and the FAA and Port reviewed and responded to the comments in the Final EIS that was issued in February 1996.

PSRC-mandated studies of alternative airport sites, demand/system management, and noise mitigation

Also in response to Flight Plan, the PSRC undertook a six-month review and decision process of the PSATC recommendations which culminated in adoption of PSRC Resolution A-93-03 in April 1993. The Resolution stated "That the region should pursue vigorously, as the preferred alternative, a major supplemental airport and a third runway at Sea-Tac." Over the course of a year, the PSRC conducted an exhaustive evaluation and public review of twenty-six existing and potential new airport sites and concluded in October 1994 that a supplemental airport was not feasible. In so doing, the PSRC Executive Board in Resolution EB-94-01 affirmed PSRC approval of a new runway at Sea-Tac and concluded that it would provide adequate capacity for the region through the year 2030. Also as part of the direction established in PSRC Resolution A-93-03, the PSRC established an independent three-member panel of experts from outside the region to determine whether the Port's noise reduction goals are being met and whether demand/system management measures could defer the need for the proposed new runway. After more than a year of review, the PSRC Expert Panel determined in a series of written orders that demand/system management measures are not feasible for deferring the need for the proposed runway and that this condition of PSRC Resolution A-93-03 had been fully satisfied.

On March 27, 1996, the PSRC Expert Panel issued its Final Decision on Noise Issues. The panel was unanimous in finding that the Port was substantially in compliance with the Airport Noise Mediation Agreement and its goals. Two of the three panelists, however, concluded that "Although the Port of Seattle has scheduled, pursued, and achieved an impressive array of noise abatement and mitigation programs," the noise reduction achieved was not sufficient to satisfy the noise condition imposed by Resolution A-93-03. Included in the Final Decision document, the panel offered a number of recommendations for potential additional noise reduction measures that if implemented, may have resulted in an affirmative panel decision. Based on the continuing regional need for additional airport capacity, the PSRC Executive Board determined that the region should continue to support a third runway at Sea-Tac, with additional noise reduction measures based on the panel's recommendations. PSRC requested and received input on the panel's recommendations from the Airport Communities Coalition, the FAA, the Port, other affected agencies, and citizens. As a result, PSRC prepared and circulated for further public review a draft list of noise reduction measures and monitoring steps that would be included as part of PSRC approval for the third runway. Following further deliberations and public comment, the PSRC General Assembly on July 11, 1996 voted 84% in favor to adopt Resolution A-96-02, which amended the Metropolitan Transportation Plan to include a third runway with additional noise reduction measures, and amended Resolution A-93-03 accordingly.

In 1990, the Washington State Legislature created the Air Transportation Commission (AIRTRAC) to recommend statewide air transportation policies. The Commission's recommendations noted that

Sea-Tac was approaching its airfield capacity and called for the state to ensure that capacity at airports throughout the state is preserved and that new capacity needs are addressed.

3. Alternatives considered

Flight Plan Study

Numerous alternatives for meeting the Region's future air travel needs have been evaluated in a range of studies. The previously discussed Puget Sound Regional Council/Port of Seattle "Flight Plan Study" evaluated the following nine system alternatives:

- No action
- Limited expansion of Sea-Tac Airport
- Expansion of Sea-Tac Airport, including a new air carrier length runway
- Closure of Sea-Tac and development of a replacement airport
- Multiple airport system involving Sea-Tac and one or more smaller supplemental airports
- A single remote airport to be functionally linked to Sea-Tac
- Demand management measures
- New air navigation and airplane technologies
- High-speed ground transportation

These system alternatives were evaluated based on a series of criteria which included: 1) airspace and the presence of conflicts with other airports or terrain; 2) operational capacity; 3) accessibility to the Region's residents; 4) economic impacts; and 5) implementation feasibility. The screening process resulted in a recommendation for further study of: a multiple airport system including the addition of a third runway at Sea-Tac; a replacement airport; use of Boeing Field as a close-in remote airport; and continued use of Sea-Tac in conjunction with demand management, new technologies, and alternate modes of transportation. The alternatives recommended for further study were evaluated in detail in terms of technical/operational, economic/financial, institutional, and environmental criteria. Several technical reports and a programmatic level Environmental Impact Statement (EIS) were prepared, and a total of thirty-five options were studied within these five system alternatives. An extensive search was conducted of potential sites for a replacement or supplemental airport, and detailed study was conducted of the most promising sites. The sites that were studied in detail included Boeing Field, Paine Field, Arlington Airport, McChord Air Force Base, and potential new sites in central Pierce County and in the Black Lake area of Thurston County. (Earlier in the study process, other airports and sites were considered and rejected, including Auburn, Bellingham, Bremerton, Moses Lake, Olympia, Port Angeles, Renton, Skagit/Bayview, and Tacoma Narrows.) Based on this analysis and public review of the alternatives, the Flight Plan Study recommended implementation of a multiple airport system which included a third air carrier-length runway at Sea-Tac Airport.

The Sea-Tac Airport Master Plan Update and EIS were designed to address the range of issues related to developing a new runway that were beyond the scope of the Flight Plan Project. This included a detailed analysis of the range of potential lengths and separations for a new runway. The Master Plan Update evaluated the operational benefits of the following eight airfield options:

- Do nothing
- 5,200' runway separated by 1,500' from the existing east runway
- 5,200' runway separated by 2,500' from the east runway
- 7,000' runway separated by 2,500'
- 7,000' runway separated by 2,500' and staggered 1,435' on the north end
- 7,500' runway separated by 2,500' and staggered 935' on the north end
- 8,500' runway separated by 2,500'
- 8,500' runway separated by 3,300'

A new runway separated less than 2,500 feet from the existing east runway would not permit dual poor weather arrival streams and thereby would not significantly reduce delay. Options separated by 2,500' would permit dual staggered arrivals, with the types of aircraft able to use the runway dependent on its length. A 5,200' runway could only accommodate about 31% of the year 2020 Sea-Tac fleet. A 7,000', 7,500', or 8,500' runway at 2,500' separation would be sufficiently long to accommodate between 91- 99% (depending on its length) of aircraft using Sea-Tac in 2020 and would provide substantial delay savings benefits. A new runway separated 3,300' from the east runway with the use of fast-radar (precision runway monitor) could potentially allow for independent dual simultaneous (non-staggered) arrival streams during poor weather, but would not produce substantially more delay savings benefits through the year 2020 planning horizon than would a runway separated by 2,500'. In addition, a 3,300' separation would have greatly increased environmental impacts and construction costs. Based on these findings, the Master Plan and EIS evaluated new runway options separated by 2,500' from the east runway with lengths of 7,000', 7,500', and 8,500'.

In addition to the new Sea-Tac runway alternatives, the Airport Master Plan Update EIS considered a range of other alternatives including a supplemental airport; other transportation modes such as bus or rail; airport demand management; new navigational technologies; improvements at Sea-Tac; and doing nothing.

4. Potential environmental impacts of the Master Plan development actions including the new runway

The following is a summary of the potential environmental impacts and mitigating measures relating to the development actions included in the Master Plan Update and discussed in the Master Plan Update EIS.

Noise and land use

The percentage of people, housing units, and area affected by sound levels of DNL 65 and greater is expected to decline in the future in comparison to current and past noise exposure, regardless of future development at Sea-Tac Airport. This decline in impacts is expected due to the Port's noise reduction program and the Federal mandate to phase-out Stage 2 aircraft no later than the year 2000.

Aircraft Noise
(DNL 65 and Greater)

	Population	Housing	Sq. Mi.
1994	31,800	13,620	9.31
2000			
Altern. 1	8,970	3,870	3.40
Altern. 2	9,890	4,020	2.87
Altern. 3	9,890	4,020	2.86
Altern. 4	9,890	4,020	2.86
2010			
Altern. 1	9,450	4,060	3.54
Altern. 2	9,870	4,190	2.97
Altern. 3	9,860	4,190	2.98
Altern. 4	9,860	4,190	2.98
2020			
Altern. 1	10,800	4,610	3.97
Altern. 2	11,270	4,760	3.31
Altern. 3	11,240	4,740	3.34
Altern. 4	11,270	4,760	3.34

Note:
Alternative 1 = Do-Nothing,
Alternative 2 = Central Unit Terminal w/ 8,500 ft runway
Alternative 3 = North Unit Terminal w/ 8,500 ft runway
Alternative 4 = South Unit Terminal w/ 8,500 ft runway
Area is non-airport land.

The development of a new parallel runway would be expected to increase dwelling unit impacts 6.1 percent over the Do-Nothing/No-Build alternative.

While this analysis has focused on the areas exposed to DNL 65 and greater sound levels, the EIS also presented the impacts associated with DNL 60. For residents that are disturbed by noise less than DNL 65, these impacts could continue and change slightly. As is shown by the assessment of noise impacts caused by aircraft flying at altitudes between 3,000 feet and 18,000 feet, these impacts are not expected to be significant.

The Port of Seattle has a long standing noise abatement program that has lead the aviation industry in mitigating aircraft noise and land use conflicts. As a result, no additional noise abatement techniques

are mandated to minimize noise impacts that could result from a proposed new parallel runway. Through the implementation of the Noise Remedy Program, the Port of Seattle has conducted an extensive noise and land use compatibility effort. A notable portion of the existing and future noise exposed area has been subject to sound insulation and, for the more severely noise affected areas, acquired and relocated. To facilitate continued noise reduction, the noise and land use mitigation programs now in effect should continue to be implemented.

- Noise Budget — The goal of the Noise Budget of an all Stage 3 fleet is anticipated to be reached by the year 2001.

- Nighttime Limitations Program — limiting the hours of operation for Stage 2 aircraft.

- Ground Noise Control — reducing the noise of ground events such as powerback operations, run-ups, and reverse thrust on landing.

- Flight Corridorization — maintenance of runway heading flight tracks by departing jets until reaching altitudes above 4,000 feet.

- Flight Track and Noise Monitoring — maintenance of noise level records and flight track location information for identification of deviations and communication with the public and users.

The Final Environmental Impact Statement summarizes the land use compatibility of the proposed Master Plan Update improvements with the current or proposed comprehensive plans of the City of SeaTac, Des Moines, Normandy Park, Burien and Tukwila. In addition, the King County Comprehensive Plan and Countywide Planning Policies and Puget Sound Region Plan (Vision 2020) are discussed. The proposed improvements are consistent with the plans and policies of the Puget Sound Region as well as those of King County. Sea-Tac Airport lies wholly within the City of SeaTac, with the exception of a portion of property in Des Moines that was acquired for noise mitigation. The construction of the proposed new parallel runway and other elements of the Master Plan Update improvements will be conducted almost entirely in the City of SeaTac. The extent to which the comprehensive plan policies in the City of SeaTac would govern the Master Plan Update improvements is currently the subject of an interlocal process between the Port and City of SeaTac.

Several land use mitigation strategies will be undertaken:

Mitigate significant noise impacts. The following five noise sensitive facilities would experience significant increased noise impacts (i.e. an increase of 1.5 DNL or more) in the year 2020 in comparison to the Do-Nothing:

- Sea-Tac Occupational Skills Center;

- Woodside Elementary;

- Sunny Terrace Elementary;

- Brunelle Residence;

- Bryan House.

The Port will coordinate with the owners of these properties and sound insulate the noise sensitive uses subject to FAA sound insulation guidelines.

Provide directional soundproofing. Residences that were insulated prior to 1992 may need additional directional soundproofing to mitigate noise generated from new flight paths from the operation of the new runway. Many residences evaluated for noise impacts prior to 1992 were not evaluated to consider the additional noise impacts that the proposed runway would generate. The Port of Seattle estimates that some 60 to 70 houses were evaluated and/or insulated prior to 1992. The Port will audit these facilities, and subject to FAA sound insulation criteria, sound insulate the remaining portions of the home that do not achieve the applicable noise level reduction guidelines.

Acquire properties in the approach transitional area. In recognition of the fact that the standard Runway Protection Zone (RPZ) dimensions do not always provide sufficient noise and safety buffer to the satisfaction of nearby residents, the FAA will cost-participate with airport operators to acquire "up to 1,250 feet laterally from the runway centerline, and extending 5,000 feet beyond each end of the primary surface. The FAA Memorandum provides funding eligibility for a box up to 5,000 feet long and 2,500 feet wide, centered on the runway and beginning 200 feet from the physical end of the runway. Based on the configuration of current airport land, local streets, and residential development patterns, the approach and transitional area selected for use as a mitigation area includes the standard Runway Protection Zone (RPZ) and a rectangular extension of the RPZ outward another 2,500 feet. In the northern approach and transitional area, 82 single-family residential parcels, 2 apartment buildings (with 28 units), and 2 mobile home parks, with 96 units, could be acquired. To the south, 71 single-family residential parcels and 6 apartment buildings (with 32 units) could be acquired. Only residential properties in the approach and transitional area would be considered for acquisition — commercial land uses, which make up most of the area to the south, would not be acquired and would remain in place on both runway ends. Based on the current assessed value of these 309 residential homes and multi-family buildings located in the approach and transitional area, it is estimated that the cost of acquisition and relocation would be approximately $35 million.

As the probable impact of low flying aircraft would not be experienced until the opening of the proposed new parallel runway, this option will receive further consideration during the forthcoming Sea-Tac Airport FAR Part 150 Update, which the Port anticipates beginning in 1996. It is anticipated that during the Part 150 Update, the Port would further explore this action with the specific residents within the Approach Transition Area, and, if the residents so desire, establish a program including relocation objectives, timing and funding priorities.

Social impacts

The Master Plan Update alternatives were evaluated for their impact on adjacent residential communities and businesses. Social impacts considered in this section include the following: residential and business displacement, and disruption of existing communities and planned development.

The following number of properties could be acquired under the "With Project" alternatives to complete construction, to clear the runway protection zones (RPZs), and to mitigate adverse environmental impacts:

	Number to be Acquired		
8,500-ft Dependent	Single Family	Condos/ Apartments	Businesses
Runway related:			
Alternative 1	0	0	0
Alt. 2, 3, & 4	388	260	105
Non-Runway related:			
Alternative 1	3	0	0
Alternative 2 & 3	3	0	0
Alternative 4	3	0	12

It does not appear that any minority, age or income group would be disproportionately affected by the proposed Master Plan Update improvements.

Human health impacts

The EIS assesses the human health related issues associated with:

- noise
- air quality
- water quality
- radio transmissions and light emissions
- aircraft incidents/accidents.

The Airport's current environmental conditions have the potential to affect human health, although that potential is difficult to assess and characterize because many research studies indicate conflicting reports of human health impacts.

In general, adverse environmental impacts are expected to decrease in the future as improved technology results in lower air, noise, and water pollutant emissions. The proposed Master Plan Update alternatives are expected to increase noise and stormwater flows slightly over the Do-Nothing alternative. However, the impacts of the future "With Project" alternatives are expected to be less than the current conditions.

Induced socio-economic impacts

As a major passenger and cargo transportation facility, Sea-Tac Airport directly and indirectly contributes to the economic structure of the Puget Sound Region. Induced socio-economic benefits are generated in the Region by changes in employment opportunities, payroll generation, business expenditures for goods and services, and tax revenues.

Airport Activity Related Impacts*
Alternative 1, 2, 3, and 4

	1993	2010	2020
Total Jobs	205,690	335,344	418,632
Personal Income (Millions)	2,585.6	4,215.4	5,262.4
Earnings/Dir Jobs	15,910	25,938.7	32,380.9
Business Revenue (Millions)	6,355.7	10,361.9	12,935.5
State & Local Taxes (Millions)	406.6	662.9	827.9

* includes airport-generated and visitor industry impacts

All of the Master Plan Update alternatives would create jobs in construction. Construction-related jobs would number approximately 8,200 for the Do-Nothing (Alternative 1) and about 45,500 for the "With Project" alternatives.

The activity-related, induced socio-economic impacts would be the same for all Master Plan Update alternatives. However, the acquisition effects would differ. The following table summarizes the impacts of the "With Project" alternatives compared to the Do-Nothing (Alternative 1):

	Impacts Due to:		
	Alt 2	Alt 3	Alt 4
Annual Loss in Property Tax (Thousands)	$227.5	$227.5	$291.9
Annual Lost Taxable Sales Transactions (Millions)	$2.2	$2.2	$15.6
Jobs Displaced	627	627	822

Impacts are less if displaced businesses relocated within the area. Assumes the 8,500 ft new dependent parallel runway and that commercial property in the RPZ is acquired.

A new 8,500 foot parallel runway would displace businesses and numerous residences through property acquisitions, reducing the existing property and sales tax revenue and employment. The property tax and sales impacts to an individual community are less than five percent. This would occur primarily in the City of SeaTac and, to a lesser extent, in the City of Burien.

Reductions in tax revenues should be offset long term by positive net gains in future tax receipts as property is more intensely developed in the Airport vicinity. Local sales tax revenues will be generated by people directly employed at Sea-Tac Airport and by airport activity (e.g., taxable spending on goods and services by people employed at the Airport, air cargo businesses, hotel and commercial uses).

Air quality

The majority of the pollutant emissions in the Puget Sound Region — 75 percent — is generated by motor vehicles (i.e., cars, trucks, buses, taxis, motorcycles). Aircraft operating at Sea-Tac contribute less than one percent of the carbon monoxide emissions, nitrogen oxides, and volatile organic compounds for all mobile sources within the Puget Sound Region. Whether a new runway is built or not, air pollutant emissions from roadway vehicles and aircraft would be expected to increase in the Region as population increases.

In assessing air pollutant impacts, the FAA and Port are required to show that the proposed improvements will conform to the State Implementation Plan's (SIP) purpose of eliminating or reducing the severity and number of violations of the ambient air quality standards and achieving expeditious attainment of such standards. To do so, two types of analysis were performed: an inventory of emissions and an assessment of air pollutant concentrations at various locations (hot spot evaluation).

The inventory of air pollutant emissions was prepared and then contrasted with the SIP. The SIP assessed aircraft emissions of carbon monoxide, nitrogen oxides and volatile organic compounds. The EIS analysis, using peak departure levels and peak total operations levels, showed that air pollutant emissions would be less than the 1990 SIP regardless of undertaking improvements at Sea-Tac Airport.

Two forms of hot spot evaluations were performed: airport perimeter locations and roadway intersection locations. The airport perimeter evaluation showed that the proposed improvements would reduce pollutant concentrations at most locations. At locations where the proposed improvements would increase concentrations, the levels would be well below the National and State Ambient Air Quality Standards.

Because surface transportation emissions are the greatest source of air pollution, an intersection hot spot analysis was performed at the more severely congested roads in the immediate airport area. This analysis showed that today, exceedances of the national ambient air quality standards exist at intersections along International Boulevard (SR 99). The proposed landside improvements included in the "With

Project" alternatives — improved terminal facilities and public and employee parking — would result in changing vehicular traffic movement and patterns in the immediate airport area. The proposed improvements were found to increase pollutant concentrations at the International Boulevard intersections at South 170th Street and South 160th Street. However, pollutant level increases could be mitigated.

The analysis performed for the EIS was a worst case evaluation and actual pollution levels may not be as great as the evaluation indicated. Thus, the Port will conduct an air monitoring program at two roadway intersections to determine if such exceedances would indeed occur. If such exceedances are found, the Port will consider appropriate actions such as those identified below in cooperation with other agencies and entities.

- Mitigation for International Blvd. and South 170th Street — the construction of an additional northbound left-turn lane (2 total); the construction of high capacity right-turn lanes in the southbound and eastbound directions; and the construction of a westbound right-turn lane. Also, consideration could be given to construction of an additional lane along International Boulevard (SR 99) by 2020.

- Mitigation for International Blvd. and South 160th Street — adding an additional southbound left-turn lane (2 total); and improvements to the westbound right-turn lane. Also, consideration could be given to constructing an additional lane along International Boulevard (SR 99) to provide additional relief at this intersection.

- Additional Initiatives For Reducing Air Pollutants within the Airport Area — The Port continues to support the air quality initiatives which have been enacted in the Puget Sound Region to improve air quality. The Port is also committed to reducing emissions from various sources at the Airport. On-going considerations have focused on reducing the number of vehicles accessing the airport by providing alternatives to single-occupancy vehicle access to and from the Airport. Other actions have addressed motor vehicle idling along the terminal curbfront. Airport staff monitor access and idling by taxis, limousines, and buses within the terminal area.

Water quality and hydrology

Changing the Airport's landscape, as would happen with the proposed Master Plan Update alternatives, could affect the hydrology of the airport area as well as the downstream systems. Alternatives 2, 3, and 4 ("With Project") would include earthwork and the addition of impervious land surface area. This decreases the amount of rainfall infiltrating the soil and increases stormwater runoff flow rates and volumes.

Preliminary estimates indicated that 61 acre-feet of new on-site detention storage would be required for the proposed developed areas that drain to Miller Creek, and 31 acre-feet of storage for areas draining to Des Moines Creek. These detention volumes would attenuate peak runoff rates from the Airport to provide protection from

downstream flooding for storms having up to a 100-year return period. New impervious areas would increase annual runoff volumes to Miller Creek by 6 to 8 percent and volumes to Des Moines Creek by 1 to 2 percent. Most of the additional volume would flow through the downstream systems at rates that have low erosion potential. Higher runoff volumes could be partially offset by stormwater infiltration where on-site soils are suitable.

Although pollutant loading will increase somewhat because of greater amounts of stormwater runoff associated with the "With Project" alternatives, compliance with mitigation requirements is expected to prevent significant pollution or degradation of surface and groundwater resources.

The following stormwater management mitigation could be considered, along with other actions that basin planning determines would mitigate the impacts of the proposed improvements:

- Provide stormwater detention for construction and operation of new on-site development.
- Design stormwater facility outlets to reduce channel scouring, sedimentation and erosion, and improve water quality.
- Maintain existing and proposed new stormwater facilities.
- Tyee pond could be relocated and enlarged as part of the SASA.
- Effective erosion and sedimentation control could be achieved by using a system of erosion controls (e.g., mulching, silt fencing, sediment basins, and check dams) that are properly applied, installed, and maintained.
- Use of Best Management Practices at construction sites, such as spill containment areas and phasing of construction activities (to minimize the amount of disturbed and exposed areas) also could prevent or reduce potential impacts on surface water and groundwater quality.
- Temporary and permanent terraces could be used for fillslopes and cutslopes wherever possible because they reduce sheet and rill erosion. Terraces reduce slope length, reducing potential rill development and surface erosion. Terraces also increase deposition, reducing transport of eroded materials from construction sites.

The Port of Seattle's National Pollutant Discharge Elimination System (NPDES) permit requires the Port to prepare several plans and to carry out several studies to identify pollutants coming from the Airport, and to prevent and control potential operational impacts on surface and groundwater resources from industrial wastewater system (IWS) and storm drainage system (SDS) discharges.

Additional mitigation for potential operational impacts to surface water quality could be considered depending on the results of the stream monitoring study and the effects of Airport stormwater runoff on

Miller and Des Moines Creeks. Potential additional mitigation that could be considered includes use of alternative, FAA-approved runway anti-icing chemicals (e.g., calcium magnesium acetate and sodium formate) or diversion of runway runoff to the IWS during anti-icing events. The latter option is being evaluated as part of ongoing IWS engineering study, which includes capital improvements to increase the treatment efficiency and capacity of the IWS treatment plant.

Basin planning is another method for investigating mitigation of water quality impacts on Miller and Des Moines Creeks and Puget Sound from Airport and urban runoff. Although the Airport affects relatively small proportions of both the Miller and Des Moines Creek drainage basins (approximately 5 and 30 percent, respectively), activities on these areas could significantly affect these drainages. The Port of Seattle is actively participating in basin planning activities in the Miller and Des Moines Creek basins with local jurisdictions, including King County and the cities of Des Moines, Normandy Park, SeaTac, and Burien.

Wetlands

Wetland investigations of the airport area identified almost 150 acres of wetland. The Master Plan Update alternatives at Sea-Tac Airport would affect areas of these wetlands through placement of fill material, grading, removal of existing vegetation, and changes in hydrologic regimes as a result of increased impervious surface area and stormwater management system restructuring.

Alternative	Wetland Impacts
Alt 1 (Do-Nothing)	1.7 acres
"With Project" (Alt. 2, 3, 4):	
8,500 ft runway	10.37 acres
7,500 ft runway	9.43 acres
7,000 ft runway	9.62 acres

Source: Shapiro & Associates. 1995

The amount and location of wetlands disrupted by the "With Project" alternatives will be determined by how much earth is excavated from the on-site borrow locations.

The Port will avoid adverse impacts where possible (e.g., use of off-site fill to avoid wetland impact in Borrow Area 8), and will minimize impacts by using Best Management Practices (BMP) during construction and operation of the proposed improvements. However, if the minimum use of on-site material occurs, maximum off-site truck trips will result as well as possible increased cost of construction.

After extensive study, including investigation of over 100 individual parcels, the Port has selected a preferred wetland mitigation site in the lower Green River Valley. Mitigation for impacts on wetlands at

the Airport, within the watershed where the impacts may occur, is not feasible for three reasons: (1) the majority of the area surrounding the Airport is developed, and not enough land area exists in the watershed to create compensatory mitigation wetlands, (2) much of the undeveloped land in the watersheds is existing wetland, or land unsuitable for wetland mitigation due to topographic (moderate to steeply sloping) or hydrologic (lack of sufficient water) conditions, and (3) the FAA guidelines strongly recommend that airports do not have "wildlife attractions" within 10,000 feet of the edge of any active jet runway. For these reasons, the Port proposes to conduct wetland mitigation outside of the watershed where these constraints do not exist.

The selected site, located in the Green River watershed, is a 69 acre parcel of land slightly south of S. 277th Street and east of Auburn Way. The undeveloped parcel currently supports a mix of upland pasture grasses and forbs that are common to abandoned agricultural land in the Puget Sound Region. Approximately 4.3 acres of reed canarygrass-dominated wetland was delineated at the site.

Floodplains

Construction and operation of the proposed Master Plan Update actions could significantly reduce the 100-year floodplain area and flood storage capacity, increase volumes of stormwater runoff and peak flows, and increase flooding potential in downstream areas on both Miller and Des Moines Creeks. However, flow modeling results using detention requirements for the new development show that the actions will not increase peak flows or potential flooding in downstream areas of Miller or Des Moines Creek.

Mitigation will include adherence to floodplain development standards and floodway management requirements of the FAA and Washington State Department of Ecology. Compensatory mitigation is required by state law for any proposed filling of 100-year floodplain so as to achieve no net loss in flood storage capacity and to prevent an increased risk of loss of human life or property damage.

Compensatory mitigation for floodplain impacts near the northwest corner of the proposed new parallel runway has been incorporated into the stream relocation design. The stream mitigation design, which was developed in cooperation with several resources agencies, including the U.S. Army Corps of Engineers, would create an equivalent amount of floodplain storage — so no net loss of flood storage capacity or increased risk of loss of human life or property damage would result.

Surface transportation

Continued regional population growth will impact the surface transportation system in the vicinity of Sea-Tac Airport regardless of the improvements undertaken at the Airport. The analysis prepared for the EIS showed that many of the existing roadways are experiencing significant congestion and low levels of service. These conditions are likely to increase in the future as the population of the region grows.

The proposed improvements will decrease the levels of service at a number of locations.

Mitigation will be considered for the adverse impacts that would occur with the Master Plan Update actions. An adverse impact is defined as a significant degradation in level of service (reducing the level of service) compared to the Do-Nothing alternative. The mitigation measures discussed in the EIS should be sufficient to alleviate the significant adverse impacts caused by proposed Master Plan Update actions.

Because of the uncertainty of the proposed extension of SR 509 and South Access, as well as the public acceptance and use of high and higher occupancy vehicles and the impact of regional traffic on airport area roadways, the Port will continue to participate in cooperative planning with State and local officials to address its respective share of surface transportation impacts. Mitigation actions that are expected to be addressed in continued mitigation planning include the following associated with the Preferred Alternative:

North unit terminal alternative (with state route 509). The following locations were identified in the EIS for possible mitigation:

- International Boulevard (State Route 99) and South 160th Street
- International Boulevard (State Route 99) and South 170th Street
- Air Cargo Road and Southbound Airport Expressway Ramps; Air Cargo Road and South 170th Street; Northbound Airport Expressway Ramps and South 170th Street
- Northbound Interstate 405 On-Ramp from Southbound Interstate 5

North Unit Terminal Alternative (Without State Route 509).

- International Boulevard (State Route 99) and South 160th Street
- International Boulevard (State Route 99) and South 170th Street
- International Boulevard (State Route 99) and South 188th Street
- International Boulevard (State Route 99) and South 200th Street
- 28th/24th Avenue South and South 200th Street
- Military Road South and South 200th Street/Southbound Interstate 5 Ramps
- Military Road South and Northbound Interstate 5 Ramps
- Air Cargo Road and Southbound Airport Expressway Ramps; Air Cargo Road and South 170th Street; Northbound Airport Expressway Ramps and South 170th Street
- Northbound Interstate 405 On-Ramp from Southbound Interstate 5

Plants and animals (biotic communities)

Construction and operation of the dependent parallel runway would have some adverse effects on fishery and aquatic resources of Miller and Des Moines Creeks and Puget Sound. About 3,700 feet of Miller Creek and its tributaries would require realignment and relocation to complete the runway. About 200 feet of Des Moines Creek would require relocation due to the 600 ft extension of Runway 34R. About 2,200 feet of open channel on Des Moines Creek would require relocation due to the South Aviation Support Area (SASA). The 200-foot section of Des Moines Creek that would be affected by the extension of Runway 34R is within the area that would be realigned as mitigation for SASA. Proposed mitigation would reduce potential impacts on the hydrology, water quality, and aquatic habitat and biota of the two creeks and Puget Sound.

Endangered species of flora and fauna

No significant impacts on threatened and endangered species are expected as a result of the proposed Master Plan Update Alternatives.

Public services and utilities

Public services and utilities would require minor changes based on the residences, businesses, and facilities displaced by development. Major utilities that would be relocated or protected in-place are the Southwest Suburban Sewer District, Miller Creek Interceptor, Seattle Water Department trunk line, Puget Power third electrical service metering point, and US West trunk lines entering at S. 176th Street. A variety of existing utility services, both on the Airport and off the Airport, would be abandoned.

Earth

Project construction and operation (including clearing, grading, excavation, and fill placement) are evaluated and potential mitigation measures identified. The Master Plan Update alternatives would require the movement of the following quantities of earth:

Alternative	Million Cubic Yards of Fill
Alternative 1 (Do-Nothing)	2.4
Alternative 2	23
Alternative 3	23
Alternative 4	23

Note: Alternatives 2, 3 and 4 assume a new parallel runway with a length up to 8,500 feet, located 2,500 ft west of Runway 16L/34R. The Do-Nothing includes the development of the South Aviation Support (SASA) and Des Moines Creek Technology Campus.

Of the 23 million cubic yards of fill needed, about 17.25 million cubic yards would be needed for an 8,500-foot new parallel runway. Preliminary investigations indicate that all of the required fill could

be obtained from a combination of Port of Seattle-owned property and off-site borrow sources.

Two seismic hazard areas have been identified by the City of SeaTac on the site of the proposed new parallel runway. They are small areas of shallow, loose sediment that likely would liquefy during a seismic event. During construction this sediment would be removed and replaced with compacted fill.

Erosion of exposed soils in areas of excavation, fill, and stockpile would occur during construction. The amount of erosion would depend on the design and implementation of an Erosion and Sedimentation Control Plan.

Solid waste

Solid waste is composed of solid and semi-solid waste, including such things as garbage, rubbish, metal, paper, plastic, and wood. Based on the analysis of solid waste conditions, and the impacts of the Master Plan Update alternatives, no significant impacts on solid waste generation and disposal are expected.

Hazardous waste

Operations at the Airport by the Port and airport tenants involve the storage and use of hazardous materials and the generation of hazardous wastes. Fifty-one potential or known hazardous substance sites exist on the Airport property and in the vicinity of the Sea-Tac Airport. Eleven of those sites are located in the area where a new parallel runway would be completed, and one is located in the proposed SASA Area. Sites located west of the Airport, and those located on Port of Seattle (POS) property, have the potential to be most affected by the Master Plan Update alternatives.

Mitigation for potential construction-related hazards include developing a Spill Prevention, Control, and Countermeasures Plan (SPCCP) outlining procedures for transport, storage, and handling of hazardous materials, and a Hazardous Substances Management and Contingency Plan outlining procedures for removal, storage, transportation, and disposal of hazardous wastes. All federal, state, and applicable local rules and guidelines for handling and disposal of hazardous substances would be followed.

Energy supply and natural resources

The proposed "With Project" alternatives (Alternative 2, 3 and 4) are expected to increase in annual energy usage seven to nine percent over the Do-Nothing (Alternative 1). All suppliers of these natural resources have indicated the capability of serving the increased demand.

Construction

As discussed in the Final Master Plan Update EIS (Chapter IV, Section 23), the transport of fill material to the airport could have adverse environmental impacts, e.g., impacts on surface transportation and impacts on properties near the construction sites. In an effort to mitigate such impacts, Interim Fill Material Transport Guidelines will be prepared relating to the acquisition of free or low cost fill material to hauled by trucks and placed on existing airport property as authorized in Resolution 3212, As Amended. The Interim Guidelines should include a process for designating preferred haul routes and specific conditions such as hours of operations, traffic control changes, and route mitigation. Depending upon the selected contractor(s) haul routes, such controls could include: provisions that restrict truck traffic during AM and PM peak periods; provisions that require the contractor to cover all loads to reduce debris and dust loss from the transport activities; and provisions for street cleaning and pavement repairs during the construction process. The Interim Guidelines are intended to govern the initial stages of acquisition and placement of fill material at the airport, and they will remain in effect until completion of the Construction and Earthwork Management Plan referenced below.

A Construction and Earthwork Management Plan would be prepared to govern the acquisition and placement of fill material for Master Plan Update development actions. It is intended that this Plan would replace the Interim Guidelines described above and would be more comprehensive in addressing the means by which fill material will be transported to the airport. In addition to the transport matters covered by the Interim Guidelines referenced above, the Plan should address the methods selected for acquiring and transporting fill material to the airport development sites. The Plan's contents will depend on the methods ultimately selected and may include such topics as construction of temporary access ramps and roads, shoreline dock facilities, conveyor systems, and/or rail facilities.

Because of the social disruption that would occur in the general vicinity of the proposed new runway construction, construction mitigation acquisition will be considered. This acquisition could include about 70 residential and commercial properties located east of Des Moines Memorial Drive between SR 509 and SR 518.

To minimize the fugitive dust transport, unpaved roads and inactive portions of the construction site will be watered (achieving a 50 percent reduction in dust) or chemically stabilized (achieving an 80 percent reduction) during dry periods.

Construction impacts are short-term and temporary. Provisions of FAA Advisory Circular 150/5370-10, "Standards for Specifying Construction of Airports," will be incorporated into construction specifications.

Aesthetics and urban design

The proposed "With Project" alternative will change the visual character of the area. Adherence to applicable design and landscaping standards can ensure that this impact would not be adverse.

Assumption regarding airport activity levels with and without the new runway

It was assumed in the Airport Master Plan Update EIS that the number of passengers and flight operations would be the same regardless of whether the new runway is built. Some commentors on the Draft EIS questioned this assumption, suggesting that increasing delay at the airport will result in slower growth in flight operations than would occur with the development of the new runway. These commentors argued that the Draft EIS was inadequate because it compared the potential impacts of the new runway to a "do nothing" alternative that was not accurate. In preparing the Final EIS, the FAA and Port responded to these questions/arguments in two ways.

First, the relationship between increasing delay and the forecast demand was reviewed and discussed in the Final EIS. When the aviation demand forecast model was developed for the Master Plan Update, an effort was made to create a model that would explain the past changes in air travel demand. The model demonstrated that changes in origin and destination (O&D) enplanements at the airport are a result of changes in regional population, income, and average air fares. Regional forecasts for the Puget Sound area, prepared by the Puget Sound Regional Council and others, project that population and income in the Region will increase during the planning period. Average air fares are not expected to increase to an extent significant enough to dampen substantially the anticipated increase in aviation demand. Therefore, the forecasts predict that aviation demand will increase in the future.

The Flight Plan study concluded that the annual service volume of the existing airfield at Sea-Tac is about 380,000 annual operations, based on acceptable levels of aircraft delay. (In 1995, there were about 386,000 operations at Sea-Tac.) However, the study also concluded that it is possible for more than 380,000 operations to occur at Sea-Tac in a year, by expanding operations into the late evening and early morning hours and by accepting increased average delay, up to a theoretical capacity of 460,000 operations per year. For a number of reasons, it is the professional judgment of the FAA, the Port and its technical consultants that the increasing delay will not result in an overall level of aviation activity significantly different from that which would occur with the new runway during the planning horizon of the Master Plan Update (through 2020). Even without the new runway, the increases in regional population and income will result in increased operations at Sea-Tac because, among other reasons, there are no acceptable alternatives.

However, in the event this forecast is inaccurate, an analysis was conducted for the Final EIS that considered the potential differences

in impacts if the increasing congestion and delay results in reduced aviation demand. As described on pages R-5 through R-18 in Appendix R, a scenario was considered in which aviation demand grows at rates 15% lower than that predicted in the Master Plan Update forecast. This analysis demonstrated that the impacts of this Do-Nothing scenario would be different from (and in most areas would be less than or occur later than) the impacts of the With Project alternatives.

More specifically, this analysis showed that fewer residences would be included in the DNL 65 noise contours and the quantity of air pollutants would be less, which is the logical result of fewer flight operations and less surface transportation to and from the airport. Impacts in other areas, including wetlands, stream relocations, floodplain impacts, property acquisitions, socio-economic impacts, and earth/fill material, would be delayed or non-existent as the construction of the new runway is delayed or abandoned. These differences provide a basis for comparison with the proposed action and have been considered by the Commission in reaching its decision to adopt Resolution 3212, As Amended. Even if the impacts of the "do nothing" alternative are less, the Commission has concluded that approval of the Master Plan Update and development of the new runway is necessary and appropriate.

5. **The Commission's Decisions: A Balancing of Multiple Considerations.**

In reaching the decisions embodied in Resolution 3212, As Amended, the Port Commission has considered a wide range of issues including, among others: (i) the need for improvements to meet the Region's growing aviation demand; (ii) the alternatives for meeting this demand including supplemental and replacement airports, demand/system management, high speed ground transportation, new air navigation and airplane technologies, and alternative configurations of a new runway and other new facilities at Sea-Tac airport; (iii) the environmental impacts of the various alternatives as documented in the Flight Plan and Master Plan Update EISs; and (iv) costs and related financial issues.

The Port has considered the potential environmental impacts of the alternative courses of action and the possible mitigating measures available to lessen or eliminate such impacts. In most cases, it is possible to mitigate potential environmental impacts to an acceptable level. For example, construction of the new runway will require filling of wetlands and relocation of a creek. But through careful planning, replacement wetlands and a relocated creek will be developed in a manner that replaces most if not all the important attributes of the affected areas. In some instances, however, there are unavoidable impacts that cannot be completely mitigated, requiring the Port Commission to balance the need for improvements and other considerations against the potential environmental impacts. The environmental impacts of a proposal, as documented in an EIS, represent one of many factors that must be considered and balanced by the

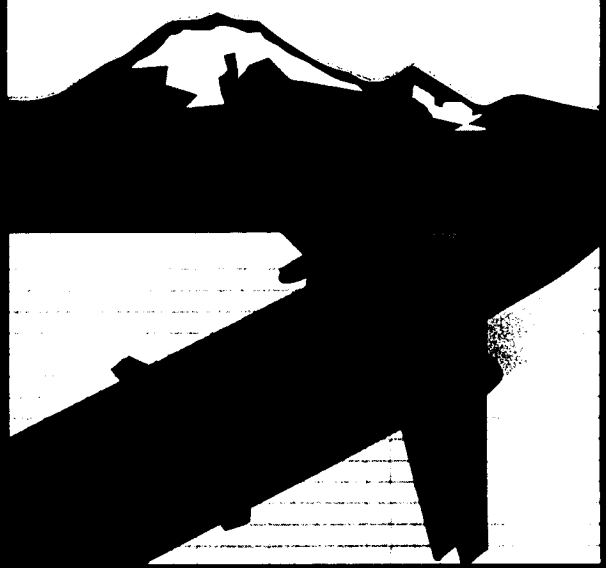
decisionmakers. This balancing judgment is recognized as necessary and appropriate in the state SEPA regulations which provide as follows:

> SEPA contemplates that the general welfare, social, economic, and other requirements and essential considerations of state policy will be taken into account in weighing and balancing alternatives and in making final decisions. ... [T]he environmental impact statement is not required to evaluate and document all of the possible effects and considerations of a decision or to contain the balancing judgments that must ultimately be made by the decisionmakers. Rather, an environmental impact statement analyzes *environmental* impacts and must be used by agency decisionmakers, along with other relevant considerations or documents, in making final decisions on a proposal. The EIS provides a basis upon which the responsible agency and officials can make the balancing judgment mandated by SEPA ...

WAC 197-11-448 (1). In enacting Resolution 3212, As Amended, the Commission has determined, on balance, that the adoption of the Master Plan Update and the development of a new dependent air carrier runway is a necessary and reasonable decision in the best interests of the Puget Sound Region.

Attachment B
to Resolution No. 3212,
as Amended

TECHNICAL REPORT NO. 3
SEA-TAC AIRPORT
PLANNING HISTORY AND
STUDY RELATIONSHIPS



AIRPORT MASTER PLAN UPDATE

F O R

SEATTLE-TACOMA INTERNATIONAL AIRPORT

P&D Aviation

AR 040059

TECHNICAL REPORT NO. 3
SEA-TAC AIRPORT
PLANNING HISTORY AND
STUDY RELATIONSHIPS

AIRPORT MASTER PLAN UPDATE
FOR
SEATTLE - TACOMA INTERNATIONAL AIRPORT

Prepared by:

The Port of Seattle
SEATTLE - TACOMA INTERNATIONAL AIRPORT

May 5, 1994

The P&D Aviation Team

P&D Aviation • Barnard Dunkelberg & Company • Berk & Associates
Mestre Greve Associates • Murase Associates • O'Neill & Company
Parsons Brinckerhoff • Thompson Consultants International

TECHNICAL REPORT NO. 3
SEA-TAC AIRPORT PLANNING HISTORY AND STUDY RELATIONSHIPS

TABLE OF CONTENTS

Section		Page
1	**INTRODUCTION**	1-1
	Background	1-1
	Project Objectives	1-1
	Scope of Study	1-2
	Study Schedule and Documentation	1-2
	Planning Team Composition	1-5
	Contents of this Report	1-5
2	**PLANNING HISTORY AND STUDY RELATIONSHIPS**	2-1
	Purpose	2-1
	Background of Airport Developments	2-1
	Airport Master Plan Update Program	2-2
	Plans and Projects Related to the Airport Master Plan Update	2-3
	Local, Regional and State Plans	2-15
	Conclusions	2-20
	BIBLIOGRAPHY	
	APPENDIX A - SEA-TAC AIRPORT DEVELOPMENT CHRONOLOGY	
	APPENDIX B - SEA-TAC AIRPORT HISTORICAL PLANNING STUDIES	

Section 1
INTRODUCTION

SECTION 1
INTRODUCTION

BACKGROUND

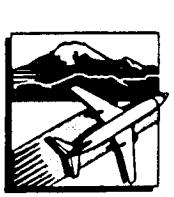
The genesis of the Seattle-Tacoma International Airport (Sea-Tac) Master Plan Update was the "Comprehensive Planning Review" conducted in 1988. This ten month program evaluated the 1985 Airport Master Plan as well as several other related planning studies. The conclusions of this analysis, as well as the results of the Puget Sound Regional Council's 1988 Regional Airport System Plan, led the Port of Seattle Commissioners to formally acknowledge that Sea-Tac would reach runway saturation near the turn of the century. In response to this challenge, the Commissioners, and the Puget Sound Council of Governments (now Puget Sound Regional Council), entered into a three-year planning effort known as the "Flight Plan" project.

The purpose of Flight Plan was to develop a regional airport system, that would meet the aeronautical needs of the region to the year 2020 and beyond. In the third phase of Flight Plan, alternative airport systems were evaluated. In the end, the 39-member Puget Sound Regional Air Transportation Committee (PSATC) chose as its preferred alternative the construction of a new runway at Sea-Tac and development of two reliever satellite airports. This ultimately led to the adoption by the Port of Resolution No. 3125, which directed that a new runway for Sea-Tac be examined in detail. Subsequently, a planning team led by P&D Aviation was selected for an Airport Master Plan Update and began work on December 3, 1993.

PROJECT OBJECTIVES

The overall objective of this project is to "prepare a comprehensive Airport Master Plan [Update] for the airside, terminal, and landside facilities needed at Sea-Tac to meet air travel demand to the year 2020 and beyond." Specifically, the master plan update study must fulfill each of the relevant objectives stated in Port Resolution 3125. These are as follows:

- Design a mechanism and process to promote [land use and community] compatibility through improved coordination, communication and involvement.
- In addition to the third runway studies, include a reconsideration of a fast rail system together with diversion of all cargo carriers.
- Fully explore the impacts of peak period pricing and other demand management techniques.
- Explore land acquisition and redevelopment to compatible uses.
- Attenuate airport noise through the use of berms and barriers.
- Promote aggressive on-airport emission reductions.
- Promote regional transit and reduction in use of automobiles.
- Improve the aesthetic appearance of the airport boundary.
- Develop a comprehensive stormwater management plan.



SCOPE OF STUDY

The first assignment of the Airport Master Plan Update study was the development of a detailed scope of work designed to fulfill the project objectives. The final scope of work, prepared on December 2, 1993, contains forty-five work tasks (Table 1-1). The detailed scope of work is contained in Technical Report No. 1, Scope of Work.

The primary issues addressed in the scope of work include:

- ***Forecasts.*** The master plan update and related Environmental Impact Statement and FAA Part 150 Study must be based on a reliable and generally accepted set of forecasts.

- ***Airside Evaluations.*** An important component of the study is the analysis of a new dependent parallel (minimum runway separation of 2,500 feet) runway. The Airspace Update Study and the FAA Airport Capacity Enhancement Task Force both determined that a substantial capacity improvement can be achieved by constructing a new parallel dependent runway.

- ***Terminal Evaluations.*** A key issue in the terminal development is to achieve a balance between added terminal capacity and additions to airside and landside capacity. Curb frontage, roadway and automobile parking are critical components.

- ***Multi-Modal Evaluations.*** There is considerable interest at the Federal, State and local levels of government to development inter-modal transportation systems that are economically efficient and improve air quality and reduce airport congestion.

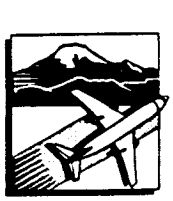
- ***Financial Planning.*** A comprehensive financial plan and implementation strategy must be developed to maximize the Port's ability to fund needed capital improvement projects.

- ***Part 150 Issues.*** The Noise Mediation Agreement resulted in substantial noise reduction programs, now being implemented. This agreement plays a vital role in existing and future planning efforts at the airport and has been incorporated into the recently completed FAR Part 150 Study 1993 Amendments. However, those amendments did not consider the implementation of a third runway, and thus the Noise Exposure Maps that were generated in the study will require updating to consider the third runway option.

- ***Process.*** Public involvement in the planning process is an important element of the Airport Master Plan Update. The public involvement program developed for the study will allow for better understanding of the sentiments in the surrounding communities and constructively involve the public in focused workshops for the project. Elements of the public involvement program include workshops, public opinion surveys, and dissemination of project information through newsletters and technical reports prepared during the study.

STUDY SCHEDULE AND DOCUMENTATION

The Airport Master Plan Update is scheduled to be completed in December 1995. During 1994, forecasts will be prepared, facility requirements will be developed and individual options for accommodating projected needs will be evaluated. In 1995, option "packages" will be developed and evaluated and concurrently an Environmental Impact Statement will be prepared.



The following documents are scheduled to be delivered to the Port during the course of the project:

- Technical Report No. 1, Final Work Scope
- Project Brochure
- Technical Report No. 2, Public Involvement Program Development Report
- Technical Report No. 3, Planning History and Study Relationships
- Technical Report No. 4, Facilities Inventory
- Technical Report No. 5A, Preliminary Forecast Report
- Technical Report No. 5B, Final Forecast Report
- Technical Report No. 6A, Preliminary Airside Report
- Technical Report No. 6B, Demand, Capacity Requirements
- Technical Report No. 7, Options Evaluation Report
- Demand Management Report
- Technical Report No. 8, "Package" Evaluations Report
- Technical Report No. 9, Draft of Master Plan Update Final Report
- Airport Layout Plan Set
- Final Report

PLANNING TEAM COMPOSITION

The Master Planning Team led by P&D Aviation consists of eight firms which are listed below with their key responsibilities:

- ***P&D Aviation*** - Project Management, Forecasts and Facility Requirements, Airside Planning, Ground Access Planning, Overall Airport Master Planning and Coordination
- ***O'Neill & Company*** - Public Involvement
- ***Parsons Brinckerhoff*** - Multi-Modal Transportation Evaluations
- ***Thompson Consultants International*** - Terminal Planning
- ***Barnard Dunkelberg & Company*** - Part 150 Integration
- ***Berk & Associates*** - Financial Planning
- ***Murase Associates*** - Airport Beautification, Landscape Architecture
- ***Mestre Greve Associates*** - Aircraft Noise Impacts

CONTENTS OF THIS REPORT

Section 2 of this report contains summaries of recent planning studies related to Sea-Tac Airport and the surrounding communities. An understanding of the findings and recommendations of these past studies and how each relates to the development of future plans for Sea-Tac is important for the preparation of the Airport Master Plan Update.

SECTION 2
PLANNING HISTORY AND STUDY RELATIONSHIPS

SECTION 2
PLANNING HISTORY AND STUDY RELATIONSHIP

PURPOSE

Technical Report No. 3, *Sea-Tac Airport Planning History and Study Relationships,* summarizes recent Port of Seattle plans and studies related to the Seattle-Tacoma International Airport Master Plan Update. It also discusses related local, regional, and state transportation and land use plans. The purpose of Report No. 3 is to document studies which will serve as inputs to the Master Plan Update and to define the planning and community context in which the airport operates.

The Airport Master Plan Update will combine existing airport plans with new planning work to create a comprehensive picture of the future of Sea-Tac Airport. It will provide the Port with a framework for developing Sea-Tac to the year 2020 and will facilitate continued land use compatibility planning efforts of airport communities and the airport.

BACKGROUND OF AIRPORT DEVELOPMENTS

Seattle-Tacoma International Airport (Sea-Tac) is the primary air transportation hub of Washington State and the Northwest United States. Located 12 miles south of downtown Seattle, Sea-Tac is the only airport with scheduled airline service in the Central Puget Sound Region (King, Pierce, Snohomish, and Kitsap Counties). Figure 1 shows the airport location.

In 1942, the Port of Seattle Commission voted to assume responsibility for a new major airport to serve the residents of the Central Puget Sound Region. The Port acquired nine-hundred and six acres and in 1943 officially broke ground for what was then called the Bow Lake Airport. Limited operations began in 1944 and by 1948, Northwest Orient Airlines and Western Airlines offered regular commercial service. On opening day, the airport had four runways. The main runway was oriented north/south and cross-wind runways were oriented east/west, southeast/northwest, and southwest/northeast. The original passenger terminal was completed in 1949.

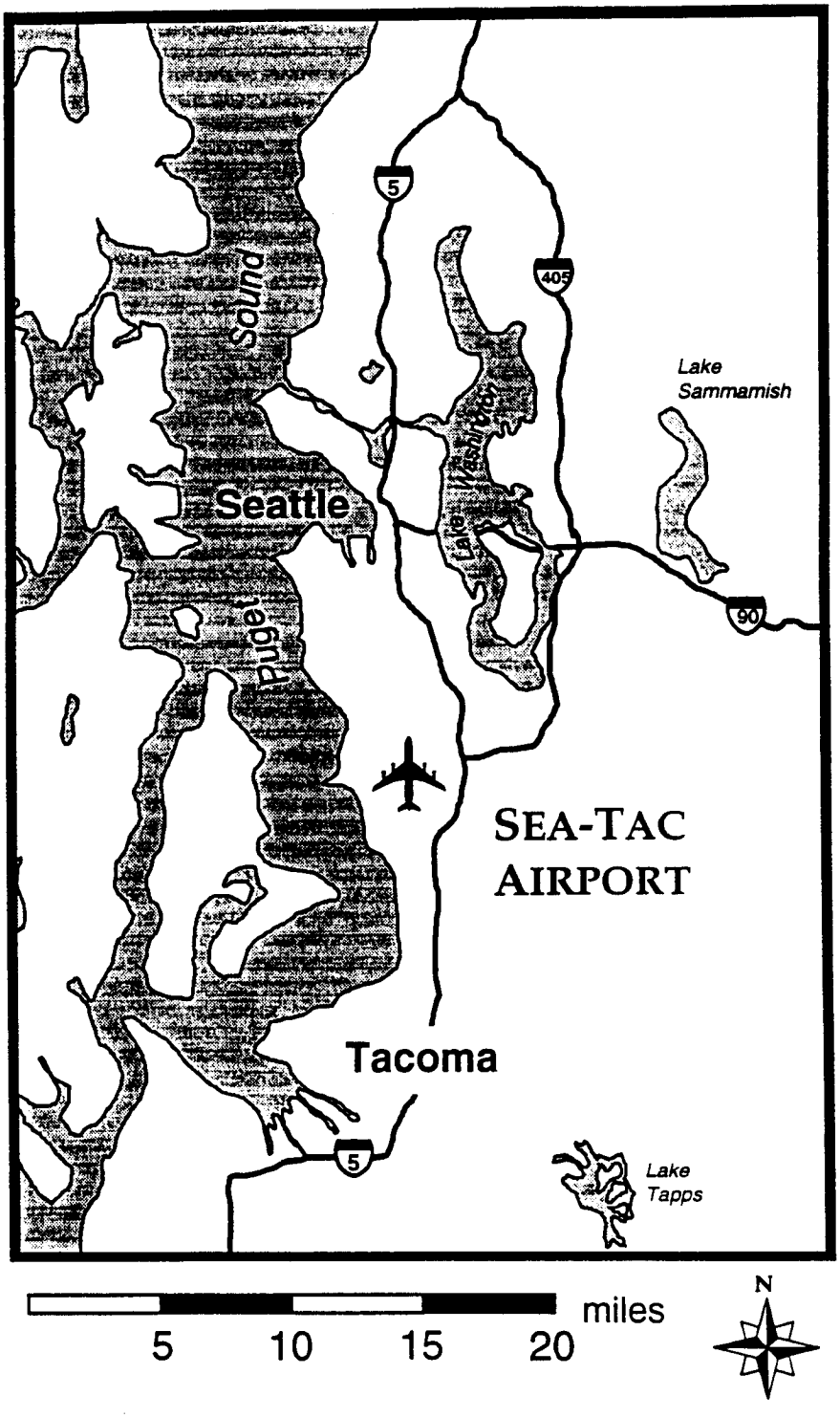
Over time, numerous improvements were made to Sea-Tac Airport and the facility grew to more than 2,500 acres. Improvements included lengthening of the main runway and construction of a second north-south parallel runway, new taxiways, and additional navigation aids. Cargo, maintenance, and fire facilities were also built. A chronology of airport developments is included in Appendix A. A brief discussion of airport developments follows.

Between 1959 and 1970, extensive additions and improvements were made to the passenger terminal. Included were four new concourses and improvements to the lobby, restaurant, shops, and cocktail lounge.

From 1967 to 1973, Sea-Tac underwent a major enhancement. Additions included the second parallel runway, north and south satellite terminals, a passenger subway to link the satellites to the main terminal, the north airport access freeway, and an eight-story parking garage. During this time, the airport terminal drives were separated into upper and lower levels for departing and arriving passengers.

In 1976, the Port of Seattle and King County adopted the Sea-Tac Communities Plan to guide

FIGURE 1
Sea-Tac Airport Location



development of the airport and the surrounding neighborhoods. Several community and airport compatibility studies have been completed since then.

Following federal deregulation of the airlines in 1978, the number of airlines using Sea-Tac doubled. This lead to increased demand for ticketing counters, baggage claim space, and aircraft gates. International flights also increased and the Federal Inspection Services (customs) facilities in the South Satellite were upgraded in 1983.

In 1992, the airport "First Class Upgrade" was completed. Included were major passenger concourse renovations which added six new aircraft gates, expansion of the parking garage from 4,500 to 8,000 spaces, new short-term metered parking, and a pick-up/drop-off plaza in the garage.

AIRPORT MASTER PLAN UPDATE PROGRAM

The last Master Plan Update for Seattle-Tacoma International Airport was finished in September 1985. In the following years, Sea-Tac experienced greater-than-anticipated growth in aircraft operations. The Master Plan forecasted 295,500 aircraft operations for the year 2005. This level was reached by 1988, and in 1993, Sea-Tac served 339,000 operations. Recent studies indicate continued strong increases in air travel at Sea-Tac over the next thirty years and have identified an existing bad weather capacity shortfall for the airfield. In response, the Port of Seattle has participated in regional airport planning efforts and conducted specific planning for many areas of the airport including the passenger terminal, airfield, cargo facilities, ground access system, and other support facilities.

The purpose of the Airport Master Plan Update Program is to update existing plans and to conduct new planning for key areas of the airport. Plans will be assembled into a comprehensive picture of the range of facilities needed to keep Sea-Tac Airport operating efficiently to the year 2020. A main goal of the Master Plan Update is to balance the airside, landside, and ground access facilities and to ensure a logical overall development of the airport. A primary component of the work is to identify and evaluate options for adding a new runway. In addition, the study will examine improvements that would be needed whether a new runway is built or not.

Two additional studies are being prepared as part of the Master Plan Update Program. These are: 1) Preliminary Engineering for a New Dependent Runway, and 2) an Environmental Impact Statement (EIS) on the Master Plan.

The Preliminary Engineering Study is being conducted by the Port of Seattle to develop baseline concepts for a new runway at Sea-Tac Airport. HNTB Corporation is the lead consultant. The Study will provide background technical data for the development of airfield options in the Airport Master Plan Update. It will also provide the necessary background information needed to analyze the impacts of a new runway in the EIS. Included will be development of conceptual airfield layouts, assessment of general on and off-site construction impacts, identification of fill material quantities and potential sources, identification of property acquisition requirements, and preparation of a conceptual construction schedule and order-of-magnitude cost estimates. The study will be completed in 1994. More-detailed engineering studies will be needed before a runway could be built.

The Federal Aviation Administration (FAA) has the lead in preparing the Environmental Impact Statement (EIS) for the Airport Master Plan

Update. The Port of Seattle will administer the consultant contract and provide day-to-day project management services. A Memorandum of Understanding (MOU) between the two agencies outlines their roles and responsibilities. Landrum and Brown is the lead consultant.

The EIS will evaluate the cumulative range of impacts for the conceptual plans developed in the Airport Master Plan. It will also identify a comprehensive approach for mitigating those impacts. In addition, the EIS will evaluate in detail the specific impacts and potential mitigation measures for a new runway. The Final EIS is scheduled to be available at the end of 1995 prior to the adoption of a final Airport Master Plan.

PLANS AND PROJECTS RELATED TO THE AIRPORT MASTER PLAN UPDATE

Recent plans prepared for Sea-Tac Airport will form the foundation for the Airport Master Plan Update. Following is a discussion of major planning efforts by the Port of Seattle and others to be considered in the Update. They are organized by the following categories: 1) Airfield and Airspace; 2) Terminal, Cargo, and Maintenance Facilities; 3) Ground Access and Land Use; and 4) Noise and Other Environment. Studies are presented chronologically within each category. Local, regional, and state plans are discussed in a later section. Earlier Planning Studies are listed in Appendix B.

Airfield and Airspace

Airport Master Plan Update, 1985

Port of Seattle (Peat Marwick and TRA), September, 1985

The underlying premise of the 1985 Sea-Tac Airport Master Plan Update was that "the primary role of the Airport is to serve the traveling public and to promote trade by accommodating the air transportation needs of the region." The Update was prepared to guide development of the airport over a twenty-year planning horizon based on a forecast of 21 million annual passengers and 295,000 aircraft operations by the year 2003. A key assumption of the plan was that the existing two runways would be able to accommodate this demand and that new runways would not be needed during the 20-year planning horizon.

The Update focused on accommodating passenger terminal and air cargo facility needs. It included recommendations to extend Concourse A and the North and South Satellites to provide for up to 94 total aircraft gate positions. These extensions would require relocation of the aircraft line maintenance hangars south of the terminal complex. The plan identified the west side of the airfield and the existing northeast cargo area as potential locations for future cargo and maintenance facilities. To improve passenger circulation, the plan recommended widening both concourses B and C. Further recommendations included adding lanes to the upper and lower automobile access drives, adding north and south wings to the parking garage, and constructing a shuttle bus plaza on the third floor of the garage.

Comprehensive Planning Review and Airspace Update Study

Port of Seattle (P&D Technologies), December, 1988

The purpose of the Planning Review Study was to assess the validity of previous plans developed for Sea-Tac in light of air travel growth levels not previously anticipated and other changing conditions at the airport. The results of the assessments were used to develop a strategy for preparing a comprehensive plan for the airport. The Airspace Update Study was prepared at the same time and provided

technical data on airside capacity and demand forecasts for use in the Comprehensive Planning Review.

The Planning Review concluded that Sea-Tac plans were adequate for current and near-future requirements, except in the area of airfield capacity. Previous plans, including the 1985 Master Plan Update, had not indicated a need for new runway capacity. The Planning Review, however, identified that passenger and aircraft operations growth had exceeded previous forecasts and that the existing runways would not be adequate to meet demand past the year 2000.

In addition to increasing airfield capacity, the Planning Review recommended expansion of the passenger terminal and implementation of the 1987 Landside Access Program to improve automobile access to the airport. Continued study of a south access roadway to the airport was also identified as a high priority. In a departure from the 1985 Master Plan Update, the Planning Review recommended that airline hangars and other facilities that would be impacted by passenger terminal expansion be moved to a new development south of the airport rather than to the west side of the airfield. To deal with increasing community concerns with aircraft noise, The Planning Review also recommended that the Port of Seattle proceed with a mediation process for managing aircraft noise at Sea-Tac.

Air Space Study (Four-Post Plan): Seattle Arrival and Departure Routes; Simulation, Analysis, and Recommendations
Federal Aviation Administration, Seattle-Tacoma Tower, 1989

The objective of the study was to identify ways to reduce aircraft delays at Sea-Tac Airport caused by airspace constraints (constraints other than the actual capacity of the airfield). The problem was that in periods of high demand, as weather conditions improved, the high-altitude route structure and holding airspace was configured in such a way that the Seattle Air Route Traffic Control Center (ARTCC) could not increase the aircraft arrival rate in a timely and efficient fashion. It could take up to thirty minutes for the ARTCC to substantially increase the metered arrival rate, resulting in up to 20 lost arrival opportunities. The study examined the efficiency and safety of thirteen alternative airspace and arrival/ departure procedure plans. The recommended plan involved routing arriving aircraft over one of four fixed points (generally southeast, southwest, northwest, and northeast). This solution, commonly called the Four-Post Plan, provided symmetrical arrival capacity (56 - 60 landings) regardless of the direction of landing and allowed for the filling of every arrival opportunity or slot with an aircraft. The Four-Post Plan was put into operation in April, 1990.

Airport Capacity Enhancement Plan
Federal Aviation Administration and Port of Seattle, June, 1991

The Capacity Enhancement Plan was a technical evaluation of options for improving airfield capacity and reducing operational delay at Sea-Tac Airport. Options examined included improved taxiways, additional or upgraded navigation aids, a new commuter runway, a new dependent runway, a new independent runway, and demand management. The hourly and annual capacity constraints of the existing airfield and the aircraft delay savings from implementing each of the options were also studied. Capacity with a delay of four minutes per aircraft was identified as 61 arrivals per hour.

Total aircraft delay was analyzed for a baseline of 320,000 aircraft operations per year and for future operations of 390,000 and 425,000 per

year. The Airfield Delay Simulation Model (ADSIM) and Runway Delay Simulation Model (RDSIM) were used in the analysis.

The Plan identified an existing bad weather arrival capacity problem at Sea-Tac. Weather conditions over the course of a typical year were identified as follows:

VFR 1 (56% of the time): Ceiling at least 5,000 feet and visibility at least 5 miles

VFR 2 (19% of the time): Ceiling between 2,500 - 4,999 feet and visibility more than 3 miles

IFR 1 (18% of the time): Ceiling between 650 and 2,499 feet and visibility more than 1,800 feet runway visual range (RVR)

IFR 2 (5% of the time): Ceiling below 650 feet and visibility more than 1,200 feet runway visual range (RVR)

IFR 3 (2% of the time): Ceiling zero, visibility less than 1,200 feet runway visual range (RVR)

In VFR 1 (good weather), the airport is able to handle two arrival streams of traffic. However, in bad weather, only one arrival stream is possible because of the close spacing of the runways. The result is a significant reduction in airfield capacity.

The Plan found that in 1989, 48,000 hours of aircraft delay at a cost of about $69 million (1989 dollars) to the airlines were incurred at Sea-Tac. With no capacity improvements, delay was projected to rise to 241,000 hours at a cost of $347 million when annual aircraft operations reach 425,000.

The Plan concluded that a new parallel runway capable of accommodating jet aircraft would provide the greatest amount of delay savings.

The Federal Aviation Administration (FAA) is currently preparing an update to the Sea-Tac Capacity Enhancement Plan. FAA will use the Terminal Airspace Model (SIMMOD) to study capacity and delay of a range of airfield and airspace improvements including reassessment of the findings of the 1991 Enhancement Plan. The Update is scheduled to be completed by fall of 1994 and will provide useful detailed information for evaluating airfield options developed in the Airport Master Plan Update.

Flight Plan Project (Puget Sound Air Transportation Committee)
Port of Seattle and Puget Sound Regional Council (P&D Technologies, Apogee Research, and Peat Marwick), October, 1992

Both the Sea-Tac Airport Comprehensive Planning Review and the Puget Sound Council of Governments (PSCOG) 1988 Regional Airport System Plan (RASP) identified that the existing two Sea-Tac runways would not be adequate to meet regional air travel needs beyond the year 2000. As a result, the Port of Seattle and the PSCOG (now Puget Sound Regional Council, PSRC) signed an interlocal agreement in 1989 to conduct a planning study to recommend a long-term air travel system for the region. The two agencies assembled a steering committee of citizens, elected officials, business people, airline representatives, and environmentalists known as the "Puget Sound Air Transportation Committee" (PSATC). The PSATC's study was called the Flight Plan Project.

Forecasts developed for Flight Plan showed that commercial air travel demand in the Puget Sound Region could reach 45 million annual passengers and 524,000 annual aircraft operations by the year 2020. A range of options including Sea-Tac expansion, supplemental airports, a replacement airport, high-speed rail, demand management, and new aircraft and navigation technologies were

analyzed. Sites throughout the Puget Sound Region were examined. Major elements of the analysis were capacity and delay, airspace, airport accessibility, environmental impacts, economic impacts, cost and funding, and institutional issues. Draft and final environmental impact statements were prepared.

The PSATC chose a multiple airport system with a new runway at Sea-Tac Airport as its preferred alternative. The PSATC recommended two supplemental airports: Paine Field in Snohomish County, and another airport to be located somewhere in Pierce County (possibly joint-use of McChord Air Force Base). The recommendation was developed to balance the region's air travel needs with environmental and economic concerns. It was designed to maximize accessibility of airports to travelers given the linear nature of the Puget Sound Region, to minimize noise and air emissions, and to be consistent with regional land use plans.

Based on Flight Plan, the Port of Seattle Commission passed a resolution (No. 3125) in November, 1992 that directed the Port staff to study a new runway in detail and to prepare a project-level environmental impact statement (EIS) in cooperation with the Federal Aviation Administration (FAA). The resolution also called for an increase in the number of homes insulated each month under the Port's Noise Remedy Program and for an extension of the Program to include apartments, schools, churches, and other institutional buildings.

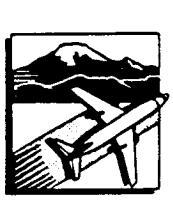
Also based on Flight Plan, the Puget Sound Regional Council (PSRC) adopted a resolution (No. A-93-03) in April, 1993 which called for a feasibility assessment of a major supplemental airport to accommodate commercial airline service. The resolution also called for the Port of Seattle to proceed with detailed plans for a new runway at Sea-Tac. The new runway would be authorized by April 1, 1996 if certain demand management and noise reduction objectives were met.

Microwave Landing System (MLS) Demonstration Program
Federal Aviation Administration, June, 1992

As part of its national test program for the Microwave Landing System (MLS) technology, the Federal Aviation Administration (FAA) is proposing to install an MLS at Sea-Tac Airport and to develop an instrument approach procedure to Runway 16L using the new equipment. The purpose of the MLS is to increase efficiency of airport flight operations for MLS-equipped commuter aircraft landing to the south during some limited poor weather conditions.

The proposed location for the necessary azimuth (compass heading), altitude, and precision distance measuring equipment is north of the airport employee parking lot near International Boulevard on South 160th Street. This is approximately 4,500 feet east of the Runway 16L centerline and 700 feet south of that runway's threshold.

The new equipment would allow for simultaneous ILS/MLS approaches to Runways 16R and 16L. The ILS approach to Runway 16R is an existing instrument procedure. The approach path for the Runway 16L MLS would be approximately 4,500 feet east of and parallel to the Runway 16R ILS approach and would include a fly visual side-step maneuver to Runway 16L once the aircraft broke out of the clouds. The proposed MLS procedure would be useable when there is at least 3 statute miles of visibility and the cloud-cover ceiling is at least 3,000 feet above the ground. The relatively steep angle of descent (4.2 degrees) associated with the approach procedure means that it can only be used by smaller aircraft such as the De



Havilland Dash 7s and 8s and Dorniers. The MLS could only be used by aircraft that have the proper signal receiving equipment on-board.

The Sea-Tac MLS is anticipated to be operational sometime during 1994.

Runway Safety Area Expansions

Runway 16R-34L Safety Area Expansion Study, Port of Seattle (HNTB), March, 1992
Runway 16L-34R Safety Area Expansions, Port of Seattle, December, 1992
Runway 34R Safety Area Expansion, Port of Seattle (Reid Middleton), August, 1993

A runway safety area (RSA) is a surface surrounding a runway to reduce the risk of damage to aircraft in the event of an overshoot or undershoot. Federal Aviation Administration (FAA) standards require RSAs at Sea-Tac to be 500 feet wide and 1,000 feet long off the runway ends. The existing RSAs do not meet these standards. The Port of Seattle has prepared several studies on RSA expansions needed to meet the standards.

Runway 34R (the eastern runway) would require a safety area extension of 465 feet on the south end. Approximately 600,000 cubic yards of fill would be needed. Most of the extension area is on the Tyee Valley Golf Course. The toe of the slope of the extended runway safety area could potentially compete with the proposed South Aviation Support Area (SASA) and South Access roadway because of the size of the fill involved. To assure that all projects have adequate space, the Port of Seattle could use sidewall-retained sections where required (as opposed to normally-sloped fill).

The north RSA on Runway 16L was partially expanded in 1993. The RSA is now 500 feet wide and 700 feet long.

The Preliminary Engineering Study for Runway Safety Area Expansion of Runway 16R-34L examined a range of options for meeting the RSA requirements on the north and south ends of that runway. Options included a wide range of RSA expansions and runway threshold relocations. The existing north RSA is 500 feet wide out to 230 feet, 350 feet wide for an additional 320 feet, and 110 feet wide for an additional 95 feet (total length = 645 feet). The south RSA is 500 feet wide out to 775 feet from the runway end. Further engineering of the Runway 34L RSA will be completed in 1994 with construction scheduled for 1995. Extension of the other three RSAs is on hold pending completion of the Airport Master Plan Update.

PSRC Regional Airport System Plan Update and Major Supplemental Airport Feasibility Study

Puget Sound Regional Council (PSRC), April, 1993, 1994 - 1996

In response to the Flight Plan Project conducted jointly by the PSRC and the Port of Seattle, the PSRC General Assembly adopted a Resolution (No. A-93-03) in April 1993 to amend the Regional Airport System Plan (RASP). The Resolution called for a feasibility assessment of a major supplemental airport and for the Port of Seattle to conduct detailed studies for adding a third runway at Sea-Tac Airport. A third runway would be authorized by April 1, 1996 unless it could be shown through financial and market feasibility studies that a supplemental airport would eliminate the need for a new runway. In addition, demand management/system management programs and noise reduction objectives would need to be pursued and achieved before a new runway was authorized. The Resolution also requested that the Federal Aviation Administration consider modifications to the Four-Post-Plan of arrivals and departures at Sea-Tac Airport.

The PSRC is conducting the feasibility studies for the major supplemental airport. The studies will include an environmental assessment, financial and market feasibility, and institutional factors analysis. The study is not intended to provide the necessary detail for final airport siting, but rather to determine the general feasibility of a supplemental airport. Several work tasks of the Sea-Tac Airport Master Plan Update relate to the Supplemental Airport Feasibility Studies. These include the air travel demand forecasts, air traffic demand management, diversion of air passengers to other modes, and the noise reduction objectives called for in the PSRC Resolution. These are all identified in the Airport Master Plan Update scope of work.

Terminal, Cargo, and Maintenance Facilities

Terminal Development Program

Port of Seattle (Thompson Consultants International), April, 1992

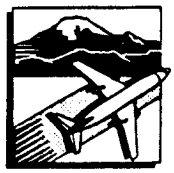
The Terminal Development Program (TDP) refines the recommended passenger terminal plan presented in the 1985 Master Plan Update. The underlying philosophy of the TDP was that all future terminal development must be as flexible as possible to meet changes in the airline industry and other conditions which may develop. In addition, future facilities must be capable of meeting the needs of both hubbing and non-hubbing airlines. The TDP presented a range of options to be considered by the Port of Seattle in developing the terminal during the pre-2000 and post-2000 timeframes. It was intended to be a "living" document which could be adjusted as needed.

Options developed in the plan were based on the passenger and aircraft operations forecasts developed for the Flight Plan Project. Before the year 2000, the terminal would need to handle a maximum of 380,000 annual aircraft operations and 20 million annual passengers. Beyond 2000, the maximum demand level was assumed to be 480,000 aircraft operations and 39 million annual passengers.

The recommended plan for pre-2000 was to: expand the main terminal for additional ticketing and baggage claim; expand and refurbish Concourse A for additional aircraft gates; expand the South Satellite for additional lobby space; prepare to relocate the international arrival facilities (including customs) from the South Satellite to Concourse A; and possibly add an office building and hotel adjacent to Concourse D.

Post-2000, the TDP examined conceptual development options which were based on a range of possible passenger and aircraft operations. These were: 1) Sea-Tac absorbs none of the projected regional passenger growth and would handle a maximum of 380,000 operations per year, 2) Sea-Tac absorbs a portion of the projected regional passenger growth with approximately 410,000 operations per year, and 3) Sea-Tac absorbs most of the projected regional passenger growth with a maximum of 480,000 operations per year.

Three option packages were developed to identify the facilities needed for each of the possible post-2000 demand levels. Under the maximum development scenario, Concourse A could be extended to the southeast and then to the south; Concourse D could be extended; the North and South Satellites could be extended parallel to the runways; and additional in-fill space could be added to the central terminal area. International arrival facilities would be relocated from the South Satellite to Concourse A. Extension of Concourse A and the South Satellite would require relocation of the aircraft line maintenance hangars currently south of the terminal complex.



Air Cargo Study
Port of Seattle (HNTB), June, 1993

The goal of the Air Cargo Study was to provide a framework for future master planning of air cargo facilities at Sea-Tac Airport. Its objectives were to identify the market forces which influence air cargo demand at Sea-Tac, to determine the projected level of future cargo activity, and to develop facility alternatives to meet those needs.

The Study reported that the air cargo outlook for Sea-Tac was favorable, although modest, compared to past performance. Total air cargo volumes were projected to increase from 347,666 metric tons in 1991 to 639,350 metric tons by 2020 (an annual growth rate of 3.5 percent). Japan is anticipated to remain the most important Asian market for the Pacific Northwest, but Southeast Asia, the Russian Far East and China offer important trading opportunities. Asian cargo imported via the Seattle harbor and bound for Europe by air has been important at Sea-Tac, but is projected to remain flat because of competition from other West Coast airports. Latin and South American markets also hold promise. For the US domestic market, the Study anticipates increased imports and continued export growth, although at a slower rate than during the 1980s.

The Study recommended that the Port provide facilities that would accommodate airline growth, include some area for air cargo handling, and preserve some space for expansion. To meet these goals, cargo warehouse requirements were projected to increase from 808,156 square feet in 1991 to 1,120,000 square feet by 2020. Hardstand requirements were projected to increase from 21 to 27 over the same time period.

The Study called for the current Airport Master Plan Update to further analyze cargo facility options, costs, financial feasibility, and timing. Some near-term improvements that could provide adequate facilities through the year 2000 include: conversion of the existing north employee parking lots to allow expansion of the ramp area between the Federal Express and Transiplex buildings; development of a ground service equipment staging area; conversion of Air Cargo Building #2 from the airport maintenance building back to a cargo building; and reconstruction of the hardstand next to Air Cargo Building #2. A new location for the maintenance building would need to be identified. Feasibility studies also were recommended for long-term facilities such as a Foreign Trade Zone, a Port-owned and operated perishables center, livestock pens and loading ramps, and improvements to increase the efficiency of the Transiplex/AVIA cargo area.

Market/Economic Feasibility and Space Planning for a Hotel and Office Building Development
Port of Seattle (The Chambers Group), January, 1993

The Study analyzed the feasibility of a possible hotel/office development at the northeast end of the passenger terminal on the site of the existing United Airlines office building. This was discussed in the 1992 Terminal Development Program.

The Study was intended to provide a baseline for future development of detailed alternatives. It concluded that a 300 - 325 room hotel would be feasible in 1995. The planning concept was for a common base structure with a 12 - 14 story hotel tower and a 3 story office building. The hotel included 310 guest rooms, 5,000 - 5,500 square feet of meeting space, a 125 - 150 seat restaurant, a 100 seat lounge, and a health facility. The office building was estimated at 55,000 gross square feet. In addition, the Study analyzed traffic and parking options, utility

capabilities, and economic feasibility.

South Aviation Support Area (SASA)
Federal Aviation Administration and Port of Seattle (TRA, et al), March, 1994

Extending Concourse A and the South Satellite as envisioned in the 1992 Terminal Development Program and 1985 Airport Master Plan Update would require that the existing aircraft line maintenance hangars south of the terminal complex be relocated. In addition, there is need for future line maintenance facilities and possibly major base maintenance facilities at Sea-Tac Airport. The Port of Seattle is proposing to locate these facilities on a new development southeast of the existing airfield. The project is known as the South Aviation Support Area (SASA).

The SASA Environmental Impact Statement (EIS) analyzes three "build" alternatives and the required No-Action Alternative. The three build alternatives consider varying levels and types of aircraft maintenance. Development of these alternatives takes into account the alignments of the proposed south access roadway and the proposed 28th/24th Avenue South Arterial. The Port would grade, pave, and extend utilities to the site and the airlines that lease the space would construct the maintenance facilities. The preferred alternative includes approximately 60 acres for aircraft line maintenance facilities as well as a base maintenance complex. About 20 additional acres could be used for non-aviation development. A direct taxiway link to the airfield would be provided. SASA development would occur in the area generally bounded by South 192nd Street, 28th Avenue South, South 200th Street, and the Tyee Golf Course.

The EIS also considered alternative locations for maintenance facilities, including the northeast and west portions of the airfield as envisioned in the 1985 Master Plan Update. However, the northeast area has been extensively developed for air cargo. The west side of the airfield was determined not to be feasible because of the increase in airfield congestion it would cause and because of inadequate safety clearances from the existing runways. Development immediately north of the airport is limited by steep slopes and the existing State Route 518. The east side of the airport is a heavily developed commercial area and the southwest is constrained by topography, wetlands, and the Runway 16R-34L safety area.

SASA is listed in the airport Capital Improvement Program and the initial construction phase is estimated to begin in about two years.

Ground Access and Land Use

Sea-Tac Vicinity Development Potential Study
Port of Seattle (TRA and ERA), March, 1986

The purpose of the study was to evaluate the development potential of 22 parcels of land totaling 830 acres in the vicinity of Sea-Tac Airport. The land was largely acquired as part of the Port of Seattle's Noise Remedy Program.

The study estimated the following land demand for the period between 1985 and 2000 based in part on the 1985 Airport Master Plan passenger forecasts: Parking (passenger, rental car storage, and employee) = 68 to 102 acres; Office = 46 acres; Industrial = 65 acres; and Hotel = 400 acres (200 rooms per acre).

The study also examined three conceptual options for developing the land and provided an economic evaluation of the options in terms of return to the Port, level of investment, tax revenue, and employment generated. The three options were: 1) emphasize commercial and

industrial development; 2) balance commercial and industrial uses with public uses; and 3) emphasize public uses, including a military cemetery and regional park. Alternative 3 was found to provide the highest level of return per dollar invested.

Landside Access Program
Port of Seattle (CH2M Hill), October, 1987

The Landside Access Program identified a comprehensive implementation plan for automobile access facilities on the airport to serve a level of 25 million annual passengers. The primary findings of the study were that the curbside capacity for arriving and departing passengers, as well as private vehicle parking capacity, needed to be expanded. Connections to the regional highway system and the ramps to the arriving and departing drives were found to require little or no additional capacity. Although the Program did not address a south access roadway link to Interstate 5, it was designed to be compatible with a south access.

The recommended Program was to: build the north and south wing additions to the parking garage, as well as a 9th floor; provide easy-access, short-term metered parking and a vehicle loading and unloading plaza in the garage; locate the rental car operations on the second floor of the garage; develop remote public parking with 3,000 spaces and remote employee parking with 2,500 spaces; and provide a new taxi holding lot at South 160th Street.

Parking Facilities Expansion, Sea-Tac Airport
Port of Seattle (CH2M Hill, KJS, The Parry Co.), December, 1988

The purpose of the project was to meet existing and near-term growth in parking demand at the airport and to reduce congestion on the terminal drive system. Air passengers were predicted to reach 20 million by 1993 and 25 million by 1999. An environmental impact statement (EIS) examined the following options: 1) Partial garage expansion and remote lots at the airport, 2) Remote lots on and off-airport, 3) remote lots or garages located far from the airport, with shuttle service, 4) full garage expansion, 5) remote mixed-use lots or garages (joint use with shopping malls or other facilities), and 6) no action. The preferred alternative was partial garage expansion and remote lots at the airport. Under this scenario, future airport parking demand would primarily be met by the Port of Seattle. The Port would add north and south wings to the existing airport garage, increasing the total parking from 4,500 spaces to approximately 8,000 spaces. To help relieve congestion on the drives, a passenger loading and unloading plaza would be established on the third floor of the garage. In addition, approximately 1,000 public parking spaces would be developed in the vicinity of South 160th Street and International Boulevard (Pacific Highway South). In addition, a 1,300-vehicle remote employee parking lot would be built along 24th Avenue South north of State Route 518 and a taxi/bus holding and staging facility would be built in the vicinity of South 160th Street and Host Road. Based on the study, the Port completed each of these projects, with the exception of the remote employee lot north of SR 518.

Airport Vicinity Land Use Inventory Project

Port of Seattle (Shapiro & Associates), April, 1994

The Land Use Inventory Project was undertaken to provide background information on existing and historical land use types and patterns near the airport, as well as socio-economic data for the surrounding communities. The study documents changes in land use since 1948 and

includes information on population, age, race, housing units, owner occupancy of housing units, median home values, median rent, median income, and building permit activity. Included is a detailed database of population and type of housing units (single family vs. multi-family) at the census block level. The study also includes a preliminary examination of property values for homes subjected to aircraft noise versus homes outside of noise areas. Major past land use planning efforts are discussed. Possible future land uses in light of city comprehensive plans being conducted under the State Growth Management Act are also discussed.

State Route 509 Extension and South Access Roadway Studies
Washington State Department of Transportation and others

The Washington State Department of Transportation (WSDOT), Port of Seattle, City of SeaTac, City of Des Moines, Metro/King County, and property owners are studying an extension of SR 509 from its current terminus at South 188th Street. The extension would run through the City of Sea-Tac and possibly farther south through Des Moines and eventually link with Interstate 5. Within the City of SeaTac, the extension would likely use existing WSDOT right-of-way to the southwest and south of the airport and possibly may use Port of Seattle property south of South 200 Street. The extension would be a limited access divided highway similar to the existing SR 509.

The parties are also studying a south access roadway to link the south end of the airport with Interstate 5. The three main types of traffic expected to be served by the proposed south access are: 1) airport traffic oriented to the south, 2) trips generated by a proposed business park south of South 188th Street, and 3) traffic into and out of the Cities of Des Moines and Sea-Tac which now accesses I-5 by way of the South 188th and South 200th Street interchanges.

Historically, it is estimated that approximately 40% of airport-related traffic is oriented to the south. Direct freeway access to the airport is available from the north, but not from the south. South-oriented airport traffic is handled by Pacific Highway South (International Boulevard) and by the I-5 interchanges at South 188th and South 200 Streets.

A 1990 study of the south access roadway by Entranco Engineers analyzed several conceptual roadway alignments and options for interchanges with the airport terminal drives system, I-5, and the proposed State Route 509 extension. Without an SR 509 extension, South Access would need to link directly to the regional highway system. Traffic flows on the proposed South Access roadway and surrounding roads were analyzed over a 20 year planning horizon (year 2010) using King County Transportation Planning and Puget Sound Council of Governments projections. The two main assumptions in the traffic analysis were for 33 million annual air passengers in the year 2010 and for 6 million gross square feet of development in the proposed business park. The business park was anticipated to include mostly office buildings (82%) with some industrial park/light manufacturing (12%) and hotels/convention centers/trade centers (6%).

A corridor-level environmental analysis of both the State Route 509 extension and the south access roadway has been underway since 1992. A Draft Environmental Impact Statement (DEIS) is anticipated by mid 1995. The EIS will examine the no action alternative and three alternative locations for the SR-509 extension to link with I-5. These are in the vicinity of: 1) South 210th Street, 2) SR-516 (Kent/Des Moines Road), or 3) South 272nd Street. In each case, the South Access Roadway and

SR 509 extension would intersect in the vicinity of South 200th Street. The EIS will be based upon the assumption that the roadways would be operational in the year 2003. It will also include evaluation of impacts out to the year 2020. Significant new land developments south of the airport will be assumed, but less than in the previous Entranco study.

Extension of the roadways have possible implications for storm water detention facilities near the airport. The South Aviation Support Area (SASA) DEIS mentioned the possibility of accommodating a portion of the SR 509 extension runoff detention on Port of Seattle property in conjunction with runoff facilities for the SASA project or other potential sub-regional detention facilities.

28th/24th Avenue South Arterial Project Draft Environmental Impact Statement
Cities of SeaTac and Des Moines (Ficklin Environmental), November, 1992

A consortium of the Cities of SeaTac and Des Moines, the Port of Seattle, King County, and land owners is studying alternative alignments for an arterial to serve existing and expected local access traffic generated by proposed business park developments in the Cities of SeaTac and Des Moines.

The Draft EIS for the project examines 3 "build" alternatives and the required No Action alternative. Each of the three alternatives would follow 28th Avenue South from South 188th Street to the vicinity of South 196th Place. Alternative #2 would continue along 28th to the intersection with International Boulevard (it would be a southbound one-way road with two lanes south of South 200th Street). Alternative #3 would step to the west and follow 26th Avenue South to the vicinity of South 208th Street and then step further to the west and continue along 24th Avenue South and terminate at South 216th Street. Alternative #5 would move west and generally be aligned between 28th and 26th Avenues South to the vicinity of South 202nd Street. It would then proceed further west and follow 24th Avenue South from the vicinity of South 204th Street to South 216th.

A Final EIS on the project was completed in May 1993. The preferred alternative was a combination of alternatives #3 and #5 above. Engineering and design work is still needed and subject to funding availability, construction could begin in about two - three years.

Personal Rapid Transit System (Sea-Tac People Mover Study)

Personal Rapid Transit (PRT) is an alternative mode of transportation under consideration by the City of Sea-Tac. It would consist of 3 - 4 person-sized, computer-controlled vehicles operating on an elevated guideway between business developments within the city, hotels, remote parking, and the airport.

In the spring of 1991, the City, in cooperation with Metro, King County, and the Port of Seattle, completed a feasibility study of a such a people mover system. The study concluded that if the technology develops, that such a system could potentially be used to help reduce automobile congestion in the city.

Regional Transit Project

A Regional Transit Authority (RTA) was recently formed to address future transit needs for the Puget Sound Area. The RTA is examining options for major expansion of existing bus service, additional bus and carpool facilities, and possibly a high-capacity light rail transit (HCT) system. The HCT would link Seattle, Tacoma, and communities on the eastside of Lake Washington.

One of the HCT alignments under consideration is along Pacific Highway South adjacent to Sea-Tac Airport. The City of SeaTac is developing land use plans for a potential HCT station in the vicinity of the airport terminal as part of its International Boulevard Center Plans.

Noise and Other Environment

Noise Exposure Update
Port of Seattle, June, 1982

The 1982 Noise Exposure Update was an update to the noise analysis presented in the Sea-Tac Communities Plan. Revised noise exposure maps were deemed necessary because of the growth in commuter operations and the growth in the number of individual carriers serving the airport. The study examined existing noise for 1980 and forecasted noise for 1985, 1990, and 2000. The noise projections were an input into the Noise Remedy Program Background Studies (see below).

Noise Remedy Program Background Studies
Port of Seattle (Peat Marwick Mitchell & Co.), January, 1985

The objective of the Noise Remedy Program Background Studies was to evaluate and update the schedule and scope of the aircraft noise remedy program contained in the Sea—Tac Communities Plan. It addressed the noise projections presented in the 1982 Sea-Tac Noise Exposure Update Study and the extent of the progress made toward implementing the original noise remedy program. The study was completed in accordance with the FAR Part 150 guidelines.

The study recommended a noise remedy program which included aircraft operational noise abatement procedures, purchase of noise-impacted homes, a sound insulation program, residential real estate sales assistance, and acquisition of avigation easements by the Port of Seattle. The Port of Seattle Commission unanimously adopted an Updated Noise Remedy Program on January 8, 1985 based on the results of the study.

Airport Noise Mediation Agreement
Noise Mediation Committee (Mestre Greve & Associates), March, 1990

Sea-Tac Airport was the first and only airport in the United States to bring together all parties affected by aircraft noise to work out a consensus-based solution. Citizens from communities throughout the Puget Sound Area, the airlines, Federal Aviation Administration, and the Port of Seattle developed a Noise Mediation Agreement that outlines specific measures to reduce overall airport noise by half by 2001. The agreement went into effect in 1991. It established a noise budget that guarantees that Sea-Tac will move steadily toward a quieter, all Stage 3 aircraft fleet by reducing the amount of noise airlines are allowed to make each year. In 1992, 73% of the aircraft at Sea-Tac were Stage III compared to 59% nationally. A nighttime limitations program to phase out noisier Stage 2 aircraft during nighttime hours was also enacted. In 1990, twenty-two scheduled Stage 2 flights were allowed to operate between midnight and 6 a.m. As of October 1993, no scheduled Stage 2 flights operate between 11:00 p.m. and 6:30 a.m. By October 1995, the agreement calls for the elimination of all scheduled Stage 2 flights between 10 p.m. and 7 a.m.

In addition, the Mediated Noise Agreement called for an increase in the rate of sound insulation for noise-impacted homes, extended full Port/FAA payment of sound insulation to all areas within the Noise Remedy Program area, improved nighttime flight corridors, established better enforcement of ground noise restrictions,

and set-up a state-of-the-art flight track monitoring system. These actions have been implemented and further refinements continue.

FAR Part 150 Airport Noise Exposure Map Update, 1991
Port of Seattle (Barnard Dunkleberg & Co. and Parametrix), April, 1993

The Noise Exposure Map Update is a technical analysis of the noise impacts of 1991 actual aircraft operations and 1996 forecasted operations. Prior Part 150 noise exposure maps were prepared in 1989, 1985 (*Noise Remedy Program Background Studies*), and 1982.

Sea-Tac's Noise Exposure Maps serve several purposes: 1) as a basis for continued Federal Aviation Administration funding of the Port of Seattle's noise mitigation programs; 2) as an assessment of the current and future noise impact of the airport, including the effects of noise mitigation measures proposed in the 1990 Noise Mediation Agreement; and 3) as an aid in future planning for airport noise remedy and abatement programs.

Future aircraft operations were projected to be 403,500 per year in 1996 as derived from the Flight Plan Project forecasts. 75% of the jets in 1996 were assumed to be Stage 3.

The noise contours are predicted to continue shrinking toward the airport. The total number of residents living within the 65 Ldn contour will likely decrease from 67,000 in 1991 to 44,000 in 1996. Acres of non-compatible land uses within 65 Ldn or greater are projected to decrease from 6,920 to 3,761 over the same period.

Airport Ground Noise Study
Port of Seattle (Mestre Greve & Associates), 1994

The Ground Noise Study is intended to provide recommendations for improving the identification, monitoring, and mitigation of ground noise sources at the airport, with a focus on nighttime noise. It will also serve as background information for the Environmental Impact Statement (EIS) on the Airport Master Plan. The study draft report identified the following considerations related to the Airport Master Plan Update: locating taxiways to minimize aircraft noise; possible use of fixed electrical power and pre-conditioned air systems at the gates instead of aircraft auxiliary power units (APUs); possible hushing facilities; and consideration of noise berms. The study is scheduled to be completed in the first half of 1994.

Airport Air Quality Inventory
Port of Seattle (MFG Consultants), 1994

The Air Quality Inventory will provide baseline data on existing air quality conditions in the airport vicinity and will be used to help design detailed air quality analysis in the Environmental Impact Statement (EIS) on the Airport Master Plan. The study is scheduled to be completed during the first half of 1994.

LOCAL, REGIONAL AND STATE PLANS

Seattle-Tacoma International Airport influences and is influenced by the surrounding communities and the greater Puget Sound Region. Facility options for the Airport Master Plan Update will consider local, regional, and state land use and transportation plans. Following is a discussion of relevant off-airport plans and policies.

Washington State Air Transportation Commission (AIRTRAC)

The Air Transportation Commission (AIRTRAC) was created by the State

Legislature in 1990 to recommend statewide air transportation policies. The Commission's mandate was: "to recommend ways to promote a statewide multi-modal transportation system that includes air, stimulate economic development through air transportation, mitigate negative impacts of aviation activities on communities, and to advance the State's competitive position in national and international trade through air transportation." The Commission's final report was made to the Legislature in December 1993.

The Commission noted that Sea-Tac Airport is approaching its airfield capacity and found the demand forecasts developed for the Flight Plan Project to be valid. Alternative modes of travel such as high-speed rail were found to be important, but would not solve air capacity problems. The recommended policies called for: ensuring that existing airport capacity is preserved and that new capacity needs are addressed; pursuing multi-modal alternatives and demand management; reducing future noise impacts and ensuring mitigation of noise impacts; improving the performance of the air transportation infrastructure to support economic development goals; and improving surface access to airports.

A Commission minority report was also prepared which concurred with the majority report, with the exception of calling for a greater State role in air transportation planning and development.

Washington State Growth Management Act (GMA)

King County and the cities within it (along with certain other counties) are required by the State of Washington Growth Management Act to prepare and adopt comprehensive plans. The primary goals of GMA include: 1) reduce sprawl by encouraging development in urban areas; 2) preserve open space and resource lands; 3) encourage multi-modal transportation systems; and 4) encourage economic development. Plans must address land use, transportation, utilities, capital facilities, and housing. The Act further stipulates that city and county comprehensive plans must be coordinated with one another and provide for siting of essential public facilities (including airports). Comprehensive plans are required to be completed by July 1, 1994. Regulations to implement the plans must then be adopted by December 31, 1994. Extensions of these deadlines have been granted in certain cases.

Airport-Vicinity Comprehensive Plans Prepared by King County

Development of communities in the airport area has been guided by several major County planning efforts in addition to comprehensive plans prepared by individual cities. Following is a discussion of plans prepared by King County over the last twenty years. A later section of this report discusses existing city comprehensive plans and updates being conducted under the State Growth Management Act (GMA).

Sea-Tac Communities Plan, 1976

The Sea-Tac Communities Plan was produced jointly by King County and the Port of Seattle. It covered an area of about forty-four square miles around Sea-Tac Airport and addressed the airport's relationship to surrounding communities. A major goal was to achieve land use compatibility. The Plan recommended a comprehensive Airport Noise Remedy Program for residential areas including acquisition or sound insulation of noise-impacted homes. A general land use concept for the airport and immediate vicinity was also developed.

Highline Community Plan, 1977

The Highline Community Plan and subsequent

Highline Community Plan Area Zoning (1981) served to implement the policies and land use concept developed in the Sea-Tac Communities Plan. In addition to the area covered by the Sea-Tac Communities Plan, the Highline Community Plan included the Cities of Des Moines and Burien. Important land use concepts in the Plan included designations for airport-related businesses, highway-oriented commercial uses, and airport open use.

Sea-Tac Area Update and Area Zoning, 1989

The Sea-Tac Area Update and Area Zoning amended portions of the Sea-Tac Communities Plan to further deal with land use compatibility in the immediate vicinity of the airport. It also supplemented and amended policies developed in the Highline Community Plan. The Sea-Tac Area Update planning area was much smaller than either of the two community planning studies and was focused on the area immediately around Sea-Tac Airport. The Update proposed no new residential land and recommended conversion of 200 acres north of the airport from residential designation to airport open use and a 200-acre business park south of the airport in the vicinity of 28th Avenue South.

City Comprehensive Plans

The cities in the airport vicinity are in the process of preparing and adopting updated comprehensive plans in accordance with the State Growth Management Act (GMA). The GMA requires adoption of comprehensive plans by July 1, 1994 with enactment of zoning controls by December 1, 1994. Some extensions have been granted to these deadlines.

Following is a discussion of the existing planning and zoning of the cities near the airport and anticipated land use changes under the new comprehensive plans. Much of this information is derived from the Port of Seattle's 1994 Sea-Tac Airport Vicinity Land Use Inventory Project.

Figure 2 is a map of the airport vicinity communities.

City of Sea-Tac

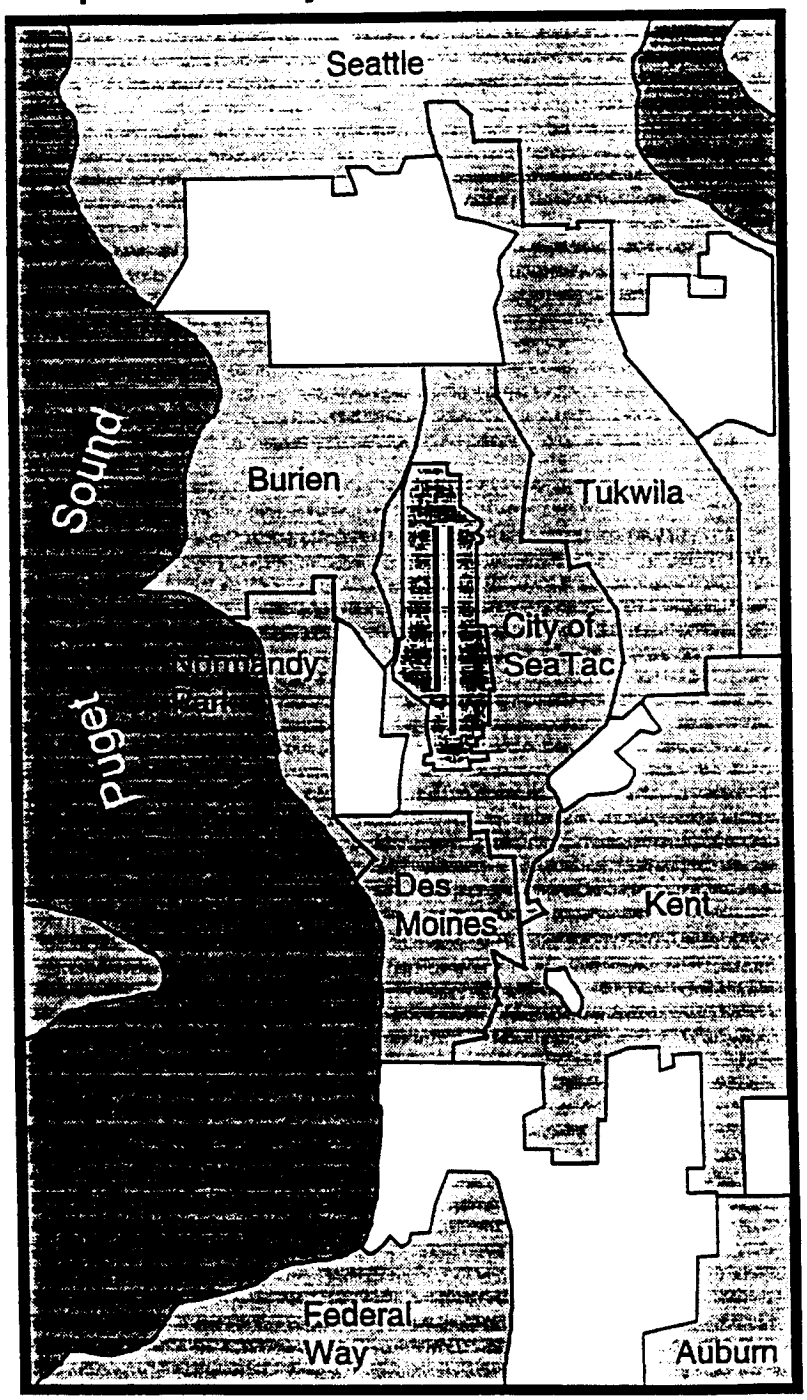
The City, which incorporated in 1990, surrounds Seattle-Tacoma International Airport on all sides. The City adopted the 1985 King County Comprehensive Plan, the 1977 Highline Community Plan, and the 1989 Sea-Tac Area Update and Area Zoning to provide policies and codes until a city comprehensive plan could be prepared.

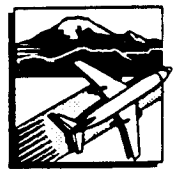
Over two thirds of the land within the City of Sea-Tac is devoted to either airport-related uses or to single family housing. The airport itself and the airport-related areas are zoned "Industrial" and the single-family areas are primarily zoned "Urban Low." Most of the commercial uses and multi-family housing are located along International Boulevard (Pacific Highway South). These are primarily classified as "Community Business," "Urban Medium," or "Urban High." In addition, the City has adopted an "Airport Use" category which permits economic uses and development of areas affected by the airport. South of the airport, a major business park is planned in an area zoned as "Aviation and Business Center." The open space north of the airport is zoned as "Park" for the proposed North SeaTac Park.

The City is preparing a Comprehensive Plan which is scheduled to be adopted by the end of July 1994. Subarea planning efforts for the International Boulevard area east and south of the airport and the Westside subarea west of the airport will be integrated into the Comprehensive Plan.

The draft International Boulevard Center (IBC) plan calls for the location of an urban center in

FIGURE 2
Airport Vicinity Communities





the area east of the airport. Urban centers are regionally-designated areas which would absorb a large portion of the additional population and employment growth of the Puget Sound Region. They are a major portion of the Regional Transportation and Land Use Plan (Vision 2020) and the King County County-Wide Planning Policies. If the International Boulevard area is designated as an urban center, substantial increases in population and employment density would be anticipated. The City is conducting further planning of the IBC area in a study known as the Transit-Supportive Land Use Master Plan.

In the Westside Subarea Plan, the City is evaluating the possibility of converting the residential neighborhood west of the airport to a light industrial park. This is the area in which the proposed new runway at Sea-Tac Airport would be located.

North of the airport, the City is developing the North SeaTac Park on property leased from the Port of Seattle.

Des Moines

The City of Des Moines is located south of the airport, adjacent to the City of SeaTac. Most of the land in Des Moines is developed as single-family residential. Multi-family housing and commercial uses are located in the downtown/ marina area and along Pacific Highway South. The City adopted the Greater Des Moines Comprehensive Plan in 1981 and adopted a revised land use element in 1991. Partially in response to the large growth in multi-family units within the City, the element contains a policy to limit the amount of new multi-family housing. The City's 1991 North Central Neighborhood Plan calls for developing a major business park south of the airport in conjunction with the City of SeaTac. The area is generally bounded by 16th and 24th Avenues South, and South 220th and South 208th Streets. A portion of the area is within the Port of Seattle Noise Remedy Program acquisition area.

Each of the elements of the comprehensive plan are being updated one-by-one. All updates are expected to be completed by the July 1, 1994 GMA deadline. Subsequently, the elements will be assembled and adopted as the City comprehensive plan.

Tukwila

Tukwila lies to the northeast of Sea-Tac Airport adjacent to the City of SeaTac. The City adopted the Tukwila Comprehensive Land Use Policy Plan in 1982. The plan promotes "mutual cooperation between governmental jurisdictions regarding land use decisions to maintain the livability of viable residential areas both inside and outside the Tukwila planning area." The airport is addressed under the Transportation and Utilities policies. This element encourages "an efficient system of air transport which serves both the people and industries of the planning area" while promoting "a harmonious relationship between airports and surrounding land uses."

Tukwila is preparing a comprehensive plan update which is expected to be completed during the first part of 1995. The plan is expected to include a new mixed use area along Pacific Highway South between South 160th and South 128th Streets. Additional multi-family housing and commercial uses are anticipated and would increase the existing development density in this portion of the city.

Seattle

The Seattle city limit is located several miles due north of Sea-Tac Airport. Currently, the City is not operating under a formal comprehensive plan, but rather under a set of policies and a land use/zoning code. The portions of the City which are closest to the airport are along the Duwamish Waterway.

This area is primarily classified as industrial. The City completed a draft Comprehensive Plan and Draft Environmental Impact Statement in 1993 and is in the process of preparing a final plan. Adoption is anticipated in July 1994 with the capital facilities element likely to be deferred until fall. The plan is focusing on concentrating future development into "urban villages." A manufacturing/industrial center is proposed for the Duwamish Area.

Kent

Kent lies several miles southeast of Sea-Tac Airport. The majority of the City is located in the Green River Valley and Kent East Hill away from the airport. The portion of the City closest to the airport is located along Pacific Highway South and is known as the West Hill. The City adopted the West Hill Plan in 1984 as part of its overall comprehensive plan. Most of the area is designated as either "Community Retail," "Limited Commercial/Office," or "Multi-family."

Kent is preparing the land use element of the new comprehensive plan. The land use element will be adopted in early 1994. The City expects that the most significant change in the West Hill area will be encouragement of mixed-use development and thus additional multi-family housing, and potentially a higher housing density along Pacific Highway South.

Federal Way

Federal Way is located approximately several miles south-southwest of Sea-Tac Airport, south of the City of Des Moines. Significant amounts of the western portions of the city are residential. Commercial developments are concentrated along Pacific Highway South and along South 320th Street in the vicinity of Sea-Tac Mall. Following incorporation in 1990, a comprehensive plan was prepared for the new city. The plan is being updated in accordance with the Growth Management Act. One of the land use alternatives being considered in the plan is development of an urban center along South 320th Street west of Interstate 5. A draft of the plan is scheduled to be available by June 1994.

Burien

Burien is located to the northwest of Sea-Tac Airport adjacent to the City of SeaTac. Due to its recent incorporation in 1992, City plans are very preliminary and are just beginning to develop. Burien adopted the land use and circulation element map of the Highline Community Plan as its interim comprehensive plan. None of the policies of the original Highline Community Plan have been adopted. The City comprehensive plan is anticipated to take several years to complete.

Normandy Park

Normandy Park is a primarily residential community located on Puget Sound west-southwest of Sea-Tac Airport adjacent to the City of SeaTac. The City's revised comprehensive plan, adopted in 1987, designates most of the city as low-density single family residential. Small concentrations of commercial and high-density multi-family uses are designated in the vicinity of Southwest Normandy Way and Southwest 200th Street at First Avenue South.

The City is preparing a comprehensive plan update under the Growth Management Act. The City is expected to remain primarily single-family residential with only minor new residential and commercial development in the future. Some additional high-density multi-family housing is planned for the area along First Avenue South described above. The comprehensive plan is scheduled to be adopted in August 1994.

Normandy Park has been considering annexing the unincorporated North Hill area west of the

airport and adjacent to the City of SeaTac. The City of SeaTac has also considered annexing this area.

CONCLUSIONS

A review of past plans prepared for Seattle-Tacoma International Airport indicates a consistent overall concept of the airport's role as a major air carrier airport which provides for needed regional air travel growth while maintaining and enhancing compatibility with the surrounding communities. Maximizing airport efficiency and balancing the airside, landside, and ground access facility needs has also been a common theme. The Airport Master Plan Update will continue these planning philosophies and will rely upon information and results from many of the recent airport and community planning efforts.

The Master Plan Update will provide the Port of Seattle with a framework for future developments at Sea-Tac and will provide neighboring communities and citizens with a clear picture of the airport's future. It will allow communities to anticipate and plan for upcoming changes at the airport. It will also help facilitate continued cooperative land use compatibility planning efforts of communities and the Port.

BIBLIOGRAPHY

BIBLIOGRAPHY

1. *100% Land Use and Development, Seattle-Tacoma International Airport,* Port of Seattle, September, 1962.

2. *28th/24th Avenue South Arterial Project, Draft Environmental Impact Statement,* Cities of SeaTac and Des Moines, November, 1992.

3. *Air Cargo Study, Seattle-Tacoma International Airport,* Port of Seattle, June, 1993.

4. *Air Transportation System Advance Plan, Technical Report No. 1,* Puget Sound Governmental Conference, August, 1968.

5. *Airborne Traffic of Sea-Tac International Airport and its Impact on the Economy of King County,* Port of Seattle, June, 1974.

6. *Airport Capacity Enhancement Plan, Seattle-Tacoma International Airport,* Federal Aviation Administration and Port of Seattle, June, 1991.

7. *Airport Expansion and Improvement Study 1958 - 1967, Current Development Review, Seattle-Tacoma International Airport,* Port of Seattle, June, 1961.

8. *Airport Noise Exposure Map Update: 1991, Seattle-Tacoma International Airport,* Port of Seattle, April, 1993.

9. *Airport Noise Exposure Update, Sea-Tac Airport,* Port of Seattle, June, 1982.

10. *Airport Noise Remedy Program: Background Studies 1983/84, Sea-Tac Airport,* Port of Seattle, January, 1985.

11. *Airport Vicinity Land Use Inventory Project, Final Report,* Port of Seattle, April, 1994.

12. *Airspace Study: Seattle Arrival and Departure Routes; Simulation, Analysis, Recommendations,* Federal Aviation Administration, Northwest Mountain Region, Seattle-Tacoma Tower, 1989.

13. *Comprehensive Planning Review and Airspace Update Study,* Port of Seattle, October, 1988.

14. *Flight Plan Project Draft Final Report and Technical Appendices (Including Draft Programmatic Environmental Impact Statement),* Puget Sound Regional Council and Port of Seattle, January, 1992.

15. *Flight Plan Project Final Environmental Impact Statement,* Puget Sound Regional Council and Port of Seattle, October, 1992.

16. *Flight Plan Project Phase I Forecasts*, Puget Sound Council of Governments and Port of Seattle, July, 1990.

17. *Future Traffic and Parking Requirements and Parking Financial Analysis*, Port of Seattle, April 1968.

18. *History of Seattle-Tacoma International Airport* (brochure), Port of Seattle, July, 1993.

19. *Landside Access Program, Seattle-Tacoma International Airport, Phase I Report*, Port of Seattle, October, 1987.

20. *Major Supplemental Airport Feasibility Study (Request for Qualifications)*, Puget Sound Regional Council, November, 1993.

21. *Market/Economic Feasibility and Space Planning for a Hotel and Office Building Development at Sea-Tac International Airport*, Port of Seattle, January, 1993.

22. *Master Plan Update for Sea-Tac International Airport, Final Report*, Port of Seattle, September, 1985.

23. *Mediated Noise Abatement Actions for Seattle-Tacoma International Airport Agreed to by the Mediation Committee on March 31, 1990 (Final Package)*, Port of Seattle and Noise Mediation Committee, March, 1990.

24. *MLS Demonstration Program at Seattle-Tacoma International Airport, Final Environmental Assessment*, US Department of Transportation, Federal Aviation Administration, June, 1992.

25. *Parking Facilities Expansion, Seattle-Tacoma International Airport, Final Environmental Impact Statement*, Port of Seattle, December, 1988.

26. *Parking Garage Study, Sea-Tac Airport*, Port of Seattle, February, 1981.

27. *Personal Rapid Transit System Feasibility Study (SeaTac People Mover Study)*, Metro, 1991.

28. *Planning for the Airport and Its Environs: The Sea-Tac Success Story*, US Department of Transportation, Federal Aviation Administration, April, 1978.

29. *Practical Annual Aircraft Handling Capacity of the Proposed Runway Configuration at the Seattle-Tacoma International Airport 1970 - 1985*, Port of Seattle, March, 1969.

30. *Resolution No. 3125*, Port of Seattle Commission, November, 1992.

31. *Resolution No. A-93-03*, Puget Sound Regional Council General Assembly, April, 1993.

32. *Runway 16L-34R Safety Area Expansions, Sea-Tac International Airport,* Port of Seattle, December, 1992.

33. *Runway 34R Safety Area Expansion, Sea-Tac International Airport,* Port of Seattle, August, 1993.

34. *Runway Safety Area Expansion Study: Preliminary Engineering Study for Runway 16R-34L, Sea-Tac International Airport,* Port of Seattle, March, 1992.

35. *Sea-Tac Vicinity Development Potential Study,* Port of Seattle, March, 1986.

36. *South Access Roadway Study, Final Report,* South Access Steering Committee, June, 1990.

37. *South Aviation Support Area, Final Environmental Impact Statement,* Federal Aviation Administration and Port of Seattle, March, 1994.

38. *South Aviation Support Area, Technical Appendices,* Federal Aviation Administration and Port of Seattle, March, 1994.

39. *Terminal Development Program, Seattle-Tacoma International Airport,* Port of Seattle, April, 1992.

40. *Third Dependent Runway Preliminary Engineering Study, Seattle-Tacoma International Airport, Scope of Work,* Port of Seattle, October, 1993.

41. *Washington State Air Transportation Commission Minority, A Bolder Response to the State's Needs: Recommendation of the Air Transportation Commission Minority,* Washington State Air Transportation Commission Minority, December, 1993.

42. *Washington State Air Transportation Commission, Executive Summary of Draft Recommendations,* Washington State Air Transportation Commission, September, 1993.

43. *Washington State Air Transportation Commission, Policy Recommendations to the Washington State Legislature, Discussion Draft,* Washington State Air Transportation Commission, November, 1993.

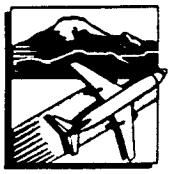
APPENDIX A

SEA-TAC AIRPORT DEVELOPMENT CHRONOLOGY

APPENDIX A

SEA-TAC AIRPORT DEVELOPMENT CHRONOLOGY

1942	Port of Seattle Commission votes to build and operate a regional commercial service airport to serve the Puget Sound Region
1944	Seattle-Tacoma International Airport opens
1949	Passenger Terminal / Administration Building dedicated
1959	North Concourse (now Concourse D) extension completed
1961	South Concourse (now Concourse A) extension completed
	Main runway extended to 11,900 feet
1964	Concourse B completed
1966	Concourse C completed
1967	Extension of Concourse B completed
1968	Construction begins on 9,450-foot second parallel runway
	Work starts on initial phase of $90 million expansion program
	Expansion of Concourse D completed
1970	North Airport Freeway road link to State Route 518 / Interstate 5 is completed
1971	Second parallel runway (Runway 16R / 34L) completed
1973	New Main Terminal, North and South Satellite terminals, and Satellite Transit System completed
	Upper and lower drive system and parking garage completed
1976	Port of Seattle Commission and King County Council adopt Sea-Tac Communities Plan
1983	South Satellite expansion completed (in-transit lounge and four new international arrival gates)



1985	Updated Port of Seattle Noise Remedy Program adopted
1987	Main Terminal expansion completed (north-end ticket counters, public waiting, baggage handling, and concessions)
1990	Sea-Tac Noise Mediation Agreement reached
1992	"First Class Upgrade" program completed (addition of north and south parking garage wings for an additional 3,500 parking stalls, new short-term parking area and pick-up / drop-off plaza, major concourse renovation including six new aircraft gates)
1993	Puget Sound Regional Council adopts a plan calling for a third runway at Sea-Tac and a new major supplemental airport

APPENDIX B

SEA-TAC AIRPORT HISTORICAL PLANNING STUDIES

APPENDIX B

SEA-TAC AIRPORT HISTORICAL PLANNING STUDIES

1969 ***Practical Annual Aircraft Handling Capacity of the Proposed Runway Configuration at the Seattle-Tacoma International Airport 1970 - 1985,*** Port of Seattle, March 1969. This study analyzed the projected capacity and delay of the airfield with two close-spaced parallel runways (the current configuration). It also contemplated a third runway 3,000' long on the northwest part of the airfield to be used by general aviation aircraft.

1968 ***Future Traffic and Parking Requirements and Parking Financial Analysis,*** Port of Seattle, April 1968. The study discussed existing and projected ground travel demand at the airport and discussed plans for constructing a parking garage (the current garage) in two phases.

1968 ***Air Transportation System Advance Plan, Technical Report No. 1,*** Puget Sound Governmental Conference, August 1968. Recommended a new supplemental airport on the Kitsap Peninsula.

1967 ***Airport Comprehensive Plan,*** Port of Seattle, March 1967. Included passenger terminal expansion, terminal and access roadways, parking facilities, and runway construction.

1962 ***Seattle-Tacoma International Airport 100% Land Use and Development,*** Port of Seattle, September 1962. Subsequent to the *Expansion and Improvement Study 1958 - 1967,* this study was intended to be a concept master plan for all airfield facilities. Particularly, it sought to balance cargo facility needs with passenger terminal development and included a plan concept for the north and south satellite terminals. It also discussed the possibility of adding a second parallel runway to help meet air traffic needs into the 1970's.

1961 ***Sea-Tac Airport Expansion and Improvement Study 1958 - 1967,*** Port of Seattle, June 1961. The study served as a master plan for the development of the passenger terminal during the 1960's. It guided extensions of the North and South concourses (now Concourses A & D) and extension of the South Central Concourse (now Concourse B) as well as enhancements of the main terminal area and the airport drives.

Attachment B

to Resolution No. 3212,
as Amended

TECHNICAL REPORT NO. 8
ASTER PLAN UPDATE FINAL REPO

AIRPORT MASTER PLAN UPDATE

F O R

SEATTLE-TACOMA INTERNATIONAL AIRPORT

P&D Aviation

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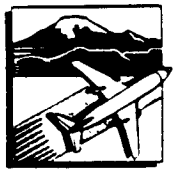

TECHNICAL REPORT NO. 8
MASTER PLAN UPDATE FINAL REPORT

AIRPORT MASTER PLAN UPDATE FOR SEATTLE - TACOMA INTERNATIONAL AIRPORT

Prepared by:

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Prepared for:

The Port of Seattle

JANUARY 1996

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TECHNICAL REPORT NO. 8
MASTER PLAN UPDATE FINAL REPORT

TABLE OF CONTENTS

Section		Page
1	EXECUTIVE SUMMARY	1-1
	Concepts Considered and Selection of Options for Final Evaluation (Section 3 of this Report)	1-1
	Evaluation of Final Alternatives (Section 4 of this Report)	1-3
	Airport Development Recommendations and Policy Issues (Section 5 of this Report)	1-3
	Financial Analyses of Recommended Master Plan Improvements (Section 6 of this Report)	1-9
	Contents of this Report	1-9
2	INTRODUCTION	2-1
	Background	2-1
	Project Objectives	2-3
	Scope of Study, Schedule and Documentation	2-5
	Planning Team Composition	2-7
3	CONCEPTS CONSIDERED AND SELECTION OF ALTERNATIVES FOR FINAL EVALUATION	3-1
	Approach	3-1
	Initial Concepts	3-2
	Selection of Alternatives for Final Evaluation	3-19
4	EVALUATION OF FINAL ALTERNATIVES	4-1
	Approach	4-1
	Terminal Options Evaluation	4-1
	Runway Options Evaluation	4-10
	Summary of Options Evaluations	4-14
5	AIRPORT DEVELOPMENT RECOMMENDATIONS AND POLICY ISSUES	5-1
	Recommended Master Plan Development	5-1
	Description of Master Plan Recommendations and Policy Issues	5-5
	Phasing of Improvements	5-22
	Capital Cost Estimates of Recommended Improvements	5-25

TECHNICAL REPORT NO. 8
MASTER PLAN UPDATE FINAL REPORT

TABLE OF CONTENTS

Section		Page
6	FINANCIAL ANALYSIS	6-1
	Introduction	6-1
	Baseline Capital Program	6-1
	Financing Aviation Improvements	6-3
	Financial Analysis of Baseline Capital Program	6-9
	Financial Strategies	6-15
	Financially Constrained Scenario, An Illustrative Example	6-25
	Summary of Findings	6-27

TECHNICAL REPORT NO. 8
MASTER PLAN UPDATE FINAL REPORT

LIST OF TABLES

Table		Page
3-1	Evaluation Summary of Master Plan Update Airside Concepts	3-7
3-2	Terminal Concept Evaluation Matrix	3-14
4-1	Terminal Options Comparative Evaluation Summary	4-2
4-2	Runway Options Comparative Evaluation Summary	4-11
5-1	Aircraft Parking Restrictions for Dual Parallel Apron Taxiways	5-8
5-2	Capital Cost Estimates for Recommended Airport Master Plan Improvements, 1996 to 2020	5-26
6-1	Capital Cost Summary	6-2
6-2	Cost Per Enplanement Projections, U.S. Peer Airport Comparison	6-2
6-3	Operating Cost Summary	6-13
6-4	Operating Cost Distribution by Line of Business	6-13
6-5	Estimated Capital Funding Program, Demand Driven Scenario	6-14
6-6	Financial Implications of Master Plan Development	6-14
6-7	Impact of Potential Program Reductions 7,500 Foot Runway Scenario	6-19
6-8	Impact of Deferred Cost Program	6-21
6-9	Impact of Accelerated Parking Development	6-23
6-10	Impact of Maximum Third Party Financing	6-26
6-11	Estimated Capital Funding Program, Financially Constrained Scenario	6-26
6-12	Financial Implications of Master Plan Development, Financially Constrained Scenario	6-28

TECHNICAL REPORT NO. 8
MASTER PLAN UPDATE FINAL REPORT

LIST OF FIGURES

Figure		Page
3-1	Third Runway Options	3-3
3-2	North Unit Terminal Option	3-15
3-3	Central Terminal Option	3-16
3-4	South Unit Terminal Option	3-17
3-5	Central Terminal Master Plan Alternative	3-20
3-6	North Unit Terminal Master Plan Alternative	3-21
3-7	South Unit Terminal Master Plan Alternative	3-22
5-1	Recommended Airport Master Plan	5-2
5-2	Recommended Terminal Plan	5-3
6-1	Projected Operating Revenues, Demand-Driven Scenario	6-16
6-2	Projected Operating Revenues, Financially-Constrained Scenario	6-16

Section 1
EXECUTIVE SUMMARY

SECTION 1
EXECUTIVE SUMMARY

This section summarizes the approach and principal findings of the evaluation of Airport Master Plan alternatives and the Master Plan recommendations through the year 2020. This summary is organized according to the remaining technical sections of this report. The following topics are addressed:

- Initial concepts considered for airside, terminal and other facility improvements.
- Selection and evaluation of final Master Plan alternatives.
- Airport development recommendations and policy issues.
- Financial analysis of recommended Master Plan improvements.

CONCEPTS CONSIDERED AND SELECTION OF OPTIONS FOR FINAL EVALUATION (SECTION 3 OF THIS REPORT)

Approach

Under each of the three primary airport functional areas (airside, terminal/access and other functional areas), a number of concepts were initially examined and narrowed to several airside and terminal/access options. These options were evaluated by the consultants and Port of Seattle staff. From these evaluations, the improvement options were refined and "packaged" into three airport development alternatives for further analysis.

Initial Concepts

Airside Concepts. Eight initial airfield concepts were developed and evaluated (a "no airfield improvements" concept and seven improvement concepts). The improvement concepts all contained a new parallel runway with lengths varying from 5,200 feet to 8,500 feet and with separations from the existing Runway 16L-34R of 1,500 feet, 2,500 feet and 3,300 feet. Evaluation criteria for the airfield concepts consisted of aircraft delay measures, development costs, and preliminary environmental screening measures.

When comparing the concepts for a new runway separated 2,500 feet from Runway 16L-34R, delay savings and the percent of operations accommodated were found to increase as runway length increases. The greatest delay savings occur for Airside Concept 5 (a new 8,500 foot runway). When compared to the next best concept (a 7,500 foot runway), it was found that Concept 5 provides additional savings ranging from $1.2 million to $1.5 million. Estimates of delay savings are based upon airfield simulation studies conducted as part of the FAA Capacity Enhancement Task Force. These additional savings coincide with activity levels ranging from 345,000 operations up to a level of 425,000 annual operations. Beyond a level of 425,000 operations, the additional annual savings escalates at a much more rapid rate to over $12 million at an activity level of 525,000 annual aircraft operations. It is important to note that these projections of delay savings calculated by the FAA Task Force reflected a constant aircraft fleet mix. The master plan has assumed a mix containing more and more heavy aircraft over time, as contained in the aviation demand forecasts (Technical Report No. 5). Though the Task Force delay estimates may be somewhat conservative, should additional heavy aircraft enter the fleet mix as

forecast, the savings in annual delay would be even greater. For these reasons, Airside Concept 5 was recommended as the preferred airside alternative for ultimate development. However, runway lengths of 7,000 and 7,500 feet were also evaluated in the final alternatives analysis.

Terminal/Access Concepts. Terminal/access development concepts were organized into three general development areas: to the north, south and center of the existing terminal area. Five terminal development concepts for the south site, one for the central location, and four for the north site were investigated. Several derivatives were examined to test slight modifications.

A preliminary evaluation was performed on each of the terminal concepts and the highest scoring option from each group was identified for further refinement and evaluation. These three options were a South Unit Terminal option, in which a new terminal would be constructed south of the existing terminal connected by Concourse A and the Satellite Terminals would be expanded, Central Terminal option in which the main terminal and Satellite Terminals would be expanded, and a North Unit Terminal option in which a new terminal would be constructed north of the existing terminal with extension of the North Satellite. Subsequent analysis recommended the North Unit Terminal concept include two concourses extending perpendicular from the new North Terminal and no Satellite extensions. This effectively reduced costs to be comparable with the Central Terminal option.

Concepts for Other Facilities. The two primary components of other facilities are air cargo and aircraft maintenance facilities. Concepts considered for accommodating future cargo requirements were developing a centralized complex at one location (the South Aviation Support Area or a north site) or a decentralized complex by siting facilities at various locations. It was concluded that accommodating a centralized cargo complex was not feasible given space constraints and a decentralized concept is recommended in which the existing cargo area would be modified and expanded through 2010. After 2010, the cargo facilities can be developed in the South Aviation Support Area (SASA).

Three potential sites were investigated for new airlines facilities and airline aircraft maintenance facilities that would be relocated due to terminal expansion. Of the three locations evaluated, only the SASA site was determined to be feasible. The ultimate redevelopment of certain displaced facilities will depend upon the need as determined by the respective carrier.

Selection of Options for Final Evaluation

A "Do Nothing" and three development options were carried forward for a more detailed assessment in the Airport Master Plan Update and the Draft Environment Impact Statement (EIS) for the Airport Master Plan Update.

- ***Alternative 1, Do Nothing/No Build.*** The Airport Master Plan Update requirements would not be addressed in the Do Nothing alternative.

- ***Alternative 2, Central Terminal (Figure 3-5).*** This alternative would include a new dependent (2,500-foot separation from Runway 16L-34R) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R; fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development for centralized terminal facilities; and completion of the SASA.

- ***Alternative 3, North Unit Terminal (Figure 3-6).*** This alternative would include a new dependent (2,500-foot separation from Runway 16L-34R) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R; fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development in a north unit terminal configuration and completion of the SASA.

- ***Alternative 4, South Unit Terminal (Figure 3-7).*** This alternative would include a new dependent (2,500-foot separation from Runway 16L-34R) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R, fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development in a south unit terminal configuration; and completion of the SASA.

EVALUATION OF FINAL ALTERNATIVES (SECTION 4 OF THIS REPORT)

Section 4 presents the evaluation of alternatives including criteria, methodologies and conclusions. The three final airport development options were evaluated extensively in the Airport Master Plan Update as well as the Draft Environment Impact Statement. The terminal and runway components of the three airport development alternatives were addressed separately because runway options were not tied to terminal options.

Terminal Options Summary

Terminal options were evaluated on 18 factors which covered airline/aircraft operations, passenger and terminal services, ground access, environmental, acquisition and construction costs, and constructability considerations. The North Unit Terminal Option clearly ranked above the South Unit Terminal and Central Terminal Options, particularly with regard to phasing. Although the Central Terminal Option ranked best under three criteria, the North Unit Terminal Option ranked equal or better than the Central Terminal Option in all of the remaining 15 evaluation criteria.

Runway Options Summary

An 8,500 foot runway would be sufficiently long to accommodate 99 percent of all arrivals by the types of aircraft projected for Sea-Tac, and 90 percent of all departures by aircraft types projected for Sea-Tac. These will account for approximately 12 percent of total operations. Furthermore, the pilot rejection rate is expected to be negligible. For these reasons an 8,500-foot runway would provide maximum efficiency in aircraft flow and therefore allow the greatest benefit in minimizing aircraft delays and flexibility in runway use.

Although the 8,500-foot option would be more expensive and have slightly greater environmental impacts than the shorter runway options, the added expense of the 8,500 foot runway could be financially feasible and could offset potentially higher construction costs of an extension at a later date should a shorter runway be initially built. Further, the incremental increase in environmental impacts could be more than offset by aeronautical benefits. A runway length of up to 8,500 feet pending final design is preferred as the ultimate runway development option. It is feasible however to construct a new runway in stages with the first stage being 7,500 feet in length.

AIRPORT DEVELOPMENT RECOMMENDATIONS AND POLICY ISSUES (SECTION 5 OF THIS REPORT)

The North Unit Terminal offers the following

advantages over other terminal options:

- Lowest overall cost per new aircraft gate.
- Shorter walking distances from parking areas and curbs to the aircraft gates.
- Adequate curb frontage to meet future traveler demands.
- Relief of vehicle congestion on the existing terminal drives.
- Minimum traffic impacts in the City of Sea-Tac.
- Greater flexibility for aircraft gate and terminal expansion beyond the year 2020.
- Less aircraft taxiing congestion around the terminals.
- Preservation of the Alaska and Delta Airlines maintenance hangars and postponement of the need for full build out of the South Aviation Support Area (SASA) site.
- No impact to City of Sea-Tac tax base by virtue of no additional property acquisition. Impacts on the commercial corner of International Blvd. and South 188th Street.
- Less passenger disruption and inconvenience during construction.

Runway Length Recommendation

An 8,500-foot runway would maximize the operational benefit of having a second poor-weather arrival stream provided by adding a new runway. A runway length of 8,500 feet offers several benefits when compared with the 7,000-foot and 7,500-foot options.

- Sufficient landing length for 99 percent of the types of aircraft anticipated to use Sea-Tac in the future (compared to 96 percent for a 7,500-foot runway and 91 percent for a 7,000-foot runway). This becomes increasingly important because more larger size aircraft will be using Sea-Tac.
- Lesser rejection by pilots opting to use the existing long runway. The Air Transport Association and extensive discussion with airline pilots support an 8,500-foot runway.
- Increased aircraft delay savings potential by accommodating more aircraft types and by reducing air traffic controller work loads associated with pilot rejection and cross over "sorting" associated with different aircraft operational requirements.
- Sufficient departure length for 90 percent of the types of aircraft anticipated to use Sea-Tac in the future (compared to 85 percent for a 7,500-foot runway and 77 percent for a 7,000-foot runway) which provides increased operational flexibility for the overall airfield.
- Provides the highest safety margin during poor weather landings (which is when the runway would be used the most).
- Greater flexibility in aircraft operations if one of the other runways is closed for maintenance or an emergency. Maintenance costs on the existing runways could be reduced by reducing the need for expensive nighttime work as is currently done.
- The additional environmental impacts of an 8,500-foot runway are minimal and can be sufficiently mitigated, as described in the Environmental Impact Statement.

Facility Improvements

The Master Plan Update proposes the following facility improvements:

- A new Runway 16X-34X with an ultimate length up to 8,500 feet pending final design. The runway would be equipped to enable Category IIIb precision approaches on 16X with Cat I capability on 34X. Instrumentation would include a glide slope, localizer, RVRs, PAPI, ALSF-II/ALSF-I, and inner/middle,outer approach markers:
  - Relocation of the Airport Surveillance Radar (ASR) and Airport Surface Detection Equipment (ASDE)
  - Relocation of South 156th Way and 154th Street South
- A midfield overnight aircraft parking apron between the new runway and Runway 16R-34L
- Construction of a new Air Traffic Control Tower and TRACON
- Installation of a Cat III ILS on Runway 16L (localizer, glideslope, middle marker, and ALSF-II)
- Extension of dual parallel Taxiways A and B the full length of Runway 16L-34R and taxiway bridge over 188th Avenue South
- Additional taxiway exits on existing runways
- Extension of Runway 34R by 600 feet and relocation of the glideslope
- Remove displaced threshold from Runway 16L.
- Clearance, grading and development of expanded Runway Safety Areas at each runway end
- Limited expansion of 4-6 gates on Concourse A and the Main Terminal
  - Relocation of Northwest flight kitchen
  - Possible development of displaced Northwest aircraft maintenance facilities in the SASA
  - Development of the by-pass roadway connecting the New North Unit Terminal with 188th Street South at 24th Street
  - Expansion of the Central Parking Garage
  - Development of an On-Airport hotel on Concourse D adjacent to the terminal
- Development of the North Unit Terminal
  - Development of the North Unit Terminal access system
  - Development of access ramps from SR 518 at 20th Avenue for access to the existing cargo area and new cargo facilities
  - Potential overhaul of the Satellite Transit System (currently under separate study)
  - Displacement of the Doug Fox Parking facility
  - Relocation of the U.S. Post Office Air Mail Facility to SASA
  - Relocation of the ARFF to the existing UAL air cargo area

- Potential relocation of Airborne cargo for an alternate site for the construction of the Air Traffic Control facility
- Development of a cargo warehouse north of SR 518 east of 24th Avenue South
- Development of the SASA:
  - If required, relocate Northwest hangar
  - Expansion capacity for cargo/maintenance (as dictated by demand)
  - Cargo facility for 11 hardstand positions
  - Ground support equipment area
  - Replacement Air Mail Facility (as dictated by demand)
- Development of additional airport employee parking north of SR 518 west of 24th Avenue South
- Development of a new airport maintenance facility at Cater Air, or other possible locations in the terminal area
- Development of a new snow equipment storage site between the RPZs of Runways 34L and 34X (subject to a separate study of the feasibility of this site)
- Development of new general and corporate aviation facilities in SASA or alternatively between the RPZs of Runways 16R and 16X (subject to further study)

It is important to note that the ultimate relocation of certain facilities indicated above are somewhat uncertain, and will depend upon the need for the facility as decided by a private company or other agencies.

In addition to the Airport Master Plan improvements, some infrastructure renewal and replacement projects will be needed over the planning period, such as electrical, industrial waste systems and fueling systems. These programs would include maintenance and replacement of existing facilities and would be required regardless of the Master Plan improvements. Both the Master Plan and infrastructure renewal/replacement projects will be subject to the Business Planning and budgeting process in terms of priorities and available dollars. The financial analysis described in this report accounts for the infrastructure renewal/replacement projects which are currently budgeted but these projects are not discussed further in this report.

It is also noteworthy to mention the potential for incorporating commercial development above certain airport facilities recommended in the master plan. There may be potential on top of existing or proposed facilities to develop non-aviation commercial uses. The potential is especially attractive for new facilities where provision for these uses can be incorporated during the design stage. Possible uses would include, but not be limited to, hotels, restaurants, specialty shops, office space, etc. When incorporating such vertical development on the airport obstruction standards contained in FAR Part 77, Objects Affecting Navigable Airspace, must be addressed, as well as TERPS.

Phasing

The development of facility improvements identified in the master plan are expected to be implemented in phases over the planning period. The phasing suggested in the master plan is based on projected traffic levels contained in the forecasts of aviation demand, and attainment of these levels. It cannot be overemphasized that where development is recommended based upon demand or traffic levels, it is ***actual***, not

forecast, demand that dictates the timing of construction. However, for planning purposes, a schedule must be provided and this schedule is based upon the forecasts of traffic contained in Technical Report No. 5.

It is also important to point out that the schedule of improvements proposed in this plan is contingent upon the availability of Federal, State, and local funds and private investment. While improvements are scheduled for specific phases in this report, it should be remembered that they must be reconciled with budgetary considerations of various public and private entities. Thus, the implementation will depend upon funding and business planning considerations, as well as the attainment of the projected traffic levels.

The timing of the above described improvements suggested in the master plan is set forth below. As described in the Introduction, the phasing of specific facility improvements is contingent upon further planning by the Port, and the following phasing is presented as a guideline to assist in the financial feasibility analysis. The traffic levels (in million annual passengers) associated with each development phase are indicated in parenthesis.

Phase 1 22 - 24 MAP (1996-2000)

- Airfield
  - Begin construction new 8,500 foot Runway 16X-34X
  - Construct expanded Runway Safety Areas for Runways 16L, 16R, and 34R
  - Construct first phase of RON apron between new runway and Runway 16R-34L
  - Develop dual parallel Taxiways A and B on south end (includes taxiway bridge over 188th Avenue South)
- Buildings and Access
  - Construct new Air Traffic Control Tower and TRACON. (Depending on the site this may require relocation of Airborne Air Freight facilities)
  - Expand Concourse A and Main Terminal
  - Construct additional cargo facilities in existing cargo area
  - Construct new snow equipment storage facility between RPZs of Runways 34L and 34X
  - Construct new general aviation facilities impacted by new runway construction
  - Construct GSE facility
  - Expand existing parking garage
  - Construct access and circulation improvements at the Main Terminal
  - Construct airport employee parking north of SR 518 (to be expanded as required in each subsequent phase)

Phase 2 24 - 27 MAP (2001-2005)

- Airfield
  - Complete construction of Runway 16X-34X
  - Expand RON apron between new runway and Runway 16R-34L

- Buildings and Access
  - Expand Main Terminal at Concourse A
  - Construct site improvements in cargo area
  - Construct new airport maintenance facility
  - Expand existing parking garage
  - Construct access and circulation improvements at Main Terminal

Phase 3 27 - 31 MAP (2006-2010)

- Buildings and Access
  - Construct first phase of North Unit Terminal (terminal and concourse) and parking structure
  - Construct site improvements in cargo area
  - Construct new ARFF facility
  - Construct access and circulation improvements for North Unit Terminal

Phase 4 31 - 34 MAP (2011-2015)

- Airfield
  - Construct exit taxiways on Runway 16L-34R
- Buildings and Access
  - Expand North Unit Terminal (gates on south side of north concourse)
  - Develop cargo apron and other site improvements for cargo in SASA
  - Expand North Unit Terminal parking structure

Phase 5 34 - 38 MAP (2016-2020)

- Airfield
  - Extend Runway 34R and dual parallel taxiway 600 feet
- Buildings and Access
  - Expand North Unit Terminal (gates on north side of north concourse)
  - Expand cargo facilities in SASA
  - Expand North Unit Terminal parking structure

Section 6 of this report describes the 5 lines of business (LOB) that the POS Aviation Division has organized as a result of a recent business planning process conducted by the Port. Each LOB has responsibility over a key operating area, which are identified as Airfield, Terminal, Concessions, Ground Access, and Commercial Properties. It should be noted that the decision to implement recommendations of the master plan will ultimately rest with one of the five LOB. A primary objective of the master planning process is to identify when facilities are required in response to demand levels, and to protect for such development by identifying suitable locations on the airport. The LOB decisions to implement master plan recommendations will consider actual demand as it materializes, and within the context of the policies and goals established for a particular LOB.

FINANCIAL ANALYSES OF RECOMMENDED MASTER PLAN IMPROVEMENTS (SECTION 6 OF THIS REPORT)

Baseline (Demand-Driven) Scenario

A financial analyses was initially prepared for the baseline Airport Master Plan program, in which capital projects are scheduled according to projected activity demand levels developed from the master plan forecast. Funding the baseline program would result in an increase in the airlines' Cost Per Enplanement (CPE). Measured in current dollars the CPE for the baseline program in the year 2000 would reach $11.53, compared with the current Port of Seattle policy of $7.35.

Financially Constrained Scenario

Although there is adequate financial capacity to fund the Master Plan improvements, much of the capacity is in the later years of the planning horizon. The implication of this analyses is that mechanisms are available that could reduce the costs of the program and the CPE for the airlines. A number of strategies were suggested and analyzed to reduce the CPE to the target level of $7.35. These included program cost reductions, changes in program phasing, non-airline revenue enhancements, and non-traditional financing mechanisms such as private sector investment.

Combining some of these strategies could provide a scenario that fits within the Port's general financial objectives. One such financially constrained scenario was evaluated, reflecting the following changes: deferring half of the Phase 1 (through the year 2000) airline capital costs into the second phase, providing parking facilities based on an accelerated development schedule, and assuming the maximum use of outside financing. The financially constrained scenario reduces the CPE in the year 2000 to $7.50, higher than the Port policy target by fifteen cents. The analyses shows that the Master Plan program can be developed within the financial constraints of the Port of Seattle by adopting policies to further defer costs or reduce costs.

In actuality, the Port recently adopted a Business Plan which has already made many of the adjustments discussed above. With those adjustments, the Port's target of a $7.35 CPE has been met.

In addition, airline (passenger and cargo) requirements are driven by forecast levels of demand measured against general planning parameters and levels of service. The degree and timing of physical development will ultimately depend on actual demand levels, the nature of a particular airline's operation, the ability and/or willingness of an airline(s) to financially support the development and actual levels of service.

CONTENTS OF THIS REPORT

This report documents the evaluation of airport master plan alternatives and presents recommendations for facility improvements to the year 2020.

- Section 1 Executive Summary
- Section 2 Introduction
- Section 3 Concepts Considered and Selection of Options for Final Evaluation
- Section 4 Evaluation of Final Alternatives
- Section 5 Airport Development Recommendations and Policy Issues
- Section 6 Financial Analysis of Recommended Master Plan Improvements

Section 2
INTRODUCTION

SECTION 2
INTRODUCTION

BACKGROUND

The population of the Puget Sound region is growing at twice the U.S. average. Governments through the region are anticipating that growth, and plans for new highway construction, rail transportation, and urban boundaries are just a few of the programs that have demanded their attention over the past several years.

Seattle-Tacoma International Airport, which is owned and operated by the Port of Seattle, is no exception. Since 1989, local governments from throughout the region have been involved in evaluating Sea-Tac's ability to accommodate regional growth.

In 1993, elected officials from the four counties surrounding Puget Sound, an organization called the Puget Sound Regional Council (PSRC), completed an extensive assessment of the region's airports. This work resulted in two major conclusions:

- The Port of Seattle should plan for, and evaluate the environmental effects of, adding a third runway and other improvements to serve regional transportation needs at Sea-Tac Airport.
- At the same time, the regional governments should continue to look for an area where a major supplemental airport could be built.

In accordance with the regional decision, the Port of Seattle began two major planning efforts in late 1993: a Master Plan Update, and in conjunction with the FAA, an Environmental Impact Statement. Final decisions resulting from these studies will be made by Port of Seattle Commissioners and the FAA. This report documents the principal findings of the Airport Master Plan Update.

Airport Master Plan Update

The Sea-Tac Airport Master Plan Update is a comprehensive planning study that will determine how Sea-Tac can best accommodate the growing number of passengers and air cargo volumes. The Master Plan has been designed to answer the following kinds of questions:

- What is the projected passenger growth at Sea-Tac? How much has traffic grown, and what changes can we anticipate for the future?
- What can be done to alleviate the aircraft delays that occur now during bad weather?
- How can the airport remain user friendly? What needs to be done to keep it as easy as possible for passengers to get in, park and get to their airline gate?
- Is there a need for a new runway? If so, how long should it be and where should it be located?
- As the number of passengers increases, what needs to be done to handle roadway congestion? What terminal expansion is needed?
- Would high-speed trains make a difference in airline travel?
- How can the aircraft using the airport be managed in a way that reduces the need for new construction? Will regulating the time

of day during which planes can take off and land--"demand management"--work?

Master Planning Approach and Concepts

There were a number of important concepts that were fundamental to the master planning approach:

- The proposed Master Plan makes maximum use of existing facilities.
- Facility improvements are designed to be consistent with the Airport Business Plan and provide for the enhancement of airport revenues.
- Future airport facility improvements will be timed and sized according to aviation demand based on future demographics and economics of the Region.
- Consistency with other Local and Regional plans will be pursued, such as plans by the City of SeaTac, King County and the Puget Sound Regional Council.
- The Airport Master Plan contains a layout plan of all recommended new facilities. This layout, especially with respect to the North Unit Terminal improvements and the South Airport Support Area (SASA), is conceptual and subject to further refinement in subsequent planning and design efforts.
- The phasing of future improvements described in the Master Plan is subject to further refinement and modification. For example, the phasing of new terminal facilities could be revised upon further study to begin with a new North Unit Terminal, rather than deferring that development until after the existing terminal is expanded. Any new airport development will be triggered by need (such as passenger or aircraft operations growth) rather than fixed time periods.

Planning Process

This report, Technical Report No. 8, one of a series of reports prepared as part of the Master Plan Update, discusses this evaluation procedure and describes the recommended Master Plan improvements. A listing of all technical reports prepared during the Master Plan Update Study appears later in this section. Technical Report No. 8 documents the final planning analyses including refinements to recommendations of previous technical reports.

The process by which various development alternatives at Sea-Tac were evaluated consisted of examining concepts for improvements to each functional area of the airport, combining the best features of the concepts to form several options for the development of the entire airport, then evaluating these airport-wide alternatives as a whole. Three airport functional areas were considered in the initial concept analysis:

- Airside, including the evaluation of a third runway, other runway improvements, taxiway improvements, safety area improvements, and navigational aids (described in Technical Report No. 6, Airside Options Evaluation, September 19, 1994).
- Terminal and access, including improvements to the existing terminal, terminal expansion and new terminals, expansion of aircraft parking apron, vehicle circulation, airport access improvements, and vehicle parking (described in Technical Report No. 7A, Terminal Options Evaluation, February 17, 1995).
- Other airport facilities, including air cargo, aircraft maintenance facilities, airport

rescue and fire fighting, general aviation, air traffic control tower, airport maintenance and administration, and other airport tenant areas (described in Technical Report No. 7B, Other Facilities Requirements and Options, February 24, 1995).

Requirements for the three airport functional areas were developed. Options for each element which would satisfy the established requirements to varying degrees were prepared and evaluated. From these evaluations, three composite Master Plan alternatives were developed and evaluated according to a range of aviation, environmental and economic criteria. From this evaluation, a recommended master plan of development was prepared. A financial analysis of the Master Plan considered development priorities and a recommended phasing of projects resulted.

PROJECT OBJECTIVES

The overall objective of the Master Plan Update Study is to "prepare a comprehensive Airport Master Plan [Update] for the airside, terminal, and landside facilities needed at Sea-Tac to meet air travel demand to the year 2020 and beyond." Specifically, the Airport Master Plan Update and related studies have fulfilled the relevant objectives stated in Port Resolution 3125. Citations of objectives from this resolution with an explanation of how each has been addressed in the Airport Master Plan Update are as follows:

- *Design a mechanism and process to promote [land use and community] compatibility through improved coordination, communication and involvement.* An extensive public involvement program was developed for the Airport Master Plan Update to allow participation of the public in the planning process. Elements of the public involvement program included 11 public workshops and meetings, public opinion surveys, telephone hotline, E-mail service and dissemination of project findings through newsletters and technical reports. Also included were meetings with technical committees, the Planners Forum, and various airline committees and briefings of elected officials and local community groups. A separate, but similar public process was conducted as part of the EIS in accordance with NEPA and SEPA requirements.

- *In addition to the third runway studies, include a reconsideration of a fast rail system together with diversion of all cargo carriers.* The potential diversion of Sea-Tac passengers to high-speed rail service was studied and documented in the following Airport Master Plan Update report: Potential diversion of Sea-Tac Airport Passengers to High Speed Ground Transportation, November 4,1994. The study concluded that, at most, 4.3 percent of Sea-Tac aircraft operations in 2020 could be eliminated due to passengers using a high-speed rail system if it were available connecting Sea-Tac with Vancouver, B.C., Portland, Oregon and Spokane, Washington. Diversion of cargo carriers to another airport was determined to be infeasible because much of the air cargo at Sea-Tac is shipped by carriers (Alaska Airlines and Northwest Airlines) which ship their cargo on passenger and combi flights as well as all-cargo flights. Furthermore, eliminating cargo flights would have little effect on airfield delays at Sea-Tac because cargo flights operate less frequently during the peak hours.

- *Fully explore the impacts of peak period pricing and other demand management techniques.* Peak period pricing and other passenger demand management approaches available to the Port of Seattle were

thoroughly investigated and documented in two Airport Master Plan Update reports: Preliminary Report on Demand Management to the Puget Sound Regional Council Expert Arbitration Panel, November 30, 1994 and Information on Demand/System Management Issues Requested by the Puget Sound Regional Council Expert Panel, April 13, 1995. These studies concluded that peak period pricing or other demand management techniques would not significantly redistribute or reduce passenger demand to effectively reduce the airfield capacity shortfall and aircraft operating delays. These conclusions were discussed in two public hearings convened by the Puget Sound Regional Council's Expert Panel and were accepted by the Expert Panel.

- *Explore land acquisition and redevelopment to compatible uses.* The Port of Seattle currently owns about 800 acres of land around the Airport which does not have direct access to the airfield. Much of this property can be redeveloped and the Port is actively pursuing development in compatible uses. For example, the Port and the City of Des Moines are currently pursuing development of the Des Moines Creek Technology Campus, a business park, on 90 acres of Port property in the City of Des Moines.

- *Attenuate airport noise through the use of berms and barriers.* Pending the final outcomes of the Master Plan Update and the Environmental Impact Statement on the update, the Draft Ground Noise Study (February 1994) conducted by the Port recommends further evaluation of the noise reduction benefits by installing berms on the western boundary of the airport. In addition, the Airport Master Plan EIS found that future noise exposure with the recommended Master Plan improvements will be less than the current noise exposure. This decline is expected due to the Port's noise reduction program and the federal mandate to phase out Stage 2 aircraft no later than the year 2003.

  Nevertheless, measures now in effect to reduce aircraft noise within the community will be continued in an effort to assure the minimization, to the extent practical, of existing and future noise levels. The measures in effect to the year 2000 include:

  - Noise Budget - limiting the total noise energy carriers may generate at the airport until the fleet is substantially at Stage 3.

  - Nighttime Limitations Program - limiting the hours of operation for Stage 2 aircraft.

  Ongoing programs include:

  - Pilot Program for Schools - soundproofing school buildings.

  - Ground Noise Control - reducing the noise of ground events such as powerback operations and run-ups.

  - Flight Corridorization - maintenance of runway heading flight tracks by departing jets until reaching specified altitudes.

  - Flight Track and Noise Monitoring - maintenance of records of noise levels and flight track location information for identification of deviations and communication with public and users.

- *Promote aggressive on-airport emission reductions.* The Port of Seattle is committed to reducing air pollutant levels by reducing emissions from various sources

at the Airport. A number of on-going considerations have focused on reducing the number of vehicles accessing the airport by providing alternatives to single-occupancy vehicles. Other actions have addressed motor vehicle idling along the terminal curbfront. Airport staff rigorously monitor access by taxis, limousines and buses and idling within the terminal area.

The Port of Seattle supports a commuter trip reduction strategy which has several components: employee shuttle bus service to remote public and employee parking to reduce vehicle trips in the terminal area; support for the regional light-rail transit system; and limiting passenger drop-off and pickup and vehicle idling at the terminal through vigorous enforcement and by successfully providing short-term parking alternatives (i.e., metered short-term public parking within the terminal area).

- *Promote regional transit and reduction in use of automobiles.* The proposed Airport Master Plan improvements promote regional transit by providing additional transit plazas (for buses) at the terminals and allowing for a new regional transportation terminal (for rail transit station) adjacent to the Central Parking Structure. Transportation demand management strategies could reduce both employee and private passenger vehicular traffic by up to 20 percent. Employee trips can be reduced by peak pricing, car pooling programs, and ridesharing incentives. Vehicular traffic can be reduced by park-and-fly lots, congestion pricing, and improved transit services. Travel demand management was investigated in detail as part of the study and was documented in a report titled, Seattle-Tacoma International Airport Master Plan International Boulevard Access Study and Travel Demand Management Mitigation Policies.

- *Improve the aesthetic appearance of the airport boundary.* The Airport Master Plan Update includes an analysis of ways to improve the aesthetic appearance of the airport boundary. The plan, provides various landscape environments around the airport which reflect the variety of settings in the Region and State and assesses aesthetic improvements to the airport perimeter. These improvements are discussed in Assessment and Development of Aesthetic Improvements to the Airport Perimeter.

- *Develop a comprehensive stormwater management plan.* A comprehensive stormwater management plan is currently being prepared by the Port. A draft stormwater master plan report is under preparation. The sizing of facilities took into account facility requirements of the Master Plan Update. Implementation of the plan will follow.

SCOPE OF STUDY, SCHEDULE AND DOCUMENTATION

The Airport Master Plan Update began in December 1993 and is scheduled to be completed in January 1996.

The primary issues addressed in the scope of work include:

- ***Forecasts.*** The master plan update and related Environmental Impact Statement and FAA Part 150 Study must be based on a reliable and generally accepted set of forecasts.

- ***Airside Evaluations.*** An important component of the study is the analysis of a new dependent parallel (minimum runway separation of 2,500 feet) runway. The Airspace Update Study and the FAA

Airport Capacity Enhancement Task Force both determined that a substantial capacity improvement can be achieved by constructing a new parallel dependent runway.

- ***Terminal Evaluations.*** A key issue in the terminal development is to achieve a balance between added terminal capacity and additions to airside and landside capacity. Curb frontage, roadway and automobile parking are critical components.

- ***Multi-Modal Evaluations.*** There is considerable interest at the federal, State and local levels of government to develop inter-modal transportation systems that are economically efficient and improve air quality.

- ***Financial Planning.*** A comprehensive financial plan and implementation strategy must be developed to maximize the Port's ability to fund needed capital improvement projects.

- ***Part 150 Issues.*** The Sea-Tac Airport Noise Mediation Agreement resulted in substantial noise reduction programs, now being implemented. This agreement plays a vital role in existing and future planning efforts at the airport and has been incorporated into the recently completed FAR Part 150 Study 1993 Amendments. However, those amendments did not consider the implementation of a third runway, and thus the Noise Exposure Maps that were generated in the study will be updated to consider the third runway option.

- ***Public Involvement Process.*** Public involvement in the planning process is an important element of the Airport Master Plan Update. The public involvement program developed for the study allows for better understanding of the sentiments in the surrounding communities and constructively involves the public in focused workshops for the project. Elements of the public involvement program include workshops, public opinion surveys, and dissemination of project information through newsletters and technical reports prepared during the study.

The following documents have been produced during the course of the project:

- Technical Report No. 1, Final Work Scope

- Technical Report No. 2A, Market Research Results which presented results of research conducted to help determine issues, define key publics and clarify citizens opinions.

- Technical Report No. 2B, Public Involvement Program Development Report, which set out a community involvement program for the master plan program.

- Technical Report No. 3, Planning History and Study Relationships which summarized recent planning studies related to Sea-Tac Airport and surrounding communities.

- Technical Report No. 4, Facilities Inventory, which documented the extent of existing airport facilities.

- Technical Report 4A, Ground Access Update integrated the previous traffic and parking studies using updated data on ground transportation. It also described the recalibration effort of simulation modelling and the resulting simulation of future traffic conditions under the different terminal development options.

- Technical Report No. 5A, Preliminary Forecast Report, which presented the final projections of aviation demand as accepted

by the FAA.

- Technical Report No. 5, Final Forecast Report, which presented final aviation and ground traffic forecasts.
- Technical Report No. 6, Airside Options Evaluation, which addressed various runway configurations for increasing airfield capacity along with other airside improvements to maximize airfield efficiency.
- Technical Report No. 7A, Terminal Options Evaluation, which documented an analysis of future passenger terminal configurations to meet program requirements as determined by projected demand.
- Technical Report No. 7B, Other Facilities Requirements and Options, which addressed the needs for other facilities such as cargo, airline maintenance, general aviation, etc.
- Demand Management Report which provided responses to issues raised by an Expert Panel on Noise and Demand/System Management Issues.
- Airport Parking Systems - Long-Range Analysis which assessed existing parking facilities and long-range auto parking requirements.
- International Boulevard Access Study and Travel Demand Management Mitigation Policies examined ways to minimize future traffic deficiencies along International Boulevard (State Route 99) including traffic control measures and travel demand management measures.
- Preliminary Traffic Study compared future terminal development options against the do-nothing alternative in terms of levels of service on airport roads.
- Technical Report 8, Master Plan Update Final Report (this report).

The following documents remain to be completed at the time of printing this report.

- Airport Layout Plan Set
- Aesthetics Paper
- Summary Brochure

PLANNING TEAM COMPOSITION

The Master Planning Team led by P&D Aviation consists of ten firms which are listed below with their key responsibilities:

- ***P&D Aviation*** - Project Management, Forecasts and Facility Requirements, Airside Planning, Ground Access Planning, Overall Airport Master Planning and Coordination
- ***O'Neill & Company*** - Public Involvement
- ***Parsons Brinckerhoff*** - Multi-Modal Evaluations
- ***Thompson Consultants International*** - Terminal Planning
- ***Barnard Dunkelberg & Company*** - Part 150 Integration and Community Planning
- ***Berk & Associates*** - Financial Planning
- ***Murase Associates*** - Airport Beautification, Landscape Architecture
- ***Mestre Greve Associates*** - Aircraft Noise Impacts
- ***Landrum & Brown*** - Passenger Terminal Concepts
- ***Claire Barrett & Associates*** - Demand Management

Section 3
CONCEPTS CONSIDERED AND SELECTION OF OPTIONS FOR FINAL EVALUATION

SECTION 3
CONCEPTS CONSIDERED AND SELECTION OF ALTERNATIVES FOR FINAL EVALUATION

APPROACH

Under each of the three primary airport elements (airside, terminal/access and other functional areas), a number of alternative concepts were examined. These were evaluated by the consultants and Port staff with input from both the public involvement process and the Technical Advisory Committee. From these evaluations three airport development options were developed for further analysis. This approach is described below.

Airport Elements Addressed

Potential Airport Master Plan improvement concepts were considered in three functional areas:

- Airside concepts, including the evaluation of a third runway, other existing runway improvements, taxiway improvements, safety area improvements, and navigational aids.

- Terminal/access concepts, including improvements to the existing terminal, terminal expansion and new terminals, expansion of aircraft parking apron, vehicle circulation, airport access improvements, and vehicle parking.

- Concepts for the development of other functional elements, including air cargo, aircraft maintenance facilities, airport rescue and fire fighting, general and corporate aviation, air traffic control tower, airport maintenance and administration, and other airport tenant areas.

A large number of concepts were initially examined for each of these elements. Passenger terminal requirements drove the development of plans for other facilities such as cargo and maintenance. Concepts were chosen to address the range of feasible expansion possibilities. Although the concepts were structured to satisfy the projected airport demand to 2020, they did so with varying degrees of effectiveness.

Methodology for Analyzing Concepts

Concepts for each element were evaluated according to applicable criteria. Airside concepts considered such factors as percent of aircraft operations accommodated by runway length, pilot preference, airfield operations delays, construction costs, aircraft noise impacts, wetlands impacts, earthwork impacts and displacement of homes and other properties. The terminal/access concept evaluation addressed such issues as capacity, flexibility, accessibility, maneuverability, balance, convenience and construction cost. The evaluation of other facility concepts considered functional relationships, access, availability of aircraft parking, impact on other facilities and phasing.

The concept evaluations included technical analysis by the consultant team as well as evaluation by Port staff. An Airport Master Plan Technical Work Group facilitated the Port staff evaluations. Furthermore, meetings were held to discuss the concepts with the FAA, surrounding cities, Puget Sound Regional Council, Washington State Department of Transportation, the Airline Technical Committee

and the public. Technical reports were prepared at each stage of the planning process, as described in Section 1. Coordination with various concerns included the following:

- Technical Advisory Committee with over 40 representatives including FAA, WSDOT, PSRC, PSAPCA, local jurisdictions, ACC, and RCAA.
- Various airline committees including Airfield Advisory Subcommittee, Airline Airport Affairs Committee, Airline Technical Committee and a Special Master Plan Subcommittee designated by AAAC.
- Local jurisdictions through the Planners Forum.
- Series of public involvement workshops (Sea-Tac University).
- Also reports, available through local libraries with E-Mail and hotline for comments.

The best features of each concept were chosen and combined to form three airport-wide development options for final evaluation: North Unit Terminal Alternative, Central Terminal Alternative and South Unit Terminal Alternative.

INITIAL CONCEPTS

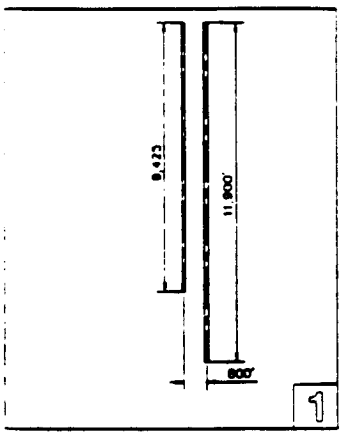
Airside Concepts

A detailed discussion of airside concepts is contained in Technical Report No. 6, Airside Options Evaluation, September 19, 1994. The description and evaluation of these concepts are summarized below.

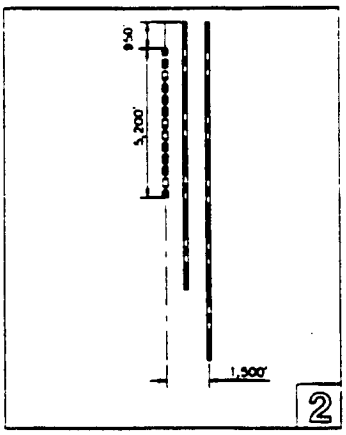
Description of Initial Airside Concepts. Eight initial airfield concepts were developed and evaluated (a no-airfield-improvement concept and seven improvement concepts). All seven improvement concepts include an extension of Runway 34R from 11,900 to 12,500 feet (takeoff length), additional taxiway exits, dual parallel Taxiways A and B along the full length of Runway 16L-34R, and extensions of the Runway Safety Areas for Runway 16L, 16R and 34R. Seven options for a new runway were evaluated. These options are illustrated schematically in Figure 3-1 and summarized below:

- ***Airside Concept 1: Existing Airfield.*** Under this concept, no improvements would be made to the airfield beyond those already underway (new taxiways). This "do nothing" concept is included in the analysis of alternatives to estimate the likely effects (for example, additional aircraft delays) of not providing additional airfield capacity. It provides a benchmark by which the other options are measured.
- ***Airside Concept 2: Commuter-Close.*** Under Airside Concept 2, a new 5,200 foot long by 100 foot wide commuter runway would be constructed 1,500 feet west of Runway 16L-34R. The new runway would serve primarily commuter and general aviation operations. However, it would be capable of accommodating landings and some departures by Airplane Design Group III Aircraft which include small air carrier jets such as the B737 and MD80. The north threshold of the new runway would be 950 feet south of the existing north runway ends.

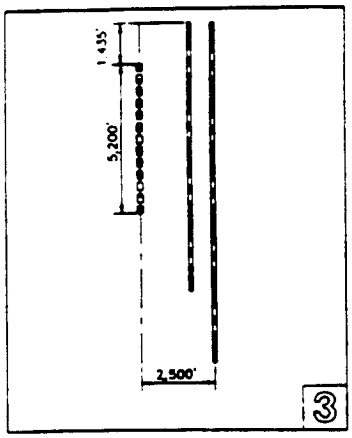
  Airside Concept 2 represents the lowest cost approach of all concepts considered. There would be no relocation of adjacent roadways (other than airport service roads) and safety area standards at the north ends of the runways would be met by relocating the north thresholds of Runway 16L-34R 300 feet to



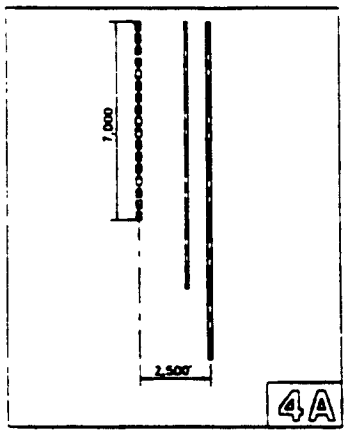
Option1 Existing Conditions



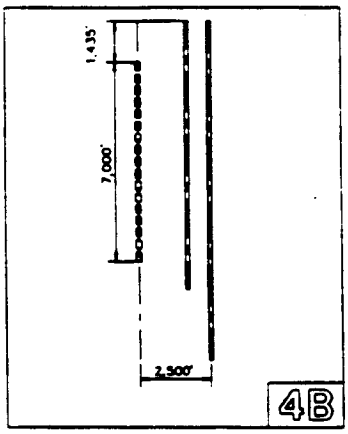
Option 2. Commuter -- Close



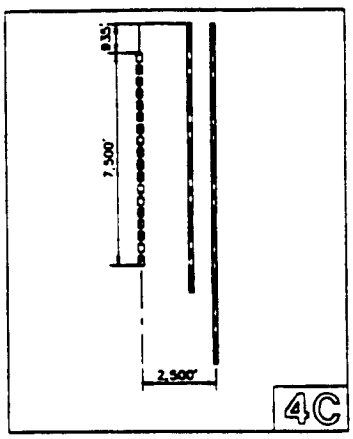
Option 3. Commuter -- Dependent



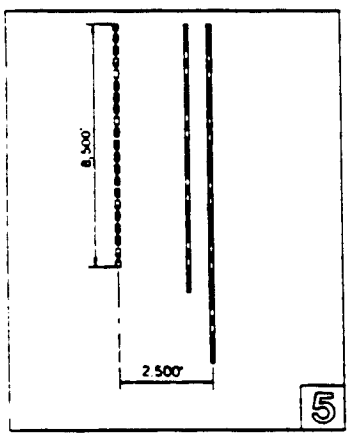
Option 4A Programatic Baseline



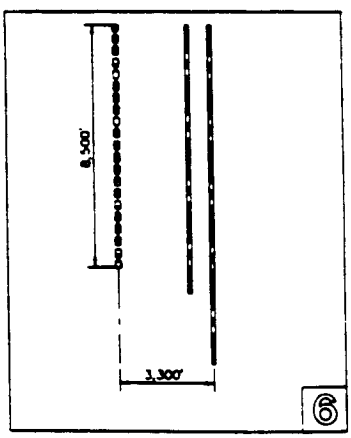
Option 4B. Programatic Baseline -- Staggered



Option 4C. Staggered 7,500 - Foot Runway



Option 5 Dependent -- Maximum Length



Option 6. Independent -- Maximum Length

Existing Runway

Proposed Runway (to be revised)

Figure 3-1

THIRD RUNWAY OPTIONS

the south and Runway 16R-34L 325 feet to the south. This would result in the shortening of Runway 16R-34L to 9,100 feet. Under this concept, Runway 16L-34R would be lengthened to the south to obtain a runway length of 12,500 feet.

Under Airside Concept 2 the separation between the runways would not permit an additional IFR arrival stream. The new runway would be used primarily for VFR traffic conditions.

- ***Airside Concept 3: Commuter Dependant.*** Airfield improvements under Airside Concept 3 would be similar to Airside Concept 2, with the exception that the new commuter runway would be 2,500 feet west of Runway 16L-34R. This greater separation would allow for two arrival streams under IFR conditions. The greater runway separation would also allow for an aircraft parking area to be located between Runway 16R-34L and the new runway. This area would be used to park aircraft which remain overnight at the airport or which must be temporarily parked for maintenance reasons. The north threshold of the new runway would be located 1,435 feet south of the north ends of the existing runways.

  The runway configuration permits the use of two IFR arrival streams and therefore the new runway would function in an IFR capacity. It is assumed for purposes of this comparison that a Category I ILS system would be installed on both ends of the new runway under this option.

- ***Airside Concept 4A: Programmatic Baseline.*** With Airside Concept 4A, a new 7,000 foot by 150 foot runway would be constructed 2,500 feet west of Runway 16L-34R (this is the baseline runway length and alignment considered for air carrier operations in the Programmatic EIS for the Sea-Tac Flight Plan Project in the early 1990s). The north end of the new runway would be aligned with the north ends of the existing runways. South 154th Street and South 150th Way would be relocated to the north around the new and existing runways. Because the roads would be relocated, the north thresholds of the existing runways would not need to be relocated to provide Runway Safety Areas meeting FAA criteria as with Airside Concept 4B. Therefore, Runway 16R-34L could be maintained at its present 9,425 foot length. Runway 16L-34R would be extended 600 feet to the south to achieve an overall length of 12,500 feet.

  The runway configuration permits parallel (staggered) ILS approaches. To provide maximum IFR benefits, each end of the new runway would be equipped for precision instrument approaches. If a third runway is added it is proposed to ultimately equip Runway 16L for Category IIIb approaches. As adequate separation will exist between it and the new runway to permit dual arrival streams, it is recommended that the new runway also be equipped for Category IIIb approaches from the north. This will permit parallel Category IIIb ILS approaches and thus enhance capacity during periods of extremely low visibility. In the interim, use of Runway 16R as the Category IIIb runway can continue until such time that demand indicates the need for dual, low visibility arrival streams.

- ***Airside Concept 4B: Programmatic Baseline Staggered.*** Airside Concept 4B is similar to Airside Concept 4A, except the north threshold of the new runway would be staggered approximately 1,435 feet to the south to eliminate the need to relocate South

156th Way and to reduce the fill requirements at the north end of the runway. The terrain at the north end of the new runway drops steeply to the north and offsetting the new runway to the south would substantially reduce the amount of fill material required and the construction cost. Under this option, the relocation of South 154th Street as well as South 156th Way would not be necessary to accommodate the new runway.

Accordingly, the north thresholds of the existing runways would be relocated to provide Runway Safety Areas (RSAs) and Runway Object Free Areas (ROFAs) which meet FAA standards. Note that a 7,000 foot runway is approximately the longest runway which can be accommodated at this separation without relocating existing public roadways to achieve RSA and ROFA standards. The new runway would be equipped with a Category IIIb precision instrument landing system at the north end, as in Airside Concept 4A.

- ***Airside Concept 4C: Staggered 7,500-foot Runway.*** Under this option, the new runway would be 7,500 feet long. This length was chosen to provide an option in which the runway length would be between that of Airside Concepts 4A/4B and Airside Concept 5 and accommodate at least 95 percent of the aircraft types projected to be using the airport in 2020. To allow the necessary RSA and ROFA at the south end of the new runway, it could be staggered at most about 935 feet to the south of the existing runway thresholds. For this reason, South 156th Way would need to be relocated to the north to accommodate the RSA and ROFA at the north end of the new runway. In other respects, this concept is similar to Airside Concept 4B.

- ***Airside Concept 5: Dependent-Maximum Length.*** Airside Concept 5 includes the construction of a new 8,500 foot by 150 foot runway, 2,500 feet west of Runway 16L-34R. The north end of this runway would be in alignment with the north ends of the existing runways. South 154th Street and South 156th Way would be relocated to the north as in Airside Concept 4A. With the north threshold of the new runway located as described above, 8,500 feet is the maximum length obtainable to comply with RSA and ROFA standards without major highway relocations.

  Because dual arrival streams are possible, the navaids described for Airside Concepts 4A and 4B are applicable to this concept. Therefore, the north end of the new runway would be capable of Category IIIb approaches.

- ***Airside Concept 6: Independent-Maximum Length.*** In Airside Concept 6, a new 8,500 foot by 150 foot runway would be constructed 3,300 feet west of Runway 16L-34R. Due to the greater separation of the new runway from the existing runways under this option, extensive road relocations would be necessary. In addition to the relocation of South 156th Way and South 154th Street, approximately one mile of State Route 509 and one mile of Des Moines Way would have to be relocated. The relocations would include the 2-level interchange between State Route 509 and Des Moines Way.

  In addition, this option would require greater property acquisition and the relocation of many more homes and businesses than under the other options.

The advantage of Airside Concept 6 is that the two outboard runways would be separated by 3,300 feet, which in the future will presumably permit simultaneously independent ILS approaches. Furthermore, it would provide for dual dependent IFR arrival streams on the two westerly runways, leaving the long runway, Runway 16L-34R, available for departures. Thus, this concept has the greatest capacity for handling air traffic under IFR conditions and would result in fewer aircraft operational delays than the other options. Navaids for Airside Concept 6 would be the same as those for Airside Concepts 3 through 5, Category IIIb approaches for south flow operating conditions.

Effects of Runway Stagger. In some options, certain types of operations on a runway may be limited by the fact that the runway thresholds are staggered. This pertains to parallel runways separated by 2,500 feet. In these cases the following should be noted.

Simultaneous radar controlled approaches and departures on parallel runways require 2,500 foot runway separation when the runways are not staggered. When thresholds are staggered, the separation may increase or decrease depending on the threshold locations and amount of stagger.

- When thresholds are staggered and the approach is to the near threshold, the 2,500 foot separation may be reduced by 100 feet for each 500 feet of stagger.

- When thresholds are staggered and the approach is to the far threshold, the minimum 2,500 foot separation requires an increase of 100 feet for each 500 feet of stagger.

This should not be confused with parallel ILS approaches which requires a minimum of 2,500 feet separation regardless of stagger. However, parallel ILS approaches are not simultaneous, but are termed "staggered approach" since the aircraft are separated diagonally while on the ILS localizer centerline.

Evaluation of Initial Airside Concepts. Evaluation criteria for the airfield concepts consisted of aircraft delay measures, development costs and environmental screening measures. A summary of the evaluation of airside concepts appears in Table 3-1.

Measurement of aircraft delays was accomplished using the Federal Aviation Administration's Airport and Airspace Simulation Model (SIMMOD). This model is a sophisticated computer simulation which realistically simulates the movement of every aircraft for a given runway option. The model produces quantitative measures of aircraft air arrival delays, departure delays, and ground taxi delays.

Development cost estimates were prepared based on information contained in the first draft of the Preliminary Engineering Report prepared by HNTB and dated March 31, 1994 and on land acquisition costs described by Landrum and Brown in a memorandum dated September 1994. To the extent possible, the same assumptions and unit cost data have been used as described in the Preliminary Engineering Report.

A preliminary evaluation (screening) of the environmental impacts of each of the airside options was conducted by the EIS consultant team. The purpose of this analysis was to allow environmental impacts to be considered early in the airside evaluation process and prior to the formulation of the EIS alternatives.

TABLE 3-1
EVALUATION SUMMARY
OF MASTER PLAN UPDATE AIRSIDE CONCEPTS

	Master Plan Update Airside Concepts [a]							
	1	2	3	4A	4B	4C	5	6
Percentage of Aircraft Operations Accommodated and Aircraft Operations Delays								
Percentage of Aircraft Operations Capable of Using this Runway Length, Year 2020								
Takeoffs	–	32	32	77	77	85	90	90
Landings	–	31	31	91	91	96	99	99
Annual Delay Savings, Year 2015 [b]								
Hours (Thousands)	0	10	55	118	118	123	130	130
Dollars (Millions)	0	21	116	246	246	258	270	270
Average Delay, 2015 (Minutes per Operation)	22	20.6	14.2	5.4	5.4	4.6	3.8	3.8
Preliminary Development Cost Estimates (Millions of 1994 Dollars) [c]								
Construction	–	79	255	347	279	294	364	596
Property Acquisition and Relocation	–	0	42	64	69	75	91	177
Total (Including 15% Contingency)	–	91	341	473	401	425	524	889
Environmental Effects (d)								
Noise: Impacted Area in Year 2020 (sq. mi.)								
65 DNL and Greater	7.45	[e]	7.51	7.67	[e]	7.65	7.84	8.13
60-65 DNL	10.12	[e]	10.05	10.06	[e]	10.09	10.08	10.17
Noise: Population Impacts in Year 2020								
65 DNL and Greater	12,800	[e]	13,050	13,450	[e]	13,380	14,030	15,040
60-65 DNL	40,820	[e]	40,440	40,700	[e]	40,770	40,760	41,030
Noise: Housing Impacts in Year 2020								
65 DNL and Greater	5,390	[e]	5,480	5,650	[e]	5,630	5,870	6,360
60-65 DNL	17,910	[e]	17,690	17,870	[e]	17,900	17,920	17,980
Air Inventory (Tons per Day in Year 2020)								
Carbon Monoxide	13.86	[e]	10.18	6.82	[e]	6.82	5.86	4.86
Nitrogen Oxides	6.82	[e]	6.49	6.19	[e]	6.19	6.11	6.02
Particulate Matter (PM10)	0.00	[e]	0.00	0.00	[e]	0.00	0.00	0.00
Sulfur Oxides	0.33	[e]	0.28	0.23	[e]	0.23	0.22	0.20
Wetland Impacts (acres)	0	[e]	4.2	5.4	[e]	5.0	5.4	27.7
100-Year Floodplain Impacts (acres)	0	[e]	1	7	[e]	2	7	30
Stream Relocation (linear feet)	0	[e]	2,760	2,970	[e]	2,760	2,970	12,240
Earth Impacts (million cubic yards)	0	[e]	12	17	[e]	13	17	28
Construction Impact (Units Displaced)								
Properties	0	[e]	330	410	[e]	400	420	700
Homes	0	[e]	260	330	[e]	300	320	500
Parks	0	[e]	0	0	[e]	0	0	1
Historic/Cultural sites	0	[e]	1	1	[e]	1	1	3
Schools	0	[e]	0	0	[e]	0	0	1

TABLE 3-1
EVALUATION SUMMARY
OF MASTER PLAN UPDATE AIRSIDE CONCEPTS

	Master Plan Update Airside Concepts [a]							
	1	2	3	4A	4B	4C	5	6
Noise Impacted (65+ DNL) in Year 2020 [f]								
Parks	6	[e]	6	6	[e]	6	6	6
Historic/Cultural sites	3	[e]	3	4	[e]	4	4	5
Churches	13	[e]	13	13	[e]	13	13	15
Hospitals/Nursing homes	0	[e]	0	0	[e]	0	0	0
Libraries	1	[e]	1	1	[e]	1	1	1
Schools	8	[e]	9	8	[e]	8	8	8

[a] Airside Concept 1 - Do-Nothing (assumes existing distribution of traffic)
Airside Concept 2 - Commuter-Close (New 5,200 foot long new runway located 1,500 feet west of Runway 16L/34R)
Airside Concept 3 - Commuter Dependent (New 5,200 foot long new runway located 2,500 feet west of Runway 16L/34R)
Airside Concept 4A - Programmatic Baseline (New 7,000 ft long runway located 2,500 feet west of Runway 16L/34R)
Airside Concept 4B - Programmatic Baseline Staggered (New 7,000 ft long runway located 2,500 feet west of Runway 16L/34R, north end of new runway south of existing)
Airside Concept 4C - 7,500 ft Staggered (New 7,500 ft long runway located 2,500 feet west of Runway 16L/34R, north end of new runway south of existing)
Airside Concept 5 - Dependent Maximum Length (New 8,500 ft long runway located 2,500 feet west of Runway 16L/34R)
Airside Concept 6 - Independent Maximum Length (New 8,500 ft long runway located 3,300 feet west of Runway 16L/34R)

[b] Annual delay savings compared with "do-nothing" delays in the year 2015. Source: Technical Report No. 6, Airside Options Evaluation, September 19, 1994.

[c] Source: Technical Report No. 6, Airside Options Evaluation, September 19, 1994.

[d] Sources: Landrum & Brown, Shapiro & Associates, and Gambrell Urban, as reported in Technical Report No. 6, Airside Options Evaluation, September 19, 1994. Population and dwelling based on 1990 census. Impacts presented for the preliminary airside options were updated in the Draft Environmental Impact Statement for the Airport Master Plan. Table 4-2 provides updated information for the three final runway options. Based on the Draft EIS by Landrum and Brown released in April, 1995.

[e] Data not available.

[f] Noise impacted noise sensitive facilities noted above do not include the units displaced by construction.

Selection of Airside Concepts for Further Consideration. As can be seen in Table 3-1, the increases in delay savings are not necessarily proportional with the increases in construction and acquisition costs. For example a two thirds increase in construction and acquisition costs in Airside Concept 6 when compared to Concept 5 yields no delay improvement until demand exceeds 425,000 operations (about the year 2015).

Current research and advancements in technology suggest separation requirements for independent approaches will continue to be reduced. It is conceivable that, at some time in the future, independent approaches will be possible to runways separated by 2,500 feet (Airside Concepts 3, 4A, 4B, 4C and 5). Selection of Airside Concept 6 with its greater costs and environmental impacts was therefore not recommended.

Although Airside Concepts 2 and 3 are the least costly of the new runway alternatives and create the least impacts, these options provide a much lower amount of delay reduction when compared to the options with at least 7,000 feet of runway length. The lower benefits of these options is caused by the limited usage of the 5,200-foot long runway. Currently only about one third of the aircraft in the Sea-Tac fleet could use this shorter runway length for landings and departures. In the future this segment of the Sea-Tac aircraft fleet is projected to decrease. Therefore, due to the limited ability to reduce future delays, Airside Concepts 2 and 3 were not recommended.

When comparing the concepts for a new runway separated 2,500 feet from Runway 16L-34R, delay savings and the percent of operations accommodated were found to increase as runway length increases. The greatest delay savings occur for Airside Concept 5 (a new 8,500 foot runway). When compared to the next best concept (a 7,500 foot runway), it was found that Concept 5 provides additional savings ranging from $1.2 million to $1.5 million. Estimates of delay savings are based upon airfield simulation studies calculated as part of the FAA Capacity Enhancement Task Force. These additional savings coincide with activity levels ranging from 345,000 operations up to a level of 425,000 annual operations. Beyond a level of 425,000 operations, the additional annual savings escalates at a much more rapid rate to over $12 million at an activity level of 525,000 annual aircraft operations. It is important to note that these projections of delay savings calculated by the FAA Task Force reflected a constant aircraft fleet mix. The master plan has assumed a mix containing more and more heavy aircraft over time, as contained in the aviation demand forecasts (Technical Report No. 5). Though the Task Force delay estimates may be somewhat conservative, should additional heavy aircraft enter the fleet mix as forecast, the savings in annual delay would be even greater. For these reasons, Airside Concept 5 was recommended as the preferred operational alternative for ultimate development.

Specific benefits resulting from the selection of Airside Concept 5 would be as follows:

Aircraft delays would be reduced to the lowest levels for demand expected through the year 2015.

Fewer aircraft would be restricted from using the runway due to landing and takeoff length limitations.

All aircraft using a longer new runway would have greater takeoff/stopping distance available.

An 8,500-foot runway length would provide a greater measure of usefulness in that it could accommodate heavy jet aircraft when one of the existing runways is closed for maintenance or

emergency.

Although Airside Concept 5 is preferred, it was concluded that the Master Plan analysis should continue to consider the options of runway lengths of 7,000 feet (Airside Concept 4B) and 7,500 feet (Airside Concept 4C) into the final phase of alternatives analysis.

Terminal/Access Concepts

Terminal/access concepts were discussed in Technical Report No. 7A, Terminal Options Evaluation, February 17, 1995. The description and evaluation of these concepts is described below.

Description of Initial Terminal/Access Concepts. By the year 2020 the existing terminal facilities will need to be expanded by up to 1.9 million square feet of new terminal area to support the forecast level of activity. Ten terminal concepts for providing this degree of expansion were developed for initial evaluation.

Both the landside and the terminal airside (i.e., apron area) compatibility issues have a material impact upon the direction that future terminal development could take. As a starting point, a number of terminal apron-area concepts were developed and reviewed. These apron-area concepts outlined the gate development opportunities of a future parallel east taxiway and considered the preservation, partial, and complete replacement of some existing terminal gate facilities. The result of this review was the development of a series of planning assumptions and the organization of terminal concepts into three general development areas to the north, south and center of the existing terminal area.

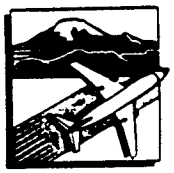
The site to the south of the main terminal is the largest in terms of total area of the three terminal development areas investigated. The site itself is as deep as the entire existing terminal complex and offers the greatest expansion potential of any option. A number of airline maintenance areas would likely require removal or relocation under most of these development concepts. In addition, the commercial area immediately to the southeast of Concourse A would need to be acquired to provide sufficient area to complete the terminal landside development. South access to the airport needs to be considered in any of these concepts. Five terminal development concepts for the south side site were investigated.

The site to the east of the existing main parking structure offers the most central location for supplementary landside facilities. Because of its limited size and configuration, only one option for this site was investigated.

A site to the north of existing terminal offers a smaller, but in some ways less constrained location than the south for the development of an expanded terminal/landside interface. This location would provide greater proximity to the main airport entrance, and could be developed without additional property acquisition. Complete development in this area would, however, require the relocation of a significant number of facilities including the main airport entrance road, the airport fire-fighting and rescue (ARFF) facility, the U.S. Postal Service (USPS) facility and a number of cargo and flight kitchen facilities prior to construction of the north unit terminal. Four concepts were investigated for this location.

A brief description of each of the terminal/access concepts follows:

- ***Terminal Concept A-1: A South Expansion of the Main Terminal.*** This concept proposes to expand the main terminal to the south in an alignment with existing Concourse A. The South Satellite



and Concourse A would be further extended and modified to provide additional aircraft parking capacity. A new underground pedestrian connector would be provided between Concourse A and the South Satellite to provide a supplemental means of access between these two buildings.

The scheme provides direct road access to the south of the existing terminal for connection to a future SR509 or South 188th Street. Regional rail transit can be accommodated but would require a connection to the main terminal.

- ***Terminal Concept A-2: A Second Unit Terminal to the South.*** This concept differs from Terminal Concept A-1 in two important aspects. First, it proposes a separate, but connected, terminal unit to the south of the main terminal. Secondly, it could have a separate access roadway system to the south which bypasses the main terminal roadways and links the new terminal to the primary terminal area access road to the north. This separate roadway access minimizes airport vehicular congestion by distributing traffic between the two separate terminal systems.

- ***Terminal Concept A-2-1: A Southside Unit Terminal with Modified Expanded Satellites Airside.*** From the landside standpoint, this concept is similar to Terminal Concept A-2, with the exception of the alignment of the bypass roadway, and the location of the future regional rail station. Like Terminal Concept A-2 the new unit terminal is physically linked to the existing main terminal by an expanded and refurbished Concourse A. However, the new unit terminal is served by a separate bypass access road from the north and separate curbs and parking facilities. The regional rail station would be integrated into this new terminal. Again, better south access with improved roadways are proposed.

  From the airside the terminal concept would be dramatically different from Terminal Concept A-2 in that Concourses B and C, and most of the North and South Satellites, would be demolished and replaced by expanded satellites on the north and south sides of the existing terminal. This major modification enables the creation of dual Group V (B747) taxilanes the length of the terminal area, and conceptually provides unlimited flexibility in gate use through the terminal area.

- ***Terminal Concept A-2-2: A Southside Unit Terminal with Reverse Roadway Flow.*** From an airside standpoint, Terminal Concept A-2-2 is identical to Terminal Concept A-2; existing satellites are expanded, Concourses B and C remain in place, frontal gates are provided along an expanded Concourse A with a new southside unit terminal.

  From a landside standpoint, Terminal Concept A-2-2 differs substantially from Terminal Concept A-2 in that the unit terminal and parking area would be separated by the roadway from the extension to Concourse A. This requires that vehicular traffic flow clockwise around the terminal building (operationally similar to Terminal 4 at Phoenix Sky Harbor International Airport) in order to permit vehicles to drop off passengers from the right side of the vehicle.

- ***Terminal Concept A-3: A Unit Terminal Along South 188th Street.*** This concept is similar to Terminal Concept A-2 in that it proposes a separate, but linked, unit terminal to be built south of the

existing main terminal. Terminal Concept A-3 also would include a separate roadway bypass and parking facility and an extension of the existing STS shuttle. Terminal Concept A-3 differs from Terminal Concept A-2 in that the new terminal would be separated from the existing main terminal by a considerable distance (approximately 1,800 ft. separation for Terminal Concept A-3 versus approximately 800 ft. separation for Terminal Concept A-2). A regional rail station would be placed between the existing and new terminals.

The physical orientation of the terminal also differs from Terminal Concept A-2 in that its landside would be oriented east-west along South 188th Street. This orientation results in a somewhat limited terminal and curb length, sub-standard roadway curves, and a constrained parking facility compared to other concepts.

- ***Terminal Concept B: A Centrally Located Transportation Distribution Center.*** Concept B proposes that a Transportation Distribution Center be developed on a site immediately east of the existing main parking structure. This facility could accommodate regional rail access as well as provide supplemental curb frontage for high occupancy vehicles, busses, or other types of vehicles designated by the Port of Seattle, which might otherwise congest the main terminal curbfront. Because of the distances involved, the Transportation Distribution Center would need to be connected directly to the existing main terminal and potentially to the satellites via a people mover and some form of baggage handling system. This system might require the use of portions of one or more floors of the existing parking structure as a right of way.

- ***Terminal Concept C-1: Unit Terminal North of the Existing Terminal.*** Terminal Concept C-1 defines a simple unit terminal with frontal gates north of the existing North Satellite. The site available for such a facility is relatively narrow, and in its present form could require that the main access road into Sea-Tac from the north be relocated eastward in order to provide sufficient parking facilities in proximity to the terminal.

  Because its ultimate airside capacity would be limited to a fraction of that provided by a South Unit Terminal, overall airport gate requirements would need to be supplemented by the expansion of either the South Satellite or Concourse A.

- ***Terminal Concept C-2: Unit Terminal North of the Existing Terminal.*** Terminal Concept C-2 is similar to Terminal Concept C-1 but maintains the airport access road in its current location. Because the remaining site available for such a facility is relatively narrow, it would require development of automobile parking facilities to the east of the main north terminal access road to Sea-Tac. On-grade parking facilities already occupy some of the site, although these might need to be converted to structural parking, and would be connected to the new North Unit Terminal by either bridges or tunnels several hundred feet long.

- ***Terminal Concept C-3: Unit Terminal North of the Existing Terminal.*** Like Terminal Concepts C-1 and C-2 the main feature of Terminal Concept C-3 is a north-side unit terminal. This unit terminal is not physically linked to the existing main terminal except through an extension of the existing STS shuttle. Like Terminal Concepts C-1 and C-2, Terminal

Concept C-3 has an independent landside circulation and parking system tied into the northside airport access system which would be relocated to accommodate the modified terminal configuration. The key difference in Terminal Concept C-3 is the exploration of the double-sided airside concourse and the resulting site requirements.

- ***Terminal Concept C-4: Unit Terminal North of the Existing Terminal.*** Terminal Concept C-4 is a variation of Terminal Concept C-3 as a northside unit terminal not physically linked to the existing main terminal at Sea-Tac except by an extension of the existing STS shuttle. Its landside circulation and parking system would also be completely independent of the existing main terminal. Terminal Concept C-4 differs from Terminal Concept C-3 in that it requires an even deeper site (requiring further property acquisition) but provides an expanded airside capacity providing additional frontal gates and lends itself to a conventional terminal arrangement similar to that which already exists at Sea-Tac.

Evaluation of Initial Terminal/Access Concepts. To narrow the terminal development concepts to a manageable and reasonable number, sixteen evaluation criteria were established. These criteria were separated into landside, terminal, airside, and cost categories. The evaluation criteria used in comparing and evaluating the terminal concepts are shown in Table 3-2.

Perhaps the single most important factor to emerge during the evaluation process was the need to incorporate flexibility and adaptability to change as operational requirements at Sea-Tac continue to evolve in the future. In addition to operational flexibility, the need to provide for incremental growth in the terminal is important and to accomplish this the terminal should be designed to accommodate a wide range of aircraft types and sizes in the future. Finally, the potential for future enhancement of the architectural character of the airport as the major international and domestic gateway to the northwestern United States was an important point of consideration.

Selection of Terminal/Access Concepts for Further Consideration. The preliminary evaluation process was performed on each of the terminal concepts, and the three highest scoring development scenarios from each group were identified for further refinement and evaluation. In this refinement process, the North Unit Terminal concept was modified to include two concourses from the new north terminal rather than northerly extension of the North Satellite. These revisions were made to provide additional gate positions at the North Unit Terminal and relieve potential apron congestion resulting from long taxilanes. Selected conceptual terminal development scenarios are presented as Figures 3-2 to 3-4.

The three shortlisted concepts for the Sea-Tac Master Plan Update reflect a number of options which may be appropriate to meet differing operational scenarios which develop in the future. These options are not necessarily mutually exclusive of one another, and may be combined as functional requirements continue to evolve. For example, development of terminal facilities to the north should not necessarily preclude the development of terminal facilities to the south should this prove practical or desirable for additional capacity or functional improvement.

Concepts for Other Facilities

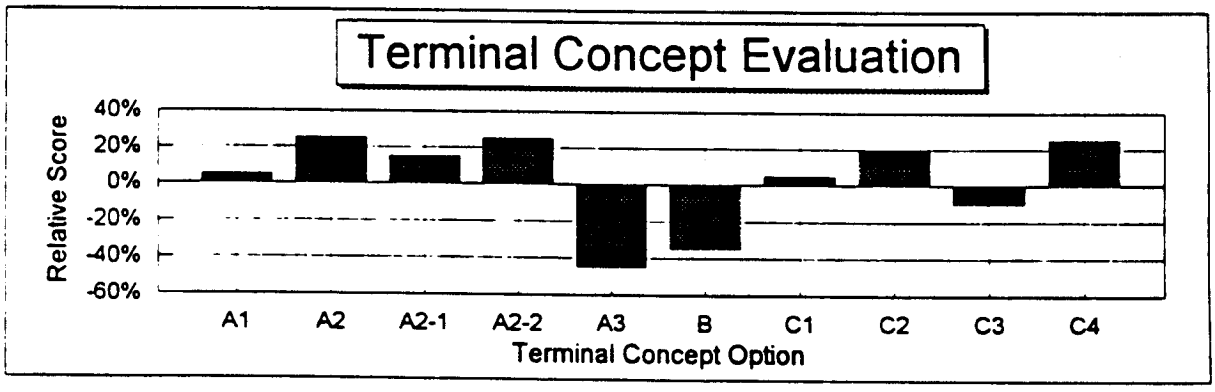
Concepts for other facilities were discussed in Technical Report No. 7B, Other Facilities

Table 3-2

Terminal Concept Evaluation Matrix

Evaluation Criteria	Weight	Conceptual Options									
		A1	A2	A2-1	A2-2	A3	B	C1	C2	C3	C4
Airside (Aircraft Gates)											
Capacity	10%	1	0	(1)	1	0	1	(1)	(1)	0	1
Flexibility	5%	0	0	1	0	0	0	0	0	1	1
Access	5%	0	0	1	0	1	0	1	1	1	1
Maneuverability	5%	0	1	1	1	(1)	(1)	1	1	1	1
Raw Sub-Total	**25%**	1	1	2	2	0	0	1	1	3	4
Weighted Sub-Total		10%	5%	5%	15%	0%	5%	0%	0%	15%	25%
Terminal											
Balance	5%	(1)	1	1	1	(1)	(1)	0	0	0	1
Capacity	5%	(1)	0	0	0	(1)	(1)	1	1	0	0
Convenience	5%	0	1	1	1	0	(1)	0	0	(1)	1
Constructability	5%	0	(1)	(1)	(1)	0	(1)	1	1	(1)	(1)
Flexibility	5%	(1)	1	1	1	1	(1)	0	0	(1)	0
Raw Sub-Total	**25%**	(3)	2	2	2	(1)	(5)	2	2	(3)	1
Weighted Sub-Total		-15%	10%	10%	10%	-5%	-25%	10%	10%	-15%	5%
Landside (Roads + Parking)											
Capacity	10%	(1)	1	1	1	0	(1)	1	1	1	1
Simplicity	5%	1	0	0	(1)	(1)	(1)	0	0	(1)	0
Constructability	5%	0	(1)	(1)	(1)	(1)	0	0	1	(1)	(1)
Compatibility	5%	0	0	0	(1)	(1)	(1)	1	1	1	1
Raw Sub-Total	**25%**	0	0	0	(2)	(3)	(3)	2	3	0	1
Weighted Sub-Total		-5%	5%	5%	-5%	-15%	-20%	15%	20%	5%	10%
Cost											
New Construction	10%	1	0	(1)	0	(1)	1	(1)	0	0	0
Special Systems	10%	0	1	1	1	(1)	(1)	(1)	(1)	(1)	(1)
Facility Relocations	5%	1	(1)	(1)	(1)	(1)	1	0	0	(1)	(1)
Raw Sub-Total	**25%**	2	0	(1)	0	(3)	1	(2)	(1)	(2)	(2)
Weighted Sub-Total		15%	5%	-5%	5%	-25%	5%	-20%	-10%	-15%	-15%
Raw Total	**100%**	0	3	3	2	(7)	(7)	3	5	(2)	4
Weighted Total		5%	25%	15%	25%	-45%	-35%	5%	20%	-10%	25%

Key: 1 = Positive Influence, 0 = Neutral, -1 = Negative Influence



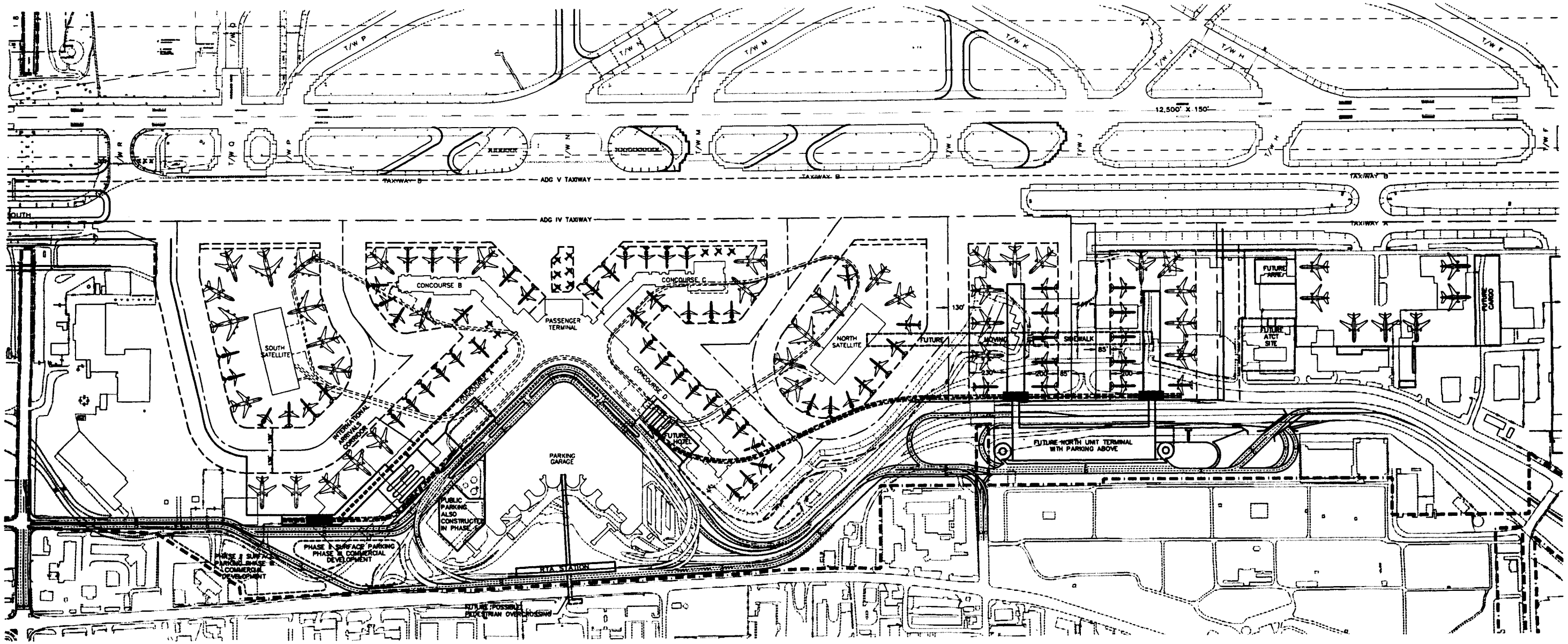


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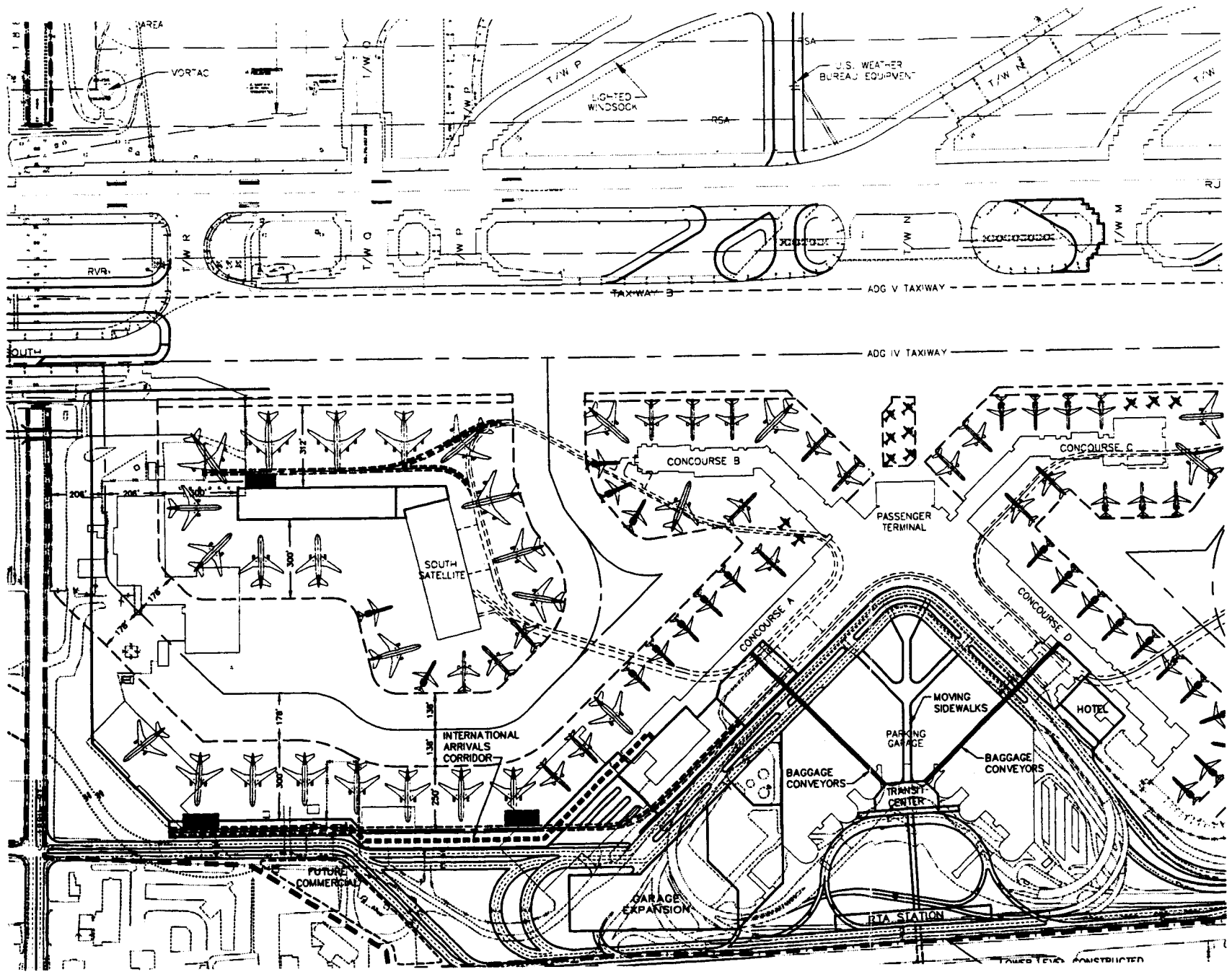
Figure 3-2
NORTH UNIT TERMINAL OPTION


VORTAC
T/W P
LIGHTED WINDSOCK
RSA
U.S. WEATHER BUREAU EQUIPMENT
T/W N
T/W M
T/W R
T/W Q
RVR
TAXIWAY B
ADG V TAXIWAY
ADG IV TAXIWAY
SOUTH SATELLITE
CONCOURSE B
PASSENGER TERMINAL
CONCOURSE C
CONCOURSE A
CONCOURSE D
MOVING SIDEWALKS
HOTEL
PARKING GARAGE
BAGGAGE CONVEYORS
BAGGAGE CONVEYORS
TRANSIT CENTER
INTERNATIONAL ARRIVALS CORRIDOR
FUTURE COMMERCIAL
GARAGE EXPANSION
RTA STATION

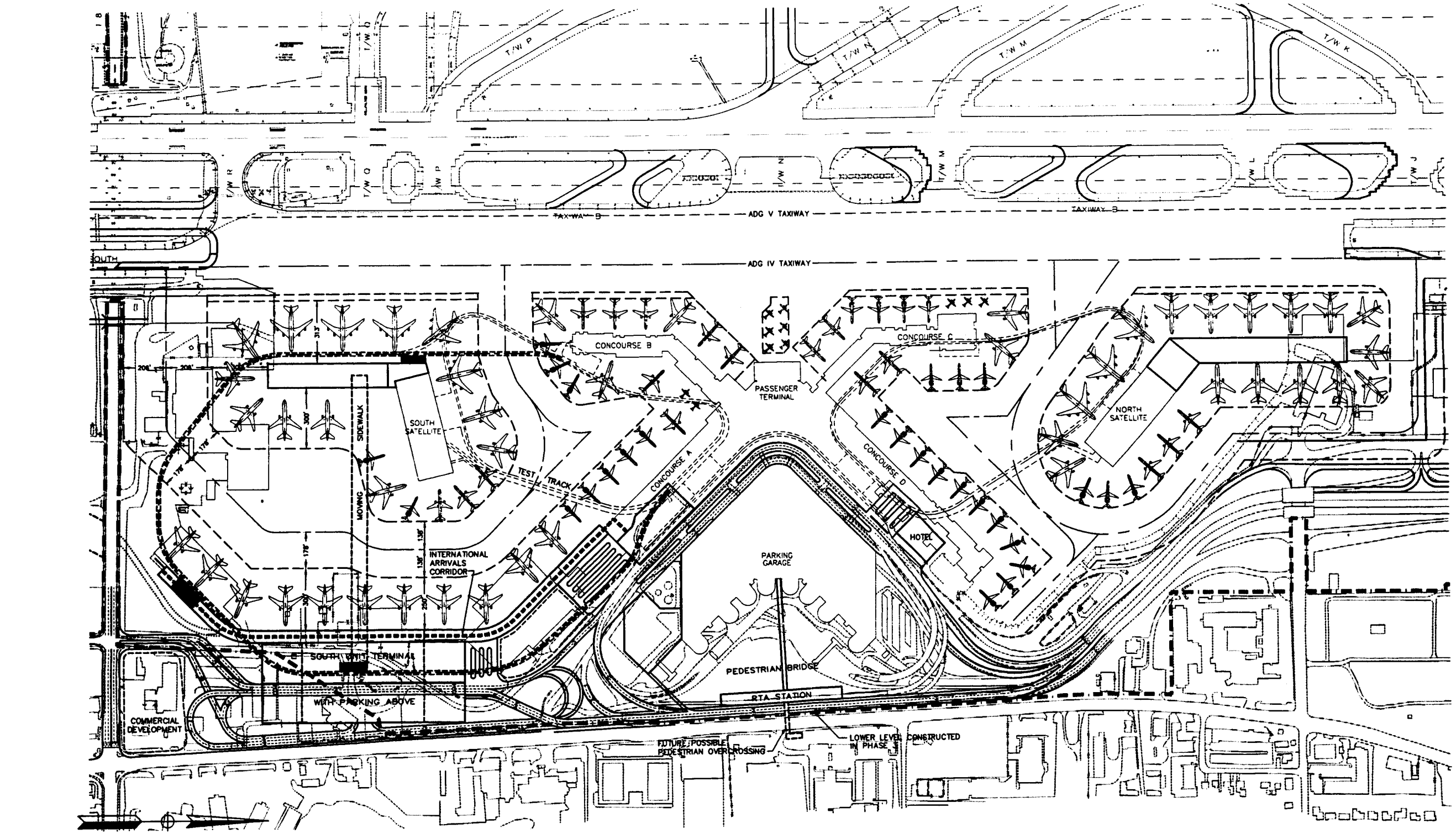


Figure 3-4
SOUTH UNIT TERMINAL OPTION

Requirements and Options, February 24, 1995. The description and evaluation of concepts for the two primary components of these other facilities are described below.

Air Cargo Facilities. Possible concepts considered for accommodating the 2020 cargo requirements are developing a centralized complex at a single location, or a decentralized complex by siting facilities at various locations on or off the Airport.

Two locations for centralized concepts were initially identified, the South Aviation Support Area (SASA) and a north site. Both sites met the two primary characteristics, plus provided advantages of promoting an efficient use of space, separating cargo and passenger traffic, and permitting phased development without interrupting existing cargo operations. However, each concept required overcoming major disadvantages in order to be implemented.

At the SASA site a centralized cargo development would utilize most of the SASA area and would not lend itself to accommodating other facilities such as aircraft maintenance, general aviation, etc. The north location presented a major conflict with existing development. It was concluded that accommodation of a centralized cargo option in the master plan was not practical and was dropped from further consideration.

The recommended option is a decentralized concept in which the existing cargo area would be modified and expanded to meet program requirements through 2010. After 2010, the projected demand can be met with supplemental cargo facilities in SASA, and in some cases, with warehouses north of SR518 as well.

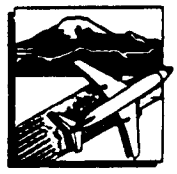
Aircraft Maintenance Facilities. Three potential sites were investigated for new airline maintenance facilities and airline maintenance facilities that would be relocated due to terminal expansion:

- ***South Aviation Support Area (SASA) Site.*** A 1994 study recommended that the SASA area be used for the establishment of future aircraft maintenance facilities. The concept provided facilities for the three existing line maintenance facilities located south of the passenger terminal as well as the construction of a base maintenance facility that was envisioned by Alaska Airlines. Provisions were made to accommodate the alignment of the proposed South Access Freeway on the West side of the site, and a corridor for the 24th/28th Avenue arterial on the east side of the site.

- ***Northeast Maintenance Site.*** This site presently houses the air cargo terminals, hardstands, truck docks and parking for all operators except Northwest Airlines, whose cargo terminal is located in the southeast quadrant adjacent to their maintenance hangar. Since the recommended cargo option proposes continued use of the area for cargo operations, the site is not viable for an aircraft maintenance complex.

- ***Far North Maintenance Site.*** This site is the Port owned property located north of State Highway 518 and west of 24th Avenue South. This site was considered in the SASA study and was rejected because of the need to construct a taxiway bridge over State Highway 518. Use of the site is further complicated by existing development, proposed use of part of the area for airport employee parking, and the need for extensive fill.

Of the three locations discussed for possible airline maintenance, only one site is deemed feasible for consideration--the SASA site. It provides sufficient area for development of



maintenance facilities and does not conflict with the recommended cargo facilities option.

The extent of aircraft maintenance development in the SASA should primarily be dictated by customer demand for continued use of those facilities that are displaced by passenger terminal expansion. Development of maintenance facilities should be reconciled with demands for other uses of the area such as cargo and general aviation.

Potential Commercial Development. The Airport Master Plan recognizes the need to promote commercial development on airport parcels not needed or suitable for other uses, as encouraged by the Airport Business Plan. A potential site for aviation-related commercial development is an "L-shaped" property north of SR 518 near the intersection with the North Airport Access Freeway.

SELECTION OF ALTERNATIVES FOR FINAL EVALUATION

In the Airport Master Plan Update and Environmental Impact Statement (EIS), a "do nothing" option and three development options were carried forward for a more detailed assessment:

- ***Alternative 1, Do Nothing/No Build.*** The Airport Master Plan Update requirements would not be addressed in the Do Nothing alternative. However, a number of other developments would occur: preparation of the SASA (as approved in the 1994 Final EIS and Record of Decision), completion of the Runway 34R RSA grading, development and implementation of declared distances for Runway 16R and 16L; installation of a Category IIIb Instrument Landing System on runway 16L; development of an on-airport hotel; and implementation of the Des Moines Creek Technology Campus.

- ***Alternative 2, Central Terminal (Figure 3-5).*** This alternative would include a new dependent (2,500-foot separation) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R; fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development for centralized terminal facilities; and completion of the SASA.

- ***Alternative 3, North Unit Terminal (Figure 3-6).*** This alternative would include a new dependent (2,500-foot separation) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R; fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development in a north unit terminal configuration with two concourses; and completion of the SASA.

- ***Alternative 4, South Unit Terminal (Figure 3-7).*** This alternative would include a new dependent (2,500-foot separation) parallel runway with a length of up to 8,500 feet; a 600-foot extension to Runway 34R, fill, clearing and grading of the 1,000-foot Runway Safety Areas for all runway ends; and completion of the landside and terminal development in a south unit terminal configuration; and completion of the SASA.

In addition to these alternatives for final evaluation, the Airport Master Plan Update, the EIS and other related planning studies have considered options with the specific purpose of addressing the issue of aircraft delay at Sea-Tac, especially during poor weather. These options would be alternatives to the construction of a

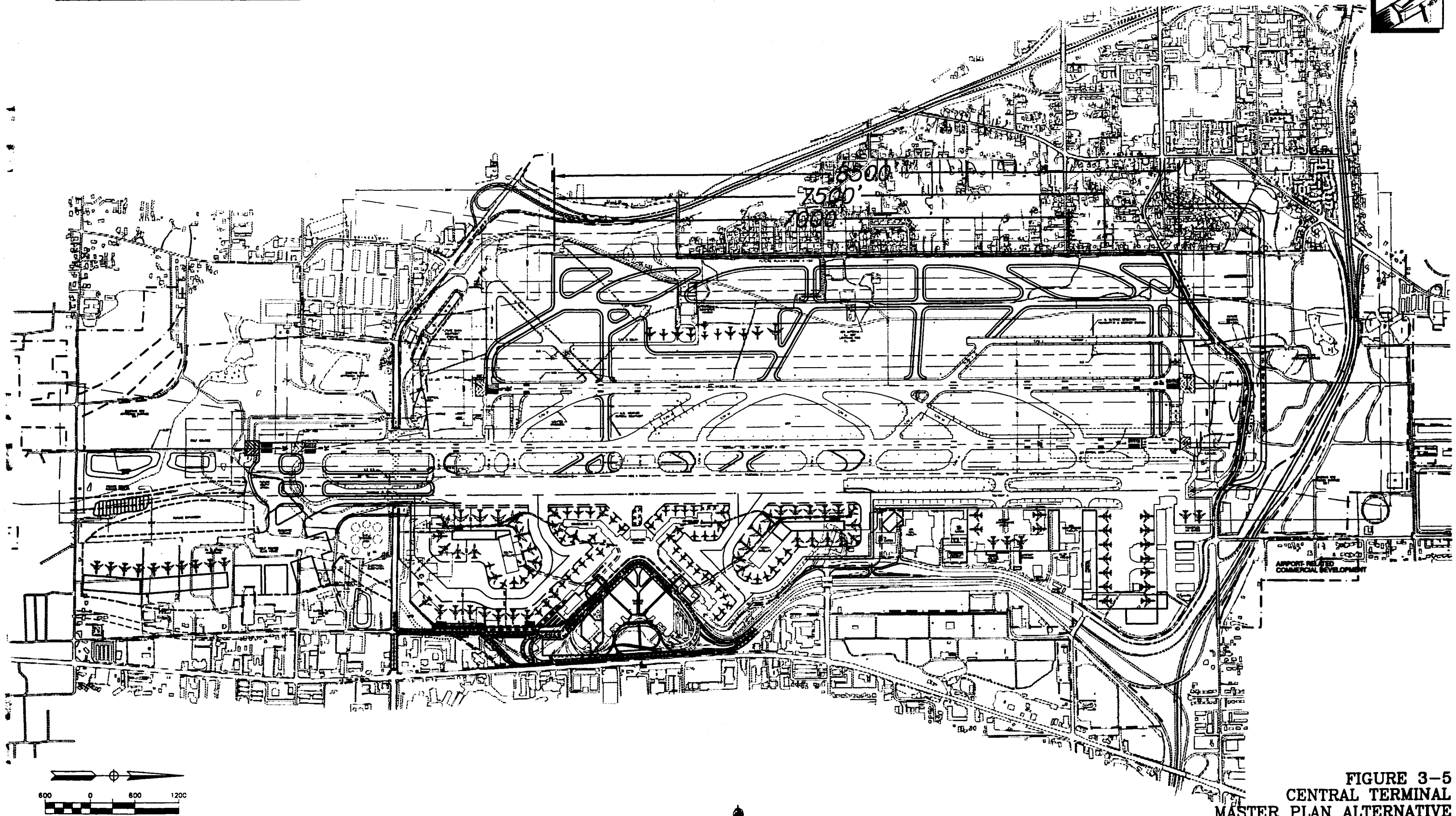


FIGURE 3-5
CENTRAL TERMINAL
MASTER PLAN ALTERNATIVE

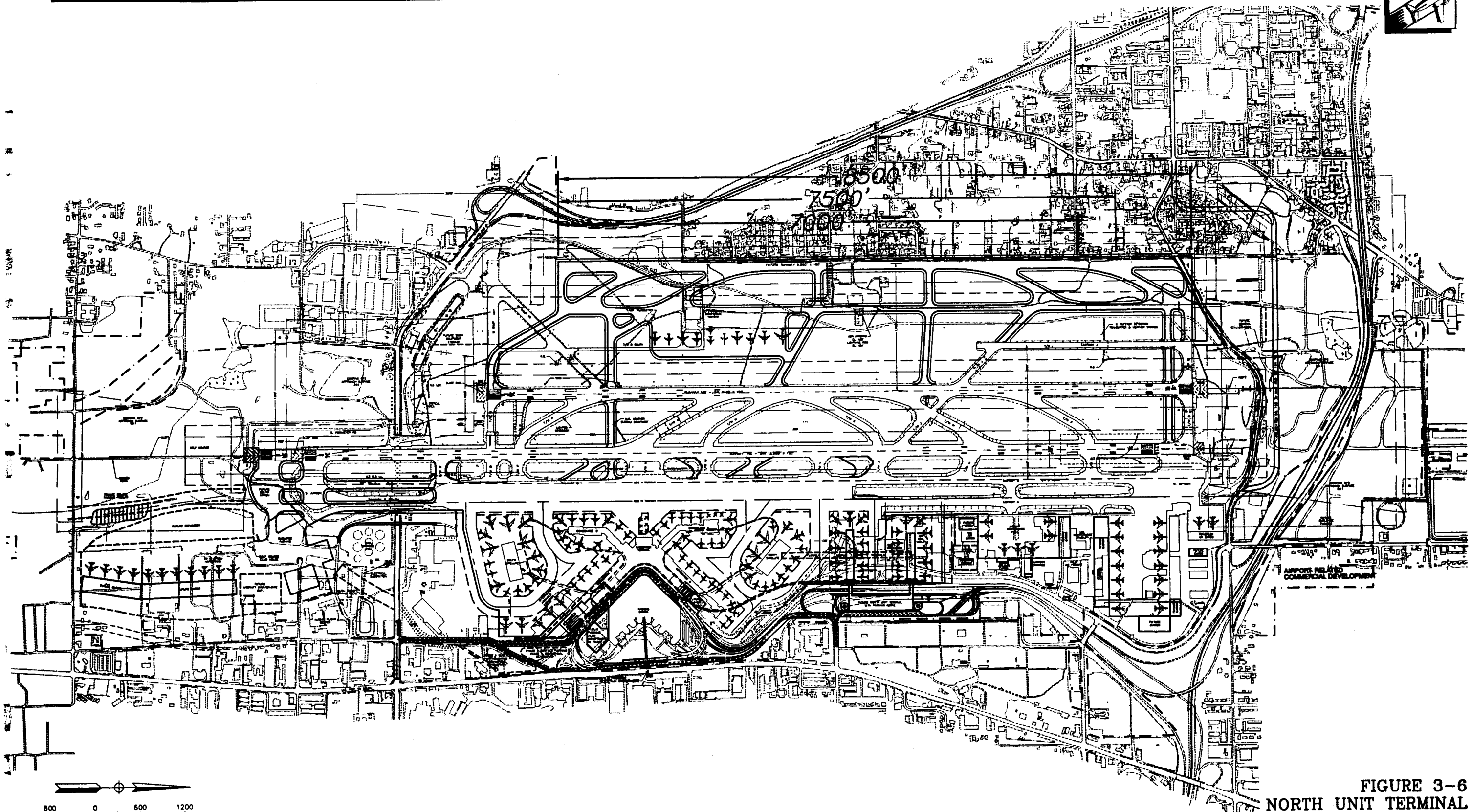


FIGURE 3-6
NORTH UNIT TERMINAL
MASTER PLAN ALTERNATIVE

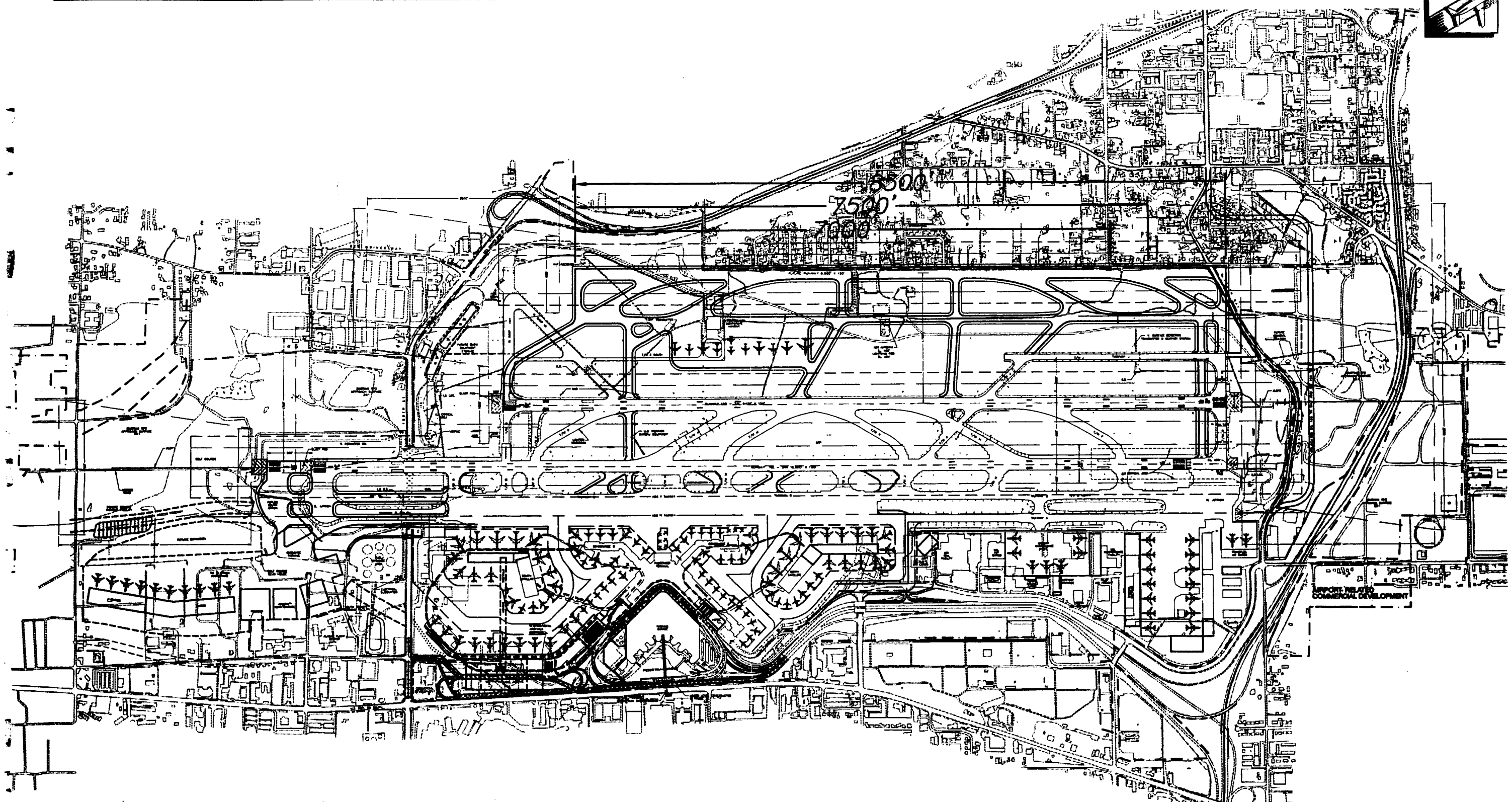


FIGURE 3-7
SOUTH UNIT TERMINAL
MASTER PLAN ALTERNATIVE

third runway at Sea-Tac and are listed below with a summary of the previous evaluation.

- ***Use of Other Modes of Transportation/ Communication (Automobile, Bus, Rail, Teleconferencing).*** It has been found that this alternative will not address the poor weather operating issues at Sea-Tac. Less than 5 percent of passengers using Sea-Tac are traveling to distances where surface transportation is efficient and cost effective and likely to be used. FAA study has found that teleconferencing is likely to have little effect.

- ***Use of Other Existing Airports or Construction of a New Airport (Replacement or Supplemental).*** Regional consensus has been established through PSRC Resolution EB-94-01 that: 1) There is no sponsor or funding for a new airport; 2) Extensive studies of these alternatives indicate that there are no feasible sites; 3) If a site could be identified, market forces and planning and development requirements would prevent the airport from successfully serving regional demand until 2010 or later. The FAA and Port have independently confirmed that a new airport would not satisfy the needs addressed by the Airport Master Plan Update.

- ***Activity Alternatives (Demand Management/System Management).*** These actions will not eliminate the poor weather operating need as all feasible actions have been implemented.

- ***Use of Air Traffic and Flight Technology.*** No technologies currently exist, or are planned, which would address the poor weather operating constraint at Sea-Tac.

- ***Blended Alternative (Combination of Other Modes, Use of Existing Airports, and Activity/Demand Management).*** The net result of this alternative would be a delay in the implementation of the Master Plan Update alternatives. Because there is no commitment to any individual or combination of elements and because aviation activity levels are currently growing at a rate higher than forecast, this option would not be a viable solution to the aircraft delay problems.

It was concluded that none of the above options would adequately address the aircraft delay issue and that the only viable alternative to avoid excessive aircraft operation delays is to build a third runway at Sea-Tac.

Section 4
EVALUATION OF FINAL ALTERNATIVES

SECTION 4
EVALUATION OF FINAL ALTERNATIVES

APPROACH

The three final airport development options were evaluated extensively in the Airport Master Plan Update as well as the Environmental Impact Statement. The results of this evaluation are described in this section. The terminal and runway components of the three airport development options were addressed separately because runway options were not tied to terminal options.

TERMINAL OPTIONS EVALUATION

The evaluation of terminal options is summarized in Table 4-1 according to six criteria: airline/aircraft factors, passenger/terminal factors, ground access, environmental factors, acquisition and construction costs, and constructibility. Although other criteria were used to evaluate terminal alternatives considered earlier in the planning process, these factors were found to be the most pertinent and important characteristics distinguishing each of the three remaining terminal options.

Most of the terminal evaluation criteria shown in Table 4-1 are subjective. Accordingly, a ranking system where "plus" equals the best ranking and "minus" equals the worst ranking ("0" equals a tie for best) was used to provide a synopsis of the evaluation results. Although some factors such as the environmental factors and costs have been quantified, Table 4-1 uses the ranking system for all criteria for consistency.

Airline/Aircraft Factors

Airline/aircraft factors considered in this comparative evaluation summary are minimization of pushback/taxi conflicts, impact on airline maintenance and deferral of the need for SASA, and gate expandability beyond the planning period.

Minimization of Pushback/Taxi Conflicts. This criteria measures the ability of the terminal option to facilitate aircraft movement within the immediate terminal and gate areas. Maneuvering conflicts are created when taxiing aircraft or aircraft being towed block the taxi lane for other aircraft. This can cause delays in aircraft reaching their assigned gate or departing their gate for the runway.

The degree of potential taxiway congestion can be measured by the number of aircraft gate positions which an aircraft must pass by on a single taxilane to the destination gate. Currently at Sea-Tac, an aircraft utilizing the end gate of Concourse A must pass by at least 11 gates which could potentially impede its taxiing. Aircraft destined for the end gate position of Concourse D could potentially be impeded by seven gates.

The South Unit and Central Terminal Options increase the length of the taxi lanes at the north and south ends of the terminal and would create the potential for greater taxiing conflicts in the terminal gate area. In the South Unit and Central Terminal Alternatives, an aircraft would have to pass at least 14 gates to reach the most inaccessible gate at both Concourses A and D.

The most inaccessible gates under the North Unit Terminal Alternative would require an aircraft to pass only 11 gates from Concourse A and 9 gates from Concourse D. From the new north unit terminal, only 10 gates would be passed by an aircraft from the most inaccessible

TABLE 4-1
TERMINAL OPTIONS COMPARATIVE EVALUATION SUMMARY [a]

	South Unit Terminal Option	Central Terminal Option	North Unit Terminal Option
Airline/Aircraft Factors			
1. Minimization of Pushback/Taxi Conflicts			+
2. Impact on Airline Maintenance and Delay of SASA			+
3. Gate Expandability Beyond Planning Period			+
Passenger/Terminal Factors			
1. Centralization of Services/Concessions		+	
2. Terminal Expandability Beyond Planning Period		-	+
3. Passenger Comfort and Convenience	0		0
Ground Access			
1. Curb Space	0		0
2. Terminal Drive Capacity		0	0
3. Intersection Congestion			+
4. Parking Requirements		+	
Environmental Factors			
1. Social Impacts			
- Properties to be Acquired	-	0	0
2. Induced Socioeconomic Impacts			
- Loss in Property Tax	-	0	0
- Loss in Taxable Sales	-	0	0
- Jobs Displaced	-	0	0
Acquisition and Construction Costs			
1. Total Cost with Moving Sidewalk	-	0	0
2. Total Cost with STS Extensions	-	0	0
Constructability			
1. Continuity of Operations During Construction		-	+
2. Incremental Staging		+	

[a] "+" = Best, "-" = Worst, "0" = Tie for Best

gate location. The reduced potential for pushback/taxi conflicts under the North Unit Terminal Option is due to the construction of two relative short concourses with independent airfield access rather than relying only on extending the existing concourses and satellites as in the South Unit and Central Terminal Options.

Impact on Airline Maintenance and Deferral of the need for SASA. This criteria measures the need to relocate existing activities in the terminal area to expand or construct new terminal facilities. Activities particularly vulnerable to relocation are the aircraft maintenance hangars operated by Alaska Airlines, Delta Airlines and Northwest Airlines located south of the existing terminal. If the facilities need to be replaced, it could require the development of the South Airport Support Area (SASA) south of 192nd Street. This area will require extensive site preparation as well as the construction of aircraft parking aprons for tenant use.

All three terminal options require the use of the site occupied by the Northwest Airlines maintenance hangar located at the end of Concourse A. The Northwest hangar is owned by the Port of Seattle and leased to Northwest Airlines. Only the North Unit Terminal Option, however, allows the continued use of the Alaska maintenance hangar and Delta maintenance hangar in that area. For this reason, the North Unit Terminal Option will reduce disruption of existing airline maintenance activities at the airport and will eventually require less intensive development of the SASA area. The North Unit Terminal Option, however, will require the relocation of the air mail facility operated by the U.S. Postal Service north of the terminal, as well as other catering/cargo areas.

Gate Expandability Beyond Planning Period. An important airline/aircraft factor is the ability to expand the number of gates beyond those required for the planning period. The 75 air carrier gates operated at Sea-Tac today will need to be expanded to approximately 100 gates to meet demand at the projected 38 MAP level. Additional gates may be necessary beyond this demand level. This criterion measures the expandability of the terminal gate positions beyond the planning period needs.

In the South Unit and Central Terminal Options, the north satellite is programmed to be expanded initially in Phase 3 and again in Phase 5. The expansion of the north satellite under the South Unit and Central Terminal Options would not allow a new north unit terminal in the same location as in the North Unit Terminal Option. Consequently, further expansion of the airport terminal gate activity to the north in the South Unit and Central Terminal Options would require more relocations and result in a greater separation between the Main Terminal and a future North Unit Terminal. Moreover, the South Unit and Central Terminal Options cannot be expanded to the south due to the location of South 188th Street and, potentially, the South Access Freeway.

On the other hand, the North Unit Terminal Option can be expanded southward in a manner similar to the South Unit and Central Terminal Options and additional concourses could ultimately be constructed to the north of the North Unit Terminal if necessary (with corresponding facility relocations).

Passenger/Terminal Factors

Passenger/terminal considerations consist of centralization of services/concessions, terminal expandability beyond the planning period and passenger comfort and convenience.

Centralization of Services/Concessions. In the Central Terminal Option passenger services and concessions would predominantly be located in the Main Terminal. This would enhance passenger convenience and reduce passenger confusion and disorientation. On the other hand, the two-terminal concepts lack the simplicity of the single-terminal design and create the potential for passenger inconvenience and confusion if poorly implemented.

Terminal Expandability Beyond the Planning Period. The terminal expandability of the three terminal options is similar to the gate expandability discussed above. Terminal expandability addresses the flexibility to add space within the central terminal building for such functions as concessions, ticket counters, and baggage claim area.

The discussion relating to gate expandability applies here also. Under the Central Terminal Option further expansion of terminal facilities to the north or south would not appear to be feasible. Although a new North Unit Terminal could be constructed, the concourses would not be as well located with respect to the terminal as under the North Unit Terminal Option and a large portion of the air cargo area would have to be relocated. In the North Unit Terminal Option, Concourse A could be expanded to the south as under the South Unit Terminal Option.

Passenger Comfort and Convenience. The ability of the concept to facilitate passenger convenience and enhance the travel experience includes passenger orientation, walking distances, level changes, accessibility, amenities, and the minimization of connecting times. As used at Sea-Tac, this criterion needs to consider the requirements of both originating/terminating and connecting passengers. Options which provide short curb-to-gate distances as well as contiguous terminal facilities are generally more desirable, while options which increase both curb-to-gate and terminal-to-terminal distances are less desirable.

Both the North and South Unit Terminals share a similar degree of passenger convenience by improving curb-to-terminal and curb-to-gate access. Decreased walking distances in turn, decrease the dependence of the concept on mechanical people-movers such as moving sidewalks and/or the STS system. Furthermore, because these terminals would be new, they could be designed to provide contemporary amenities and sufficient space to enhance the passenger experience throughout.

Of these two alternatives, the South Unit Terminal has the benefit of being contiguous to the existing terminal, thereby facilitating (off-line) connecting passenger movements but with the negative of connecting to gates on the south satellite via a long underground connector. The North Unit Terminal provides direct access to all its gates via relatively short piers, and could provide a direct passenger connection back to the Main Terminal by an extension of the STS shuttle.

The passenger convenience of the Central Terminal Option becomes somewhat strained due to the dependence on the existing core terminal building and the Transit Plaza east of the parking garage. While curb-to-terminal activities remain relatively unchanged from the existing curb, passengers using the Transit Plaza would be required to travel nearly 1,000 feet across the parking structure to reach the terminal itself. All passengers would face increased curb-to-gate distances due to the lengthening of Concourse A and the North and South Satellites necessitating some form of mechanized people mover to render these distances manageable.

Ground Access

Ground access considerations addressed in the comparative terminal evaluation are curb space at the terminal, terminal drive capacity, intersection congestion in the airport area, and centralized airport parking.

Curb Space. The amount of curb frontage for passenger pick-up and drop-off along the face of the terminal building is an important element in minimizing terminal drive congestion. Both the upper and lower roadways of the existing terminal have about 1,600 feet of curb at the building face.

Curb frontage under each of the terminal options would be as follows:

Location	South Unit Terminal Option	Central Terminal Option	North Unit Terminal Option
Main Terminal			
Departure Level	1,980'	2,350'	2,050'
Independent Curb	1,400'	1,700'	1,500'
Transit Curb	750'	750'	750'
Transit Plazas	2	1	2
Arrival Level	1,980'	2,350'	2,050'
Unit Terminal			
Departure Level	1,000'	–	850'
Arrival Level	1,000'	–	850'
Transit Plazas	Yes	–	Yes
Total Curb Frontage	8,110'	7,150'	8,050'

Thus either the North or South Unit Terminal Option would provide the opportunity for the greatest amount of vehicle space in front of the terminal area for passenger loading and unloading. The Central Option does not meet forecast requirements for curb frontage.

Terminal Drive Capacity. The Main Terminal drive currently consists of three through lanes and two curb lanes on the lower level, and two through lanes and two curb lanes on the upper level. At the upper level, the innermost curb lane is 11 feet wide, while the rest are 9 feet or less in width; at the lower level, the three innermost lanes are about 10 feet wide, while the two outer lanes are 12 feet or more in width. With the proposed improvements under all three terminal options, the Main Terminal drive will be widened to four through and two curb lanes on the upper level. The new lanes would be 20 feet at the curbside and 12 feet for through traffic. The lower level roadway at the face of the terminal would remain essentially unchanged for all three options. Under all three terminal options, the Main Terminal drive would have through lane capacities of 1,970 vehicles per hour on the lower level and 4,540 on the upper level.

The terminal drive volume and volume-to-capacity ratio measured in vehicles per hour from 12:00 to 1:00 PM of the average day peak month in the year 2020 at the Main Terminal would be as follows:

Location	South Unit Terminal Option	Central Terminal Option	North Unit Terminal Option
Main Terminal			
Lower Level			
Volume	1,080	1,140	850
V/C	55%	58%	43%
Upper Level			
Volume	1,420	2,320	1,670
V/C	31%	51%	37%

Along the upper main terminal drive, which is a critical area for potential traffic congestion, the Central Terminal Option would have a volume/capacity ratio of 0.51 compared with 0.31 and 0.37 for the South Unit and North Unit Terminal Options, respectively. The South and North Options will result in a higher level of service on the main terminal drive.

Intersection Congestion. As described in the Draft EIS, continued regional population growth and growth of aviation demand will impact the surface transportation system in the vicinity of Sea-Tac Airport regardless of the improvements undertaken at the Airport. Total Airport surface traffic is expected to increase from approximately 87,600 vehicles per average day in 1994, to approximately 161,500 vehicles per average day in the year 2020 without airport improvements or under any terminal option. Year 2020 traffic volumes on the regional surface transportation system in the vicinity of the Airport are expected to be approximately 36 percent higher than current levels due to regional population and employment growth.

The Draft Environmental Impact Statement identified the following impacts (note that the Final Environmental Statement could show somewhat different results). The South Unit and Central Terminal Options would adversely impact the surface transportation system in comparison with the Do-Nothing Alternative. Adverse impacts were identified at the following three intersections:

- The intersection of Air Cargo Road and S. 170th Street would remain at Level of Service (LOS) F but the average delay would more than double. LOS is a measure of roadway or intersection congestion, with A being free flow and F being highly saturated.

- The intersection of Northbound Airport Expressway ramps and S. 170th Street would degrade from LOS B to LOS F.

- The intersection of International Boulevard and S. 170th Street would remain at LOS F but the average delay would more than triple.

No adverse impacts were identified at any of the freeway ramp junctions. Mitigation measures could eliminate these impacts, such as moving employee parking to a site north of SR 518.

The North Unit Terminal Option would not impact the surface transportation system in comparison to the Do-Nothing Alternative.

Parking Requirements

A detailed study of parking needs for all future options projected a need to expand parking on-site above existing levels. (Airport Parking Systems-Long Range Analysis. P&D Aviation.) Currently, the main terminal has 9,400 parking spaces allocated as follows: 1) Rental Cars: spaces for both ready-car access and on-site vehicle preparation - 1,400 spaces; 2) Employee Parking: 517 spaces; 3) Short-Term Metered Parking: 1,000 spaces; and, 4) Long-Term Spaces 6,483. The POS has 4,018 spaces for employee parking, mostly located away from the main terminal complex. The POS operates no remote parking areas for public use.

All three expansion options estimate that on-site public parking needs will increase to 14,800 spaces. This represents a Port policy of providing an estimated 50% of all parking demand at the 38 MAP operating level on the airport as opposed to off-site lots. The three options differ in parking space concentrations at terminal areas. The Central Terminal Option would retain all spaces at the main terminal to a maximum of 10,200 public spaces; the balance of public parking spaces (4,600) would be located at a remote facility on-site, connected to the main terminal complex with shuttle buses. The South and North Unit Terminal options cap public parking at the Main Terminal at 10,900 spaces, with either Unit Terminal having 3,900 public spaces.

It is anticipated that Short-term Metered Parking would double to 2,000 total spaces as demand increases and the balance of short and long-term spaces is divided proportionally among the terminal option schemes. Any additional public spaces required would be operated off-site by private operators or by the POS at on-site remote locations away from the terminal area.

In addition, car rental ready car spaces must be increased to 3,100 spaces, with an equivalent area (approximately 25 acres) on-site for car preparation. In the Central Option all ready car rental spaces would be at the Main Terminal, while the North and South Unit Terminal Options would shift 900 spaces to either unit terminal from the Main Terminal, reducing the number of ready car spaces there to 2,200. The site noted will be needed for rental car preparation, storage, and quick-turn around preparation located on airport property. The three terminal options have some differences in how rental-car ready spaces would be phased into operation, but total ready-car space would be the same in all three options, as is the need for on-site rental car support facilities.

Finally, employee parking will also have to expand to about 6,800 spaces from the existing 4,100 spaces, using the POS standard of 2.5 employees per parking space or to 5,500 spaces if the POS switches its parking allocation factor to one parking space per 3 employees. Data collected in 1995 strongly recommends that the POS consider using the higher space allocation factor. Thus, about 1,400 added parking spaces are needed in all three options to accommodate employee parking. The three options do have immediate and continued impacts on employee parking facilities due to phased development proposed in all three options. Therefore, most employee parking is planned to shift to a site north of SR 518, near South 24th Avenue in all three options.

In summary, the Central Terminal Option would have 13,500 spaces (public parking and ready-car rental area) at the terminal, with 4,600 spaces located at a remote location on-site. The North and South Unit Terminal options would leave 13,300 spaces at the Central Terminal and 4,800 at the Unit Terminal for public parking and rental car ready spaces. Summarized below are the parking requirements for each terminal option.

OVERALL TERMINAL AREA PARKING REQUIREMENT (NON-EMPLOYEE FACILITIES) [1]

Central Terminal Garage - Central Terminal Option

	Year 2020 Requirement
Public Parking [2]	10,200
Employee Parking	200
Car Rental	3,100
Subtotal	13,500
Remote Parking	4,600
Total	18,100

Central Terminal Garage - North or South Unit Terminal Option

Public Parking [2]	10,900
Employee Parking	200
Car Rental	2,200
Subtotal	13,300
Remote Parking	0
Total	13,300

North or South Unit Terminal Garage

Public Parking [2]	3,900
Car Rental	900
Subtotal	4,800
Remote Parking	0
Total	4,800

[1] All numbers rounded to the nearest hundred.
[2] 15%-20% of spaces assigned to short term parking.

Environmental Factors

Environmental factors addressed in the comparative evaluation summary of terminal options are social impacts and induced socioeconomic impacts. These criteria were found to be the most relevant characteristics distinguishing each of the three remaining terminal options. An in-depth analysis of the full range of potential environmental impacts and potential mitigation measures is included in the Final Environmental Impact Statement (FEIS) on the Airport Master Plan Update.

Social Impacts. The Central and North Unit Terminal Options would not require the acquisition of property by the Port for terminal construction or related roadway and vehicle parking development. The South Unit Terminal Option would require the acquisition of 12 commercial properties north of South 188th Street and west of International Boulevard. No residential or other properties would need to be purchased for any of the terminal options. The impacts described here apply to only the relocations due to terminal construction.

Induced Socioeconomic Impact. Sea-Tac Airport, a major passenger and cargo transportation facility, directly and indirectly contributes to the economic structure of the Puget Sound Region. Induced socioeconomic impacts are generated in the region by changes in employment opportunities, payroll generation, business expenditures for goods and services, and tax revenue. The existing and forecast induced socioeconomic impacts as reported in the Draft EIS are:

	1993	2020
Total Jobs	205,690	418,632
Personal Income ($ millions)	2,585.6	5,262.4
State and Local Taxes ($ millions)	406.6	827.9

The displacement of businesses described in the preceding subsection would result in losses in property tax, taxable sales and jobs for the South Unit Terminal Option, compared with the Central and North Unit Terminal Options. The Draft EIS estimates these induced socioeconomic affects of the South Unit Terminal Option as follows:

	Socioeconomic Effect of South Unit Terminal Option, 2020
Loss in Property Tax/Year ($ thousands)	64.4
Lost Taxable Sales Transactions/Year ($ millions)	13.4
Jobs Displaced	195

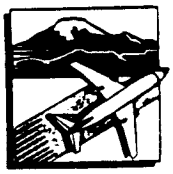
This analysis assumes that the displaced businesses will not relocate in the area.

Acquisition and Construction Costs

Costs include property acquisition, relocations and demolition, terminal construction, terminal equipment (loading bridges, baggage handling systems, moving sidewalks), Satellite Transit System improvements, roadways and vehicle parking, engineering and architectural services and allowance for contingency and other costs not specifically itemized. All costs were estimated in 1994 dollars.

Costs were prepared for two assumptions to estimate the low and high cost range of Satellite Transit System (STS) improvements (which are currently under study). Each of these is described below. Capital cost estimates for the Sea-Tac Airport Master Plan Update are included in a memorandum by P&D Aviation to the Port of Seattle dated April 21, 1995 and subsequent data submitted April 26, 1995.

Total Cost with Moving Sidewalks. The lower cost estimate assumes the new terminal areas would be served by moving sidewalks and



expanded curbside shuttle service, rather than the extension of existing STS lines. The STS system would be upgraded in the first phase by a major overhaul of existing vehicles and the procurement of new vehicles to accommodate increased passenger levels on the existing lines. Total terminal-related costs for each of the terminal options are estimated as follows:

Terminal Option	Terminal and Roadway/Parking Cost Without STS Extension: Cost (millions of 1994 dollars)	Cost per Narrowbody Equivalent Gate
South Unit	1,035.4	32.4
Central	820.2	25.6
North Unit	820.3	24.9

The number of new narrowbody equivalent gates is 32 for the South Unit and Central Terminal Options and 33 for the North Unit Terminal Option.

Total Cost with STS Extension. The higher STS cost estimate assumes the STS system would be upgraded as described above and in addition the existing shuttle and loop systems would be expanded to serve the new terminal areas for inter- and intra-terminal passenger movements. Under the STS extension alternative, moving sidewalks would also be provided to enhance the movement of passengers along concourses and to connect the expanded South Satellite with the extended Concourse A in the South Unit Terminal Option and to connect the North Satellite with the new north unit terminal concourses in the North Unit Terminal Option.

Terminal Option	Terminal and Roadway/Parking Cost With STS Extension: Cost (millions of 1994 dollars)	Cost per Narrowbody Equivalent Gate
South Unit	1,073.4	33.5
Central	881.6	27.5
North Unit	866.6	26.3

Constructibility

Issues addressed under constructibility are the continuity of operations during terminal construction and the flexibility for incremental staging of terminal development.

Continuity of Operations During Construction. It is important to maintain ongoing terminal operations throughout construction with a minimum of disruption and inconvenience. Related considerations include the proximity of construction to ongoing operations, the need for temporary construction and detours, the availability and location of construction staging areas, construction access, and the degree of renovation necessary in existing terminal areas. In the North Unit Terminal Option, the existing terminal and concourse areas are relatively unaffected, with most of the new terminal and concourse construction occurring to the north. Moreover the North Unit Terminal Option is estimated to require the renovation of only 150,000 square feet of existing terminal areas. This option, therefore, would disrupt existing terminal operations the least for construction and/or renovation.

Construction of the Central Terminal Option would impact both ends of the existing terminal as well as the South and North Satellites and Concourses A and D. Because of the existing airside and landside site constraints, this option would provide limited areas for construction lay-down and phasing. Furthermore, the Central Terminal Option is estimated to require the renovation of over 300,000 square feet of existing terminal structures. Disruption of terminal activities is correspondingly anticipated to be the greatest under the Central Terminal Option.

The South Unit Terminal Option could require the renovation of over 200,000 square feet of existing terminal space. Construction of this

option would also impact one end of the existing terminal as well as the South and North Satellites and Concourse A. While the new south unit terminal could be constructed outside of the immediate terminal area, development of the new pedestrian tunnel to the south satellite could necessitate temporarily closing the existing taxiway. While less disruptive than the Central Terminal Option, it is significantly more disruptive than the North Terminal Option.

Incremental Staging. Another important aspect of constructibility is the ability to construct the new terminal space in stages to meet demand in a cost effective manner as it occurs. In the Central Terminal Option, expansion of the terminal area consists of extensions of the North and South Satellites, extension of Concourse A, and additions to the existing terminal at the south and north ends. The central parking garage would be expanded in an incremental fashion to the south. These additions could be accomplished in an incremental fashion as needed to meet passenger demand.

On the other hand, the South and North Unit Terminal Options require a major unit terminal addition, which involves substantial road relocations as well as terminal construction. Although these unit terminals could, to some degree, be expanded in phases (such as phasing of concourse development), the unit terminal options would not offer the flexibility of staging new terminal development that the Central Terminal Option would offer.

RUNWAY OPTIONS EVALUATION

Runway evaluation criteria addressed in this stage of the analysis are: airline/aircraft factors, environmental factors, and acquisition and construction costs. Most of the runway criteria shown in Table 4-2 could be quantified. Therefore, Table 4-2 is shown in terms of numerical values rather than rankings. Similarly to the terminal options, other criteria besides those shown in Table 4-2 were evaluated during earlier runways studies. The criteria shown in Table 4-2 are the most relevant for this stage of analysis where the final three runway options are being evaluated.

Airline/Aircraft Factors

Airline/aircraft factors relate to the effectiveness of the runway option in reducing aircraft operations delays and improving the overall efficiency of the airfield operations.

Percentage of Fleet Mix Accommodated in 2020. Using an analysis similar to that described above, it was concluded that the 7,000 foot runway would be sufficiently long to accommodate 91 percent of the types of aircraft expect to be using the airport, the 7,500 foot runway 96 percent and the 8,500 foot runway 99 percent. Landing lengths were based on typical landing weights, wet pavements and an allowance for accommodating Category III operations in accordance with FAA requirements. The longer runways would allow more aircraft to land on the new runway, thereby increasing airfield efficiency.

Percentage of Takeoffs Accommodated in 2020. Although the new runway will be used predominantly for landings, it is important to identify its takeoff capabilities for those times when it would be used for departures. In Technical Report No. 6, Airside Options Evaluation, runway lengths were evaluated according to the percentage of aircraft which each could accommodate in takeoffs and landings. The aircraft mix is based on the projected percentage of aircraft arrivals and departure in 2020. This analysis revealed that the 7,000 foot runway would be sufficiently long to accommodate 77 percent of the types of aircraft expected to be using the airport for

TABLE 4-2
RUNWAY OPTIONS COMPARATIVE EVALUATION SUMMARY [a]

	7,000' Runway Option	7,500' Runway Option	8,500' Runway Option
Airline/Aircraft Factors			
1. Percentage of Takeoffs Capable of Using this Runway Length, 2020	77%	85%	90%
2. Percentage of Landings Capable of Using this Runway Length, 2020	91%	96%	99%
Environmental Factors [b]			
1. Noise Impacts (Year 2020)			
- Number of People Affected by DNL65	10,800	10,800	11,300
- Housing Units Affected by DNL65	4,600	4,600	4,800
- Non-Airport Area Affected by DNL65 (sq. mi.)	3.2	3.2	3.3
2. Social Impacts			
- Single Family Homes to be Acquired	346	359	386
- Condominium/Apartment Units to be Acquired	26	260	260
- Businesses to be Acquired [c]	96	104	105
3. Wetlands			
- Wetland Acres Affected	9.1	8.9	9.7
4. Earth Resources			
- Million Cubic Yards of Fill	13.52	16.77	17.25
Acquisition and Construction Costs [d]			
1. Estimated Property Acquisition and Relocation Cost ($ millions)	82.9	105.3	109.7
2. Estimated Construction Cost ($ millions)	224.8	240.1	295.9
	307.7	345.4	405.6

[a] Note that data in this table were updated after the initial airside options analysis (Table 3-1).
[b] Based on the Draft EIS by Landrum & Brown released in April 1995.
[c] Assumes businesses in South Runway Protection Zone are acquired rather than the acquisition of an avigation easement.
[d] Includes only costs associated with a new runway. Excludes costs associated with extension of Runway 16L-34R, new taxiways to Runway 16L-34R, RSA improvements to existing runways, and environmental mitigation. (Revised since April 1995).

takeoffs, the 7,500 foot runway 85 percent and the 8,500 foot runway 90 percent. Takeoff requirements were based on typical maximum flight distances, zero runway gradient, zero wind and a temperature of 84°F. Aircraft departing to the south (runway gradient of -0.71 to -0.72) would require a shorter runway takeoff distance; aircraft departing to the north (runway gradient of 0.71 to 0.72) would require a longer takeoff distance. Aircraft requiring the longest takeoff distances are generally widebody aircraft flying long stage lengths. The longer runways would accommodate a greater percentage of the airport's operations and therefore would provide greater flexibility and efficiency in the use of the airfield.

Pilot Rejection Rate. When multiple landing runways are available, a pilot has the option (subject to any airline rules applicable) of rejecting the landing runway assigned to him by the air traffic control tower and requesting another runway. The Airline Transport Association (ATA) and airline pilots have stated that the pilot rejection rate for the shorter runway lengths compared with the 8,500 foot option will be significant due to the less desirable length and the proximity of the two longer parallel runways. FAA tower controllers have commented that this type of pilot rejection will complicate air traffic management and contribute to delays.

In an effort to collect additional information related to this concern, a survey was conducted of 10 commercial airports which have similar characteristics of traffic and airfield configuration. Results of the interviews show a pattern of rejection of shorter landing runways, especially if longer runways are closer to the terminal building.

Environmental Factors

The principal environmental factors considered in this stage of planning are noise impacts (numbers of people, housing units and non-airport area affected by DNL65), social impacts (single family homes, condominium/ apartment units and businesses to be acquired), wetland acres affected, and the volume of fill required. These criteria were found to be the most relevant characteristics distinguishing each of the three remaining runway options. An in-depth analysis of the full range of potential environmental impacts and potential mitigation measures is included in the Final Environmental Impact Statement (FEIS) on the Airport Master Plan Update.

Noise Impacts (Year 2020). For this comparative evaluation, the extent of noise impacts of DNL65 and greater include number of people affected, housing units affected and non-airport area affected. In the noise analyses presented in the Draft Environmental Impact Statement, April 1995, impacts were quantified only for the 8,500 foot runway option. In earlier environmental documentation, noise contours were prepared for the 7,000 foot and 7,500 foot runway options using somewhat different runway use assumptions. The earlier screening analysis was prepared using the best information available at the time but subsequent analysis has resulted in refined operating assumptions. The data in Table 4-2 for the number of people affected, housing units affected, and non-airport area affected for the 7,000 foot and 7,500 foot runway options were estimated by P&D Aviation on the basis of the data for the 8,500 foot runway documented in the April 1995 Draft EIS and the percentage relationships in the data for the three runway options contained in the earlier analysis.

The results of this estimation procedure indicate that the shorter runways would affect slightly fewer people, housing units and off-airport area than the 8,500 foot runway (Table 4-2). The 3.2 square miles of off-airport property in the

year 2020 DNL65 for the 7,000 foot and 7,500 foot runway options would encompass an estimated 10,800 people and 4,600 housing units. The 3.3 square miles off-airport area affected by 2020 DNL65 for the 8,500 foot runway is estimated to include 11,300 people and 4,800 housing units. These results are due to the differences in mix of aircraft and number of aircraft which would use the new runway according to its length.

Social Impacts. The social impacts of residential and business displacement required by the construction of a new runway are addressed in the Draft EIS. Included are estimates of the number of single family homes, condominium/apartment units and businesses which could be required for the runway development. The acquisition of these properties could be needed to provide for runway construction, to clear the runway protection zones (RPZs) and to mitigate adverse environmental impacts. The mitigation area is located to the west of the primary acquisition area and east of State Route 509. State Route 509 would be considered an existing boundary which would protect properties to the west from adverse impacts and also minimize splitting of neighborhoods. Land parcels to be acquired in the primary construction area, runway protection zone area and mitigation area were identified using September 1994 King County Assessor's office data and the Seattle Common Land Database.

Estimated acquisitions for the 7,000 foot runway option are 346 single family homes, 26 condominium/apartment units and 96 businesses. Acquisition for the 7,500 foot runway would be 359 single family homes, 260 condominium/apartment units and 104 businesses. The 8,500 foot runway option is estimated to require the acquisition of 386 single family homes, 260 condominium/apartment units and 105 businesses.

Wetlands. Each of the runway options would affect a portion of the existing wetlands around Sea-Tac Airport. Wetland impacts would include placement of fill material, dredging, removal of existing vegetation, and changes in hydrologic regimens as a result of increased impervious surface area and storm water management system restructuring.

About 33 individual wetlands could be directly affected by development at the airport including fill for the following: 9.1 acres for the 7,000 foot runway option, 8.9 acres for the 7,500 foot runway option and 9.7 acres for the 8,500 foot runway option. These quantities include wetland areas on the airport which could potentially be used as borrow areas for fill material (2.2 acres of wetlands) and the South Airport Support Area (SASA) (2.2 acres of wetlands). The SASA wetlands impacts have been addressed in another EIS but are included here for overall evaluation.

Earth Resources. The potential impacts on earth resources that could result from runway construction (including clearing, grading, excavation and fill placement) were evaluated in the Draft EIS. The sources of fill materials, depth of fill placement and methods of placement and compaction were also addressed.

The following quantities of earth fill would be required for runway construction: 13.52 million cubic yards for a 7,000 foot runway, 16.77 million cubic yards for a 7,500 foot runway and 17.25 million cubic yards for an 8,500 foot runway. Preliminary investigations indicate that the required fill would be obtained from a combination of Port of Seattle-owned property and off-site borrow sources.

Acquisition and Construction Costs

Property acquisition and construction costs were estimated in 1994 dollars. Acquisition costs

include property purchase, relocations of residents and businesses, and allowance for contingency and administrative and legal costs. Construction costs in Table 4-2 associated with the new runway include mobilization, relocated items, demolition, earthwork, drainage, utilities, paving, radar, lighting, navaids, engineering, and an allowance for contingencies. Environmental remediation requirements have not been identified at this stage of planning, and therefore those costs are not included.

Detailed cost estimates were provided by P&D Aviation to the Port of Seattle in a memorandum dated April 21, 1995 and supplemental data prepared April 26, 1995. The cost estimates contained in Table 4-2 were summarized from these data sources. The estimated cost of the 7,000 foot runway is $307.7 million. The estimate cost of the 7,500 foot runway is $345.4 million, approximately 20 percent greater than the 7,000 foot runway option. The estimated cost of the 8,500 foot runway option is $405.6 million, approximately 18 percent greater than the 7,500 foot runway option.

SUMMARY OF OPTIONS EVALUATIONS

Terminal Options Summary

The North Unit Terminal Option clearly ranks above the South Unit Terminal and Central Terminal Options. Although the Central Terminal Option is ranked best under three criteria, the North Unit Terminal Option ranks equal or better than the Central Terminal Option in all of the remaining 15 evaluation criteria. No weighting has been given to the criteria in Table 4-1. Nevertheless, the North Unit Terminal Option would generally be viewed as superior to the other options.

Runway Options Summary

As Table 4-2 indicates, the 8,500 foot runway would clearly perform best in aeronautical terms. An 8,500-foot runway would be sufficiently long to accommodate 99 percent of all arrivals by the types of aircraft projected for Sea-Tac and 90 percent of departures by the types of aircraft projected for the Airport. Furthermore, the pilot rejection rate is expected to be minimized. For these reasons an 8,500-foot runway would provide maximum efficiency in aircraft flow and therefore allow the greatest benefit in minimizing aircraft delays.

Although the 8,500-foot option would be more expensive and have slightly greater environmental impacts than the shorter runway options, the added expense of the 8,500 foot runway is financially feasible. Further, the incremental increase in environmental impacts must be weighed against the aeronautical benefits. A runway length of up to 8,500 feet, pending final design, is preferred as the ultimate runway development option.

Section 5
AIRPORT DEVELOPMENT RECOMMENDATIONS AND POLICY ISSUES

SECTION 5
AIRPORT DEVELOPMENT RECOMMENDATIONS AND POLICY ISSUES

RECOMMENDED MASTER PLAN DEVELOPMENT

As a result of the evaluations described in Section 4, Airport Development Alternative 3, a North Unit Terminal with a runway of up to 8,500-feet, is the recommended long-term Master Plan development. The recommended Airport Master Plan improvements are shown in Figure 5-1. Terminal improvements are illustrated in Figure 5-2.

Terminal Recommendation

The North Unit Terminal is superior to both the Central Terminal and the South Unit Terminal options for a number of reasons. Under this concept, several new gates could be added to Concourse A by 2000 with the new North Unit Terminal to be constructed in about fifteen to twenty years as dictated by level of service and actual demand. The North Unit Terminal option offers the following advantages over other terminal options:

- Lowest overall cost per new aircraft gate.
- Shorter walking distances from parking areas and curbs to the aircraft gates.
- Adequate curb frontage to meet future traveler demands.
- Minimizes vehicle congestion on the existing terminal drives.
- Minimizes traffic impacts in the City of SeaTac.
- Greater flexibility for aircraft gate and terminal expansion beyond the year 2020.
- Less aircraft taxiing congestion around the terminals.
- Preservation of the Alaska and Delta Airlines maintenance hangars and postponement of the need for full build out of the South Aviation Support Area (SASA) site.
- No impact to City of Sea-Tac tax base by virtue of no additional property acquisition.
- Less passenger disruption and inconvenience during construction.
- Connection to the Main Terminal by an extension of the STS shuttle.

Runway Length Recommendation

An 8,500-foot runway would maximize the operational benefit of having a second poor-weather arrival stream. A runway length of 8,500 feet offers several benefits when compared with the 7,000-foot and 7,500-foot options.

- Sufficient landing length for 99 percent of the types of aircraft anticipated to use Sea-Tac in the future (compared to 96 percent for a 7,500-foot runway and 91 percent for a 7,000-foot runway). This becomes increasingly important because more larger size aircraft will be using Sea-Tac.
- Lesser rejection by pilots opting to use the existing long runway. The Air Transport Association and extensive discussion with

airline pilots support an 8,500-foot runway for this reason.

- Increased aircraft delay savings potential by accommodating more aircraft types and by reducing air traffic controller work loads associated with pilot rejection and cross over "sorting" associated with different aircraft operational requirements.

- Sufficient departure length for 90 percent of the aircraft operations anticipated to use Sea-Tac in the future (compared to 85 percent for a 7,500-foot runway and 77 percent for a 7,000-foot runway) which provides increased operational flexibility for the overall airfield.

- Provides the highest safety margin during poor weather landings (which is when the runway would be used the most).

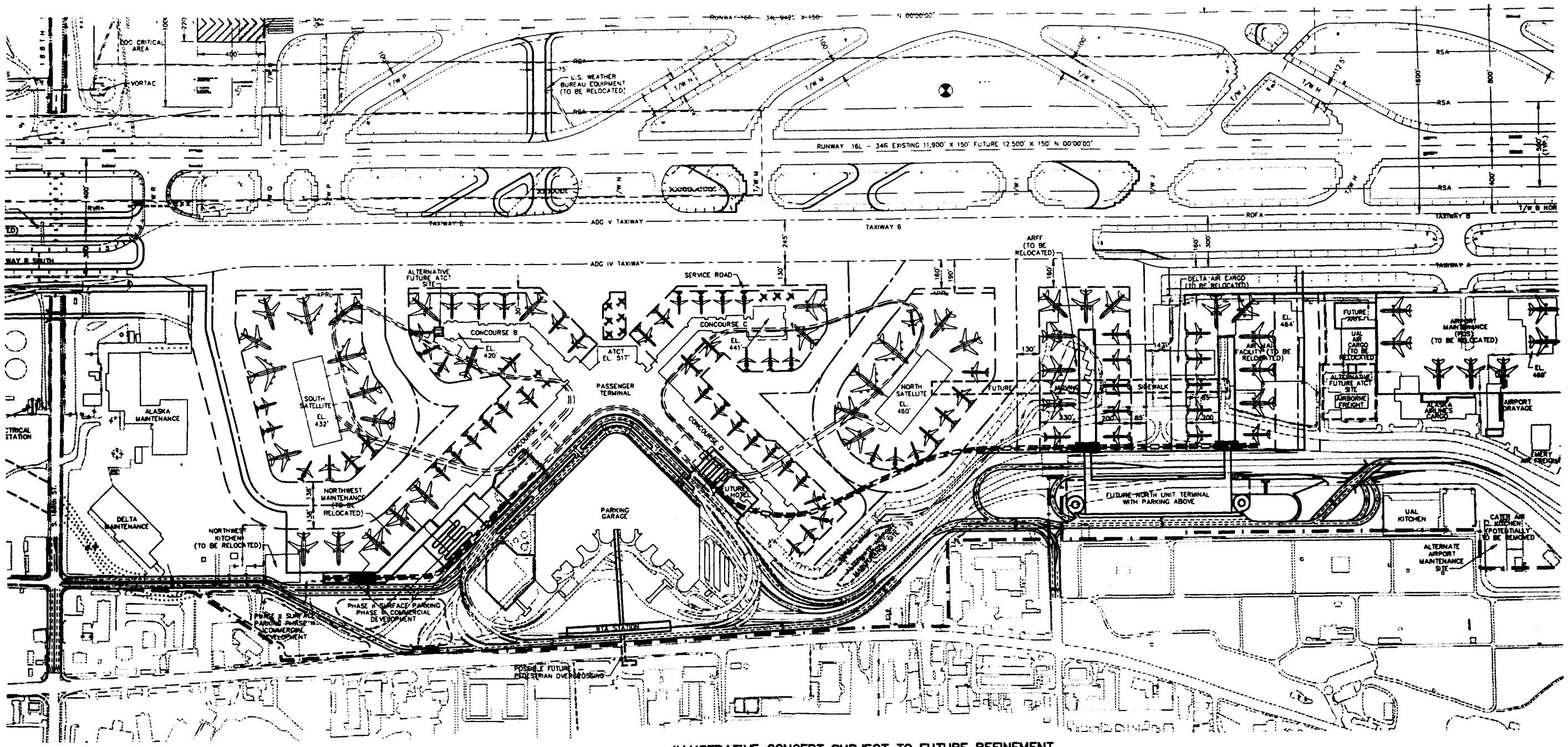
- Greater flexibility of aircraft operations if one of the other runways is closed for maintenance or an emergency. Maintenance costs on the existing runways could be reduced by reducing the need for expensive nighttime work as is currently done.

- The additional environmental impacts of an 8,500-foot runway are minimal and can be sufficiently mitigated, as described in the Environmental Impact Statement.

Facility Improvements

The Master Plan Update proposes the following facility improvements:

- A new Runway 16X-34X with a length up to 8,500 feet pending final design. The runway would be equipped to enable Category IIIb precision approaches on 16X with Cat I capability on 34X. Instrumentation improvements would include a glide slope, localizer, RVRs, PAPI, ALSF-II/ MALSR, and inner/middle,outer approach markers:
  - Relocation of the Airport Surveillance Radar (ASR) and Airport Surface Detection Equipment (ASDE)
  - Relocation of S. 156th Way and 154th Street South
- A midfield overnight aircraft parking apron between the new runway and Runway 16R-34L
- Construction of a new Air Traffic Control Tower and TRACON
- Installation of a Cat IIIb ILS on Runway 16L (localizer, glideslope, middle marker, and ALSF-II)
- Extension of dual parallel Taxiways A and B the full length of Runway 16L-34R and taxiway bridge over 188th Avenue South
- Removal of displaced threshold from Runway 16L
- Additional taxiway exits on existing runways
- Extension of Runway 34R by 600 feet and relocation of the glideslope
- Clearance, grading and development of expanded Runway Safety Areas at each runway end
- Limited expansion of 4-6 gates of Concourse A and the Main Terminal depending on configuration and use.

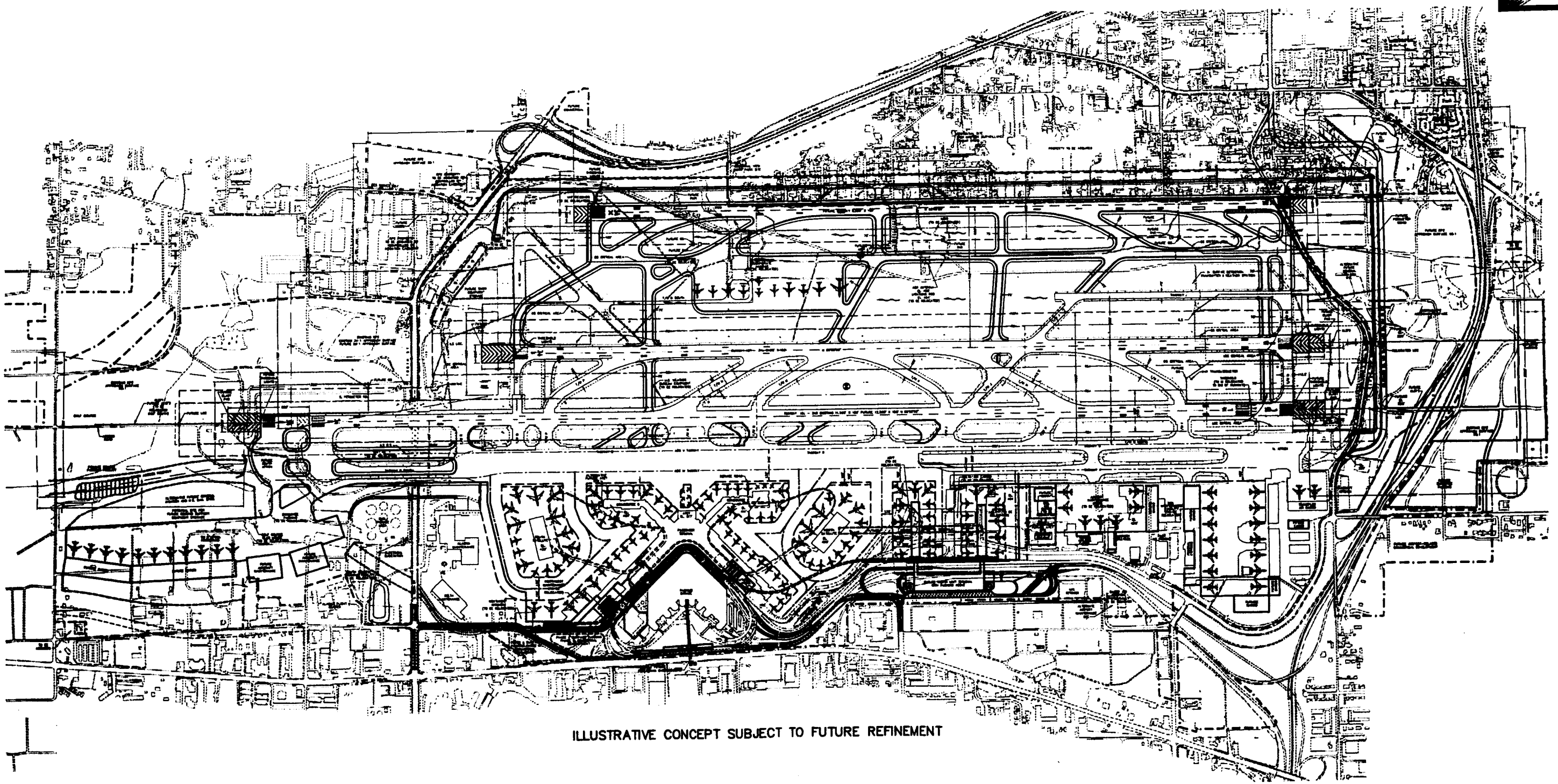


ILLUSTRATIVE CONCEPT SUBJECT TO FUTURE REFINEMENT

600 0 600 1200

1"=600'

Figure 5-2
RECOMMENDED TERMINAL PLAN



ILLUSTRATIVE CONCEPT SUBJECT TO FUTURE REFINEMENT

600 0 600 1200
1" = 1200'

Figure 5-1
RECOMMENDED AIRPORT MASTER PLAN

- Relocation of Northwest flight kitchen, possibly to an area north of SR 518, if necessary
- Development of displaced Northwest aircraft maintenance facilities in the SASA if necessary
- Development of a by-pass roadway connecting the New North Unit Terminal with South 188th Street at 24th Street
- Expansion of the Central Parking Garage
- Development of an On-Airport hotel on Concourse D adjacent to the terminal

■ Development of the North Unit Terminal

- Development of the North Unit Terminal access system
- Development of access ramps from SR 518 at 20th Avenue for access to the existing cargo area and new cargo facilities
- Potential overhaul of the Satellite Transit System (currently under study)
- Displacement of the Doug Fox Parking facility
- Relocation of the U.S. Post Office Air Mail Facility to SASA
- Relocation of the ARFF to the existing UAL air cargo area

■ Potential relocation of Airborne cargo for an alternate site for the construction of the Air Traffic Control facility

■ Development of the SASA:

- If required, relocate Northwest hangar
- Expansion capacity for cargo/maintenance
- Cargo facility for 11 hardstand positions
- Ground support equipment area
- Replacement of Air Mail Facility

■ Development of additional airport employee parking north of SR 518 west of 24th Avenue South

■ Development of a new airport maintenance facility

■ Development of a new snow equipment storage site between the RPZs of Runways 34L and 34X (subject to a study currently underway for approval of this site)

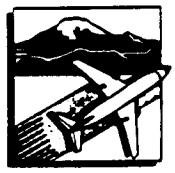
■ Development of new general and corporate aviation facilities in SASA or alternatively between the RPZs of Runways 16R and 16X (subject to further detailed study)

DESCRIPTION OF MASTER PLAN RECOMMENDATIONS AND POLICY ISSUES

Recommended Master Plan improvements are described below. Relevant policy issues associated with the airport development recommendations are addressed.

Airside Improvements (Figure 5-1)

Recommended Master Plan airside improvements consist of new taxiway exits to Runway 16L-34R, a 600-foot extension of Runway 16L-



34R, extensions of Taxiways A and B, expansion of Runway Safety Areas (RSAs) and Runway Object Free Areas (ROFAs) for Runways 16L, 34R and 16R, a new parallel runway and associated taxiways, navaids for the new runway, and new overnight (RON) aircraft parking.

Taxiway Exits to Runway 16L-34R. Under a three-runway configuration, Runway 16L-34R is expected to be used frequently as an arrival runway, especially during poor weather conditions and peak arrival periods. In light of this, enhancements of exits to Runway 16L-34R are recommended to reduce the weighted average runway occupancy time (WAROT).

It should be noted that extensive development of exit taxiways for the present primary arrival runway (16R-34L) has recently been completed. These improvements have significantly reduced ROT. Over time, as increased use of Runway 16L-34R for arrivals occurs, changes in taxiway geometry to improve exit performance should be considered.

In south traffic flows, runway occupancy times for Runway 16L can be substantially reduced by adding 30° exits located 5,568 and 7,756 feet from the landing threshold. Earlier in the planning analysis an assessment of runway exits was performed using a simulation model called REDIM (Runway Exit Design Interactive Model). Briefly described, for a given mix of aircraft, the model simulates landing operations and quantifies runway occupancy time, exit utilization, as well as identifying optimal exit locations. The model simulates landing operations and measures ROT from the time an aircraft crosses the landing threshold to the time it clears the runway. Based on a number of modelling runs using the existing taxiway configuration for Runway 16L and the long range aircraft fleet mix, reductions of ROT on the order of 20 percent were identified as possible through the addition of the above stated two exits.

The simulation indicated that most aircraft are capable of regularly exiting at the "Broad Ramp" (Taxiway N), except for B747 and MD-11, especially during wet runway conditions. The shorter exit would allow many aircraft currently turning off at Taxiway N to exit earlier, while the longer exit would also permit most B747s and MD-11s to exit earlier.

Likewise, in north traffic flows, substantial reductions in ROT were identified as possible by adding turnoffs at approximately 5,500 and 7,700 feet from the present landing threshold of Runway 34R. Ultimately, these can be implemented by expanding Taxiways M and J to provide a 30° exit geometry.

The additional exits will allow aircraft to clear the runway sooner, and thus provide greater opportunities to release departures.

It should be noted that these improvements should not be confused with recently constructed exit taxiways on Runway 16R-34L. However, in south flows, the locations of the proposed exits for Runway 16L correspond with locations of recently constructed runway turnoffs for Runway 16R (Taxiways M and P). Therefore, similar reductions in ROT should accrue. Full realization of the ROT reduction would depend on traffic volumes and ground traffic flows (use of dual parallel taxiways and Broad Ramp).

These improvements are intended for implementation in later development phases of the planning program (approximately 2011 to 2015), as the fleet mix changes and activity levels rise. As such, the benefits of the proposed exits should be reevaluated in view of factors such as aircraft mix, operational efficiency, aircraft performance, runway utilization, etc., prior to implementation. Since an extension of the end

of Runway 34R is planned for the same general time frame, the final location of exit taxiways must also be reconciled with the ultimate location of the runway threshold.

Extension of Runway 16L-34R. It is recommended that Runway 16L-34R be extended from 11,900 feet to 12,500 feet. The 600-foot runway extension would be at the south end. It would provide the runway length required at Sea-Tac to accommodate the full range of aircraft and weather conditions.

Extension of Taxiways A and B to Full Length of Runway 16L-34R. Dual parallel taxiways are proposed east of Runway 16L-34R for the full length of the runway due to the increasing need for opposite direction taxiing. By providing unidirectional dual parallel taxiways, interference with opposite flow traffic is minimized. A partial dual parallel system exists for the north half of the airfield (Taxiways A and B North). The apron on the west side of the passenger terminal presently is used as a dual taxiway for narrow-body aircraft. However, the apron pavement is not marked for dual taxiways.

The projected density of traffic in the terminal area suggests that dual taxiway capability on the terminal apron will be necessary in the future. The depth of the terminal apron under the Master Plan recommendations will be increased to allow a dual taxiway capability for aircraft up to Aircraft Design Group (ADG) IV on Taxiway A and ADG V on Taxiway B, provided that aircraft parking at some gates in Concourses B and C are limited to certain aircraft models. The arrangement of aircraft parking positions would need to be modified as well as the configuration of loading bridges. This could involve replacement, removal or modification of some loading bridges. In addition, there may be modifications required to the end of Concourse C to ensure that the line of sight from the north ATCT site is maintained if it is selected. As such, the V/IV configuration is planned for the out years and when the North Terminal is fully operational.

Table 5-1 indicates the affected gates and the aircraft that could be parked with Taxiway A designed to ADG IV standards. The aircraft models indicated as being accommodated are typical of the mix of aircraft contained in the forecasts of air traffic activity previously presented in Technical Report No. 5. Note that the end of Concourse C adjacent to Taxiway A would be limited to commuter aircraft gates. A controlled survey will need to be conducted to verify the aircraft gate sizes that could be accommodated with dual taxiway capability.

Pertinent criteria for taxiway separations are:

	Aircraft Design Group	
	IV	V
Taxiway centerline to parallel taxiway/taxilane centerline (feet)	215	267
Taxiway centerline to fixed or movable object (feet)	130	160

As depicted on Figure 5-1, the proposed dual taxiway system will ultimately allow the following categories of aircraft to taxi simultaneously in opposite directions:

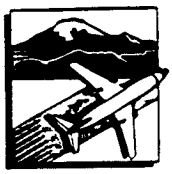
- From the Runway 16L threshold to the future North Unit Terminal location: ADG V on both taxiways.
- From the future North Unit Terminal location to the end of Concourse C: ADG V on Taxiway A and ADG IV on Taxiway B or ADG IV on Taxiway A and ADG V on Taxiway B.

TABLE 5-1
AIRCRAFT ACCOMMODATED AT SELECTED SEA-TAC GATES WITH PROPOSED DUAL PARALLEL APRON TAXIWAYS [a]

Gate	Accommodated Aircraft
B7	B727, B737-500/300/400, MD80, MD90, A319, A320, B757-200, B767-200, A310, A321
B9	B737-500/300/400, MD80, A319, A320, A321
B11	B727, B737-500/300/400, MD80, MD90, A319, A320, A321, A310
C6	B737s, B727, MD80, MD90, A320, A319
C8	B737-500/300/400, A319, A320, A321
C10	B737-500/300/400, MD80, A319, A320, A321
C12	B737-500/300/400, B727, A319, A320
C14	B737-500
C16	ATR 72, RJ 70/85
S12	B727, B737-500/300/400, MD80, MD90, A319, A320, A321, A310, B757-200

[a] A controlled survey is needed to verify this information.

Note: Aircraft accommodated assumes airport service road is relocated outside taxiway object free area for a parallel apron taxiway, Taxiway A, designed to ADG IV standards and Taxiway B designed to ADG V standards.



- From the end of Concourse C to the south end of the terminal apron: ADG IV on Taxiway A and ADG V on Taxiway B.

- From the south end of the terminal apron to the Runway 34R threshold: ADG V on both taxiways.

It is proposed that this taxiway system be implemented between Runway 16L and the south end of the terminal apron when the first phase of the North Unit Terminal is constructed (Phase 3) or sooner if traffic and resulting delays warrant it. The percentage of ADG IV aircraft (e.g., B767, B757, MD-11, A300) and ADG V aircraft (e.g., B747, B777, MD12, A340, A330) in the air carrier passenger mix of Sea-Tac is projected to increase in the future:

Aircraft Design Group	Percent of Air Carrier Passenger Operations 1993	2000	2010	2020
III	73.8	68	59	50
IV	25.6	30	37	45
V	0.6	2	4	5
	100.0	100	100	100

Therefore, there will be a increasing need for opposite direction taxiing of aircraft adjacent to the terminal by ADG IV and V aircraft.

As an interim measure, the Port is currently considering marking the terminal apron to provide a dual taxiing capability for ADG V/III operating configuration in Phase 1. Because this would be an interim measure, reflectors could be considered rather than lights for taxiway illumination. Implementation of this interim measure will require further coordination with the FAA and airlines. Longer term impacts of an ultimate ADG V/IV configuration would involve a revised aircraft parking plan and modification, removal or replacement of loading bridges. Additionally, impacts to Concourse C would have to be considered.

Runway Safety Areas and Runway Object Free Areas. A runway safety area (RSA) is defined as a rectangular area centered about the runway that is cleared, drained, graded and usually turfed. Under normal conditions, this area should be capable of accommodating occasional aircraft that may veer off the runway, as well as fire fighting equipment. For Sea-Tac, the requirement for the RSA is an area 500 feet wide centered on the runway centerline and extending 1,000 feet beyond each runway end.

The existing runway safety areas for Runways 16L, 16R and 34R do not meet current FAA criteria. The existing RSA for Runway 34R is 535 feet long and 500 feet wide. The Runway 16L RSA is 700 feet long with varying widths from 180 to 500 feet. The RSA for Runway 16R is 645 feet long with the width varying from 180 to 500 feet. The reasons for not meeting the FAA standards are steep terrain and/or the presence of roads at the ends of the runways.

In addition to dimensional standards, FAA has established longitudinal and transverse gradient standards for safety areas. For the first 200 feet of RSA beyond runway ends the longitudinal grade must be between zero and three percent with any slope being downward from the runway end. For the remainder of the extended RSA the maximum longitudinal grade is such that no part of the runway safety area penetrates the approach surface as specified in FAR Part 77. The maximum longitudinal grade allowed is 5 percent. Transverse (lateral) grades are limited to between 1.5 and 5 percent with the maximum recommended to promote drainage.

The runway object free area (ROFA) is a two dimensional ground area surrounding the runway. Its clearing standard precludes parked

aircraft and objects, except objects whose location is fixed by function. At Sea-Tac, the ROFAs extend 400 feet on either side of the runway centerlines, along the entire length of runways and 1,000 feet beyond each end.

The following objects are located within the ROFA at Sea-Tac:

- Runway 16R - road (South 154th Street).
- Runway 16L - road (South 154th Street), localizer transmitter building and ALS regulator building.
- Runway 34L - localizer antenna and equipment shelter, RVR transmissometer and receiver, VORTAC and rotating beam ceilometer (RBC).
- Runway 34R - ALS substation.

With the exception of the road, all object locations are fixed by function and related to navaids and airport electronic equipment. Therefore, these navaids and electronic equipment are allowed to be within the ROFAs by FAA standards. The Master Plan recommends that the RSAs and ROFAs be modified to fully comply with FAA criteria.

To obtain compliance with FAA standards full 1,000 foot RSAs and ROFAs are proposed beyond the present Runway 16L and 16R ends. This approach will require fill material to maintain necessary grades and relocating South 156th Way/South 154th Street to the north but will not require the relocation of the thresholds of Runways 16L and 16R in order to provide adequate safety area.

The RSA for Runway 34R will be extended to the south. To accomplish this, additional fill material will be required to maintain the necessary grades. Furthermore, the existing approach light towers and electrical systems in the RSA area must be modified. The RSA for Runway 34L has been extended to 1,000 feet.

New Parallel Runway and Associated Taxiways. The Master Plan recommendations include the construction of a new runway up to 8,500-foot by 150-foot pending final design, 2,500 feet west of Runway 16L-34R. The north end of this runway would be in alignment with the north ends of the existing runways. It is recommended that construction begin in Phase 1. South 154th Street/South 156th Way will be relocated to the north. With the north threshold of the new runway located as described above, 8,500 feet is the maximum length obtainable to comply with RSA and ROFA standards.

The layout of the runway and associated taxiway system for the new runway was developed by the HNTB Corporation (Seattle-Tacoma International Airport, Third Dependent Runway, Preliminary Engineering Report, Volumes 1 and 2, First Draft, March 31, 1994). The HNTB Preliminary Engineering Studies include topography and soils investigations, roadway and utility relocations, and other factors which potentially would be involved in the construction of the new runway.

Navaids. The 2,500-foot separation between outboard runways is sufficient to permit parallel ILS approaches. To provide maximum IFR benefits, each end of the new runway would be equipped for precision instrument approaches. Since Runway 16L will be equipped for Category IIIb approaches if a new runway is constructed, and adequate separation will exist between it and the new runway, it is recommended that the new runway also be equipped for Category IIIb approaches. This will permit parallel Category IIIb ILS approaches and thus enhance capacity during periods of extremely low visibility (less than

800 feet RVR). Use of Runway 16R as the Category IIIb runway should continue in the interim until such time that demand indicates the need for dual, low visibility arrival streams.

Overnight Aircraft Parking Apron. An aircraft parking apron for overnight (RON) aircraft will be located between Runway 16R-34L and the new runway. The RON apron construction will be split between Phases 1 and 2. The RON apron will ultimately be approximately 1,800 feet long and 550 feet wide. Due to Federal Aviation Regulations (FAR) Part 77 restrictions, the remote parking ramp will not accommodate aircraft with tail heights greater than that of the B767.

Terminal Improvements (Figure 5-2)

Upon reviewing the various terminal development options for Sea-Tac, the North Unit Terminal concept was selected as the most appropriate for the future development of terminal facilities. During the process of this review, the North Unit Terminal concept was refined, to include two concourses extending from the North Unit Terminal rather than an extension of the North Satellite. While this concept reflects a consensus among Airport staff and the Master Plan team regarding the most appropriate direction for further terminal development at Sea-Tac, it should be recognized that this concept has been developed to only a preliminary level of detail. As such, it should be considered a general plan for further terminal development at the airport leading to more definitive design and engineering studies in the future as the identified projects are initiated. For example, ultimate expansion of the North Unit Terminal (beyond 2020) could include a third concourse to the north. Although this area is proposed for development of ARFF and Air Traffic Control facilities, their configuration and design could possibly be developed to accommodate a third concourse.

Ongoing studies including those of the future use of the STS system, traffic demand management, and others will provide valuable information which may be incorporated in the further design of terminal facilities at the airport. In addition, future changes in passenger demand, airline service, and the regulatory environment may all create opportunities for further refining of this concept to more closely meet the needs of all airport users.

Finally, the conclusions of the master plan should not preclude continued enhancements and improvements to the existing terminal facilities. Rather, they define a broad range of future conditions which should be considered when making interim improvements. The following sections provide a summary of those conditions, as well as issues which may require further study.

Aircraft Gates and Ramp Area. The initial airside expansion of the North Unit Terminal option is the extension of the existing Concourse A to the south providing for between 4 and 6 additional widebody and narrowbody gates. This concourse extension requires the demolition of the existing Northwest hangar area but does not impact the Delta and Alaska maintenance facilities and ramp areas to the south of the terminal. Development of the Concourse A extension should recognize the potential for its development as an international arrivals concourse, should the FIS be relocated to the Concourse A location. In this regard, any design for Concourse A should consider the possibility of a future mezzanine level to provide for a secure passenger corridor as well as design of vertical circulation near each gate which may permit cross-utilization by either international or domestic traffic.

At some point in the future, when activity levels require, the ramp area directly west of the

terminal will need reconfiguration to create two parallel taxiways. Because of the proximity to Concourses B and C, the outer taxiway will provide for design Group V (B747 sized) aircraft, and the inner will be limited to design Group IV (MD-11 and smaller) aircraft. This configuration will also limit the size of aircraft parked on Concourses B and C to narrowbody aircraft only, with the end of Concourse C further limited to commuter aircraft. This reconfiguration will also likely require the relocation and/or replacement of a number of loading bridges along the west side of Concourses B and C in order to serve the revised aircraft positions. Airlines located along these gates providing widebody service will require relocation elsewhere at the airport.

Use of the terminal by potential future very large aircraft (VLA) with a wingspan of greater than 213 feet have been provided for at the west ends of the South and North Satellites only. Because these aircraft would primarily serve long-haul international traffic, these locations should prove adequate. Use of the terminal area taxiways by these aircraft would require special procedures to be established by the FAA, and would inevitably require the temporary closure or restrictions on the use of the future inner parallel taxiway.

The North Unit Terminal concept consists of two pier-type concourses on an east-west axis, each providing a mix of between 10-15 widebody and narrowbody gates. A third concourse to the north could potentially be added. The concept provides for B747 parking on the west ends, widebody aircraft parking on the outer sides of the north and south concourses, and B757 parking elsewhere between the concourses. A dual B757 taxilane has been provided between the concourses which could also be converted to a single widebody taxilane with widebody parking alongside. The concourse to the south would share the taxilane currently serving the North Satellite and Concourse D. The North Unit Terminal concourses would be connected via pedestrian bridges to terminal facilities located to the east across the North Access Freeway.

The sizing and positioning of these concourses has been planned to allow construction of the south concourse, while maintaining ongoing operations at facilities immediately to the north. Construction of the concourses in this area, however, will require relocation of the existing ARFF facility as well as closure of the non-secure service road.

During the terminal planning process, the potential for a 3 pier variant of the North Unit Terminal was identified. This variant is desirable in that it provides additional terminal expansion flexibility. This flexibility should be protected when designing future improvements. Therefore, it is recommended the final designs for the control tower and ARFF facilities should protect the possibility of an eventual third pier expansion wherever possible.

The New North Unit Terminal. The initial terminal concept itself may be developed as a relatively conventional two level terminal, with adjoining parking (possibly above), served by an upper and lower level roadway, but several unique conditions must be accommodated due to its position on the site. The most significant of these is the alignment of the North Airport Access Freeway which separates the concourses from the terminal. This condition necessitates that all passenger and baggage movement between the terminal and concourses be accommodated via bridges or tunnels crossing the on-grade alignment of the North Airport Access Freeway. Given the geometry of the site, the most likely configuration for the terminal is to provide for outbound baggage handling in either a sub-grade level with vehicular tunnels connecting the terminal to the

apron areas, in an interstitial level between ticketing and baggage claim, on the ramp underneath the concourses, or in a combination of these locations. From an interstitial level, baggage could be transported to and from the ramp via conveyors mounted alongside the pedestrian bridges.

Ticketing, concessions and other passenger services would be provided at the level of the upper terminal curb. Enplaning passengers would flow directly from ticketing, across the pedestrian bridges to the concourses without needing to change levels. Depending on the concession layout desired and any ultimate connection to the STS system, security screening could be located at either the terminal or the concourse.

Baggage claim and arrival services would be provided at grade facing the lower level terminal curb. If necessary or desirable, a full floor or mezzanine could be created above the ticketing lobby to provide for Port and tenant offices.

Passenger and Baggage Connection Between the North Unit Terminal and Main Terminal. Passenger and baggage movement between the North Unit Terminal and the existing terminal will be provided along one of three general alignments. While the exact design and system will be contingent on the ultimate design of the facilities themselves as well as the outcome of ongoing studies by the Port, provision for these three means of connecting the North Unit Terminal and main terminal should be preserved in any future development areas to the north of the existing terminal. The first alignment is that of a tunnel connecting a midpoint of the concourses to the North Satellite. As envisioned in the Master Plan, this tunnel would accommodate secure passenger movement between the North Satellite and North Unit Terminal via moving sidewalks. Passengers wishing to continue on to the Existing Terminal would do so via the existing STS system. Alternatively, this connection might be made via an extension to the north loop of the STS system.

The second preserved alignment is that for an extension of the existing STS shuttle to a point near the base of each of the two new piers. Because the existing STS system operates from the secure side of the terminal, the connections at the North Unit Terminal would need to be on the secure side of the concourse or the area in the main terminal reconfigured to non-secure. In addition to the STS system, provision for one or more high-speed baggage conveyors and/or a dedicated service road in each direction should be provided to enable transfer of connecting passenger baggage between the two buildings.

The third connection between the two terminals would be via the surface roadway system using regularly scheduled shuttle vehicles and would provide for non-secure transportation of passengers and employees between the two buildings.

It should be noted that the ultimate use of the STS is uncertain. An independent study is currently underway which will examine in detail the preferred long term plan for passenger conveyance systems. The conclusions may be variants of concepts shown in this Master Plan. As such, the alignments indicated on plans in this report are conceptual. The final alignments and systems will depend on the STS study recommendations and design of the systems as well as the needs of airlines who will use the terminal.

North Unit Terminal Roadways. The location of the terminal will require the demolition of the existing bridge connecting the North Airport Access Freeway with the airport service road and 170th Street. Access from

170th Street will need to be integrated into the design of the terminal roadways, while the service road providing access to the north end of the main terminal will require relocation, elimination, or conversion for other uses. As this service road is located along one of the terminal connecting alignments noted previously, its redesign should be an integral consideration of eventual STS extension or inter-terminal baggage movement.

Roadway access to the terminal from the North Airport Access Freeway is from the northwest in order to retain a conventional right-handed passenger loading area at the two level terminal curbside. The exit roadways allow the vehicles to exit the terminal in both the northbound and southbound directions. The southbound exit also provides a ground transportation connection between the North Unit Terminal and the Main Terminal but will require more detailed engineering to provide for all of the various horizontal, vertical, and merging vehicular movements required in this confined location.

Short term, daily, and some rental car parking will be provided in structural parking levels directly above the terminal building which will be accessed directly from helical ramps off of the terminal curbside. The parking exits will be provided on the north of the terminal, with provisions for traffic to exit to both the north and south.

Modifications to the Existing Terminal. The existing terminal will require various ongoing modifications and upgrades over time to allow it to serve the traveling public well into the next century. Many of these were identified in the Terminal Development Plan (TDP) prepared in 1991. The most notable of these recommendations included substantial improvements to the main outbound and interline baggage system, relocation of the Federal Inspection Services (FIS) facility to Concourse A, and extensions to both the North and South Satellites and Concourse A. Changes in the TDP recommendations which impact the existing terminal include the elimination of the North and South Satellite extensions, retention of the FIS in the South Satellite, and the inclusion of a future hotel on the north end of the terminal complex.

Because of the somewhat constrained airfield geometry at the North Unit Terminal, the South Satellite and/or Concourse A remain the most viable locations for accommodating the large aircraft typical of international activity. In the longer term, expansion of the terminal to the south is also anticipated to provide for improved ticketing and baggage claim facilities to serve domestic passengers. While an extension of Concourse A was previously considered as a potential location for a relocated FIS facility in the TDP, practical considerations have resulted in this concept being dropped in favor of maintaining FIS operations at its existing location at the South Satellite. The original intention of this relocation was to eliminate the need for double-handling of bags and to provide for a more pleasant arrival experience for international passengers. The limited area for Group V aircraft along Concourse A, combined with the significant cost required to replace this facility resulted in an interest on the part of the Port to maintain continued use of the existing FIS facility. Furthermore, current trends and forecast activity levels suggest that the existing FIS facility has, or may be adapted to provide, sufficient capacity to accommodate international arrivals activity throughout the master plan timeframe. Ongoing operational improvements combined with the potential for a dedicated passenger and baggage tunnel for arriving international passenger movements to the main terminal may provide opportunities for qualitative improvements in the arriving international passenger experience.

However, in the interest of maintaining maximum flexibility, it is suggested that the Port maintain the potential for the relocation of FIS facilities to the south end of the terminal adjacent to Concourse A. As a result, any future development and design of Concourse A should consider the ability to adapt those gates for use at some future time into an international arrivals facility. This primarily means consideration of a sterile passenger connector on the mezzanine level of the concourse and some provision for a vertical core to serve them. It is therefore suggested that this issue be reviewed in further detail and a final determination on the ultimate location of the FIS be made during the design of the Concourse A or any terminal expansion to the south.

As a part of the Concourse A extension, some accommodation of outbound baggage sortation will need to be made to replace that currently performed in part of the Northwest hangar facilities. While these facilities may be relocated on the ramp underneath the Concourse A extension, design of this extension should be consistent with a comprehensive plan for the long-term development of the south extension of the terminal building. In addition, expansion of the existing security screening area will likely be required to facilitate the higher passenger volumes entering Concourse A.

Access, Circulation and Parking Improvements (Figures 5-1 and 5-2)

Vehicular traffic to the airport is projected to double by 2020 when the 38 MAP activity level is reached, growing from about 87,000 vehicles per day in August 1994 to over 160,000 vehicles in 2020. Therefore, a number of roadway, access, circulation, parking, and transportation policies are recommended. These recommendations complement the development of a North Unit Terminal as well as the other recommended improvements.

Roadway Access Improvements and Issues. Roadway access improvements recommended in the Master Plan and related policy issues are described below.

- The North Access Road has the greatest traffic moving capacity of any facility serving the terminal area and will remain at acceptable service levels at the 38 MAP level. Since 70 percent of all airport users and visitors come from this direction, the North Unit Terminal will intercept traffic without impacts to other area roadways and will reduce traffic volumes before reaching the Main Terminal complex area.

- Access from SR 99 and areas south of South 188 Street will be constrained, although the North Unit Terminal will alleviate future congestion on SR 99 and South 188 Street somewhat. A number of traffic improvements at intersections adjacent to the existing terminal complex on these two roads can reduce congested intersection operations to acceptable levels.

  The POS recognizes the importance of SR 509 extension and the proposed South Airport Access Road and supports this development. It is a regionally significant improvement to the freeway system. Both facilities must work in concert to provide true traffic relief from areas south of the airport complex, which is subject to increased congestion not only due to airport traffic, but considerable growth based on local and regional land use patterns and roadway plans and programming.

- The North Unit Terminal placement will require a change to the access to the north cargo area. A proposed new SR 518 interchange on the north side of the airfield is proposed to provide access to the north cargo area, plus the relocated employee

parking area, and possible other development opportunities in the vicinity of South 24th Avenue. This new interchange will have to be designed so it works with existing interchanges at SR 99 and Des Moines Memorial Drive, plus the constraints placed by SR 518's alignment and adjacent topography.

- Major improvements are recommended for the access ramps and upper and lower curbside roadways at the Main Terminal. The North Unit Terminal option will improve the traffic flow pattern at the Main terminal when the airport is at 38 MAP. Phasing of substantial increases in parking and support facilities for public use, rental cars, and employees will be provided.

- While the north unit terminal will absorb 30 percent of all passenger activity, the central terminal will still have more passengers than it does today, and connections for access to and from the south of the terminal are sensitive local and regional issues. To accommodate passengers coming from south of South 188th Street, the terminal roadway system would be extended southward. This can be done to link to the proposed South Access Road, or the proposed 24th/28th Avenue connection leading to South 188th Street. Thus, inbound passengers from the south will enter the terminal area at South 188th Street, placing them on the terminal roadway system rather than using SR 99 (the SR 99 entry point will be used only by transit vehicles to reduce congestion on International Boulevard). To compliment this movement a southbound roadway, decked over the northbound existing roadway east of the parking garage complex is proposed. If other roads are built, and the southbound deck is not, then all traffic going south from the North Unit Terminal would: use the already congested curbside roadways in from the main terminal building to go south; or use SR 99 to go south. Without this southbound roadway, congestion in the most congested portion of the terminal complex would be unacceptably increased, or SR 99, the most sensitive regional roadway would have to handle southbound traffic from the North Unit Terminal.

- While the North Unit Terminal plan shows that access to the terminal complex from 170th Street and a new interchange to be developed on SR 518 would provide connections to Air Cargo Road and the employee parking facility on South 28th Avenue at SR 518, other options need to be examined in detail. These proposed improvements have some impacts that other concepts might alleviate.

  Access options could include developing 160th Street as an access point and eliminating 170th Street, and the need to consider the SR 518 interchange in conformance with Washington State DOT and Federal Highway guidelines for limited access highway interchange spacing and development. In addition, traffic conditions on SR 99 could be impacted by any of these options and proper connections to roadway improvements south of the terminal complex have to be addressed as they reach final development stages. On-airport traffic improvements and traffic mitigation will require constant attention to design and traffic flow issues both in the vicinity of the existing terminal and as refinements to the North Unit Terminal concept.

Circulation Issues. Circulation issues related to Master Plan improvements are discussed below.

- The future status of regional rail or City of Sea-Tac people mover facilities are not clear, however all terminal improvement schemes allow integration or connections to these potential rail systems. It is important to appreciate that with or without rail facilities, regional access is a major issue. The placement of regional rail systems has not alleviated access problems in most other American cities with rail service to airports. The local people mover system has other impacts and potential benefits but are within the City of Sea-Tac and are not regional in nature.

- Regional park-and-fly systems, using express buses from large parking areas 10 or more miles from airport terminals have been shown in the United States and Europe to be more effective than regional rail systems, when using HOV express lanes, in getting passengers to leave their cars far away from airport terminal areas. Likely candidate areas are those sections of the Puget Sound region far from the terminal, near major roadways that can intercept travelers well before the airport area. Express shuttle service to park-and-fly lots have been shown capable of absorbing 20 percent of passenger traffic from specific high demand corridors when coupled with easy parking access, low parking rates and high quality transit service. Actual operations can be by public or private agencies, often at break-even operating cost.

- Transportation Demand Management (TDM) strategies can reduce both employee and private passenger vehicular traffic by up to 20 percent through a number of different coordinated actions. Employee trips can be managed through parking pricing, car pooling programs, and ridesharing incentives. Experience has shown that park-and-fly lots, congestion pricing, improved transit services, private transit vehicle access charges, and balancing parking rates to optimize traffic can reduce private vehicle traffic to the terminal area.

  The Port of Seattle, the City of SeaTac and Metro are currently working together to explore ways to improve public transit service at the airport and to help Metro implement its Six Year Transit Development Plan, 1996-2001. Improved public transit service could reduce single-occupant vehicles accessing the terminal and reduce traffic congestion on arterial roads near the airport and the region. Metro's Six-Year Plan identifies the City of SeaTac area as a transit hub location and Sea-Tac Airport as a major regional destination. Potential public transportation improvements include enhancements to the current airport bus stop and alternative locations for a transit hub at or near the airport. Discussions are expected to continue as Metro implements the Six-Year Plan.

- Rental car activity, both on-site and off-site, plus the siting of parking areas both on and off-site can impact overall vehicle traffic at the terminal and in the immediate surrounding areas. Transit connections from off-site private operations are a major source of traffic based on actual facility location, with private autos and transit vehicle both using the same location on roadways near the terminal. Working with the City of Sea-Tac to implement congestion reducing traffic policies and regulating off-site facilities can help improve traffic flow on arterial roads near the terminal.

Parking Improvements. The following improvements in airport parking are recommended.

- On-site parking for both short and long term parking should increase from the current level of about 7,500 spaces all in the Main Terminal to about 14,800 total spaces to meet the demand placed by 38 MAP. Thus, considerable parking garage expansion and some opportunities for remote on-site parking are called for.

  Parking will be allocated to meet passenger demand at both the existing terminal and new North Unit Terminal. This will allow the POS to handle 50 percent of the projected parking demand without TDM strategies. Congestion reduction strategies would call for remote park and fly lots, plus remote parking areas located in areas around the airfield and off-site that minimize traffic congestion and site traffic problems.

- Rental Car facilities will be expanded from the approximately 1,400 spaces now in the Main Terminal parking garage for both ready car areas and car preparation area(s) to nearly 3,100 spaces for ready-car area and about 25 to 30 acres for vehicle quick-turn-around preparation. To minimize traffic congestion off-site, all these facilities should be located on-site. All 2020 plans allocate the 3,100 ready car spaces among the terminal parking facilities based on terminal passenger traffic for the three terminal expansion options. Quick-turn-around auto preparation areas now inside and next to the main parking garage could be relocated to other areas on-site to reduce the cost of housing these facilities while minimizing traffic impacts on adjacent arterials if located off-site.

- Employee parking is subject to changes in airline and terminal employment. While projected to grow from about 10,000 jobs today to about 17,000 jobs by 2020, recent trends suggest that this employment expansion could be optimistic. The current 4,100 spaces provided for employees would grow to match employment trends.

  To reduce capital outlay, recent surveys of employee parking show that one parking space per three (3.0) employees, rather than the current practice of one space for every 2.5 employees, could be used to reduce the total amount of employee parking in the future. However this formula would still require an added 1,400 spaces for employee parking to meet projected demand.

  Because of the phased nature of long-term expansion of the terminal, cargo, and aircraft maintenance programs, new sites for existing employee parking are required. Concentrating most, or all, employee parking north of SR 518 at South 24th Avenue would be desirable from traffic flow impacts and long-term shuttle bus operations.

Other Facility Improvements (Figure 5-1)

Air Cargo Facilities. Future air cargo needs will be met by modifying and expanding the existing cargo area north of the passenger terminal and constructing additional cargo facilities in SASA after 2010.

It was determined that the area between the present United cargo building and POS maintenance building offered the greatest opportunity for expanding parking for cargo aircraft. In order to accomplish this it is necessary to remove the POS maintenance building. This building is one of the oldest in the cargo area and its use is inconsistent with the cargo function. By redeveloping the apron in this area an additional two aircraft parking positions will be created. The following highlights the phasing plan for expansion of cargo

facilities at the Airport. All cargo building construction will be done by private entities in response to market demands. An illustration of a potential phasing plan is as follows.

- ***Phase 1 (1996-2000)***

  Construct a cargo building (240,000 square feet) on the south side of the main cargo apron.

- ***Phase 2 (2001-2005)***

  - Construct a new POS Airport maintenance facility at the site of the existing Cater Air flight kitchen east of the North Airport Access Freeway or alternately west of the North Access Freeway near Concourse D.
  - Demolish the POS maintenance building.
  - Demolish United Airlines maintenance building.
  - Modify Alaska Air Cargo and Air Freight Distribution Center buildings to allow construction of hardstand area for seven widebody (DC-10 sized) aircraft.
  - Construct hardstand.
  - Construct cargo building (81,000 square feet) on the north side of the newly constructed hardstand area.
  - Expand Transiplex A to the south (25,125 square feet).
  - Construction new Transiplex warehouse (25,000 square feet).

- ***Phase 3 (2006-2010)***

  - Construct a cargo building (80,000 square feet) east of the main hardstand area.

- ***Phase 4 (2011-2015)***

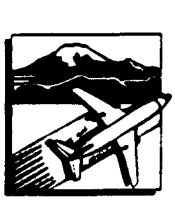
  - Begin development of cargo facilities in SASA. It is noted that the existing Delta cargo terminal will be relocated because of ultimate passenger terminal expansion in this phase. While development of SASA for cargo use can be deferred until Phase 4, construction of cargo facilities earlier should be considered under certain circumstances. An example would be if a cargo carrier desires to significantly expand operations at the Airport.

- ***Phase 5 (2016-2020)***

  - Expand SASA cargo facilities.

Airline Maintenance Facilities. The SASA site is the recommended location for replacing airline maintenance facilities lost due to cargo area construction (United Airlines maintenance facility) or terminal expansion (Northwest Airlines maintenance facility in Phase 1) and the addition of new airline maintenance facilities. The SASA site provides sufficient area for the development of maintenance facilities and does not conflict with recommended air cargo and passenger terminal improvements. Figure 5-1 shows all recommended and potential functions in the SASA site to indicate that there is available space if demand exists and alternate sites are not selected.

Airport Rescue and Fire Fighting (ARFF). The ARFF facility must be relocated to allow the construction of the North Unit Terminal. It is recommended that the new ARFF building be located on the site presently occupied by United Airlines' air cargo facility, immediately north of the new North Unit Terminal.



Based on analysis contained in the Seattle-Tacoma International Airport Third Dependent Runway Preliminary Engineering Report (HNTB, March 1994), it was determined that this location will support response time requirements contained in FAR Part 139. This requires that at least one firefighting vehicle be able to reach the midpoint of the farthest runway and begin application of fire retardant within 3 minutes from the time of alarm. Within 4 minutes from time of alarm, all other firefighting vehicles shall be capable of reaching the midpoint of the farthest runway and begin application of fire retardant.

The design of the ARFF building should consider possible northern expansion of the North Unit Terminal with a third concourse. All efforts should be made, where practical, to develop a design that avoids precluding such terminal expansion. It is also important that the design consider unimpeded access for vehicles responding to emergency alarms.

General and Corporate Aviation Facilities. General and corporate aviation facilities at Sea-Tac are the Signature Flight Support facility and the Weyerhaeuser corporate flight department. Signature, the only fixed-base operator doing business at the Sea-Tac, fuels and parks general aviation aircraft. Weyerhaeuser maintains a hangar and fueling facilities for its own aircraft and rotorcraft. Signature must be relocated to extend Taxiway A to the south and Weyerhaeuser must be relocated for the construction of the parallel runway. While both operators can generically be categorized as general aviation uses, they are independent operations and do not have to be moved to the same location on the airport. In fact, the operations are quite different in that Signature services the public, whereas, the Weyerhaeuser hangar is intended for company aircraft. The ultimate location of these facilities will depend on the operators' desire for expansion, and financial ability to support relocation.

In the siting analysis of facilities, two locations were identified for these uses. These were SASA and a north end location between the RPZs of Runway 16R and a new runway. Due to questions on the timing of SASA development and development costs of the north location, the two sites are retained to provide flexibility for the potential relocation of these facilities.

Subsequent to the completion of the siting analyses, the Port also indicated that there may be potential on the west side of the new runway for development of a corporate aviation hangar. The configuration of such development will depend on the final design of the new runway, Part 77 imaginary surfaces, navaid critical areas, and earthwork. The location may also be suitable as a possible replacement for View Point Park.

The option of expanding the Signature Flight Support area to accommodate future FBO requirements is not feasible. The site will be severely impacted by object free area clearances and a service road associated with the recommended development of a dual south parallel taxiway.

Lastly, there may also be some future opportunities in the southeast corner of the terminal area around the Delta hangar. This will depend on the final disposition of the hangar which at the time of this writing has not been determined.

Air Traffic Control Tower and TRACON. A new air traffic control tower and TRACON at Sea-Tac is proposed by the FAA. Two alternative sites have been identified by the "Air Traffic Control Tower Siting Study" conducted by HNTB: a location in the area of the existing Airborne Freight building, and a site at the end

of Concourse B. The existing control tower would remain for ramp control. The new control tower is scheduled for development during Phase 1. If the new control tower is constructed in the cargo area, the roof at the end of Concourse C would need to be lowered to provide adequate line of site to a Group V/IV configuration along Taxiways A and B.

Both locations would give the controllers a clear line of sight to all runway thresholds, departure queues and holding aprons.

Flight Kitchens. The Northwest Airlines Flight Kitchen will be relocated in Phase 2 due to terminal expansion to the south. The United Airlines flight kitchen could be impacted by terminal roadway development for a North Unit Terminal. The facility presently totals 65,000 SF and was constructed in 1990. Only a small portion of the building would be required for roadway development. It also appears possible that a roadway alignment that avoids the flight kitchen is feasible. It should also be noted that the above described roadway development would be implemented in later phases consistent with the timing of the North Unit Terminal.

Space will be available for relocated flight kitchens in the area north of State Highway 518 and east of 24th Avenue South. These parcels are east of the area identified for future employee parking. Uses shown for the site are airport maintenance and remote cargo warehouses. Sufficient area would be available to accommodate relocated flight kitchens and the other uses considered such as a cargo warehouse or airport maintenance.

Aviation Fuel Storage Facility. Planned future eastside airport facilities will not effect the location of the main fuel storage tanks. New underground fuel storage tanks to supply the new hydrant system at the expanded terminal will be integrated into the hydrant system design.

The truck fill stand will require expansion to improve the road geometry for the large refueler trucks. A new truck fill stand is also planned in the vicinity of the new North Unit Terminal. Only commuter aircraft and all-cargo aircraft will be fueled by trucks.

Airport Maintenance Facility and Snow Equipment storage. It is recommended that the existing airport maintenance facility be relocated to allow cargo aircraft apron expansion. There are several opportunities on the airport to develop a new maintenance area. The building plus parking, fueling and vehicle wash rack could be developed on a 4 to 5 acre plot, having direct access to the airfield. A building area of approximately 65,000 SF is required. The existing facility, which totals 50,000 SF, does not adequately address existing requirements. Possible sites would include the area east of the north access freeways, (Cater Air), and the southeast corner of the terminal area around the Delta hangar. The latter will depend on the final disposition of the hangar, which as yet, has not been determined.

Another site suggested as a possible location for an airport maintenance facility is the old fuel farm located off the end of Concourse D. While the location may be attractive in terms of STS maintenance, the ultimate use of the site is dependent on the disposition and proximity of operational fuel facilities. More importantly, the location does not provide sufficient area to develop required facilities and would mix airport maintenance related traffic with terminal traffic.

Additional space will be required for storage of snow removal equipment. FAA AC 150/ 5220-18, Buildings for Storage and Maintenance of Airport Snow and Ice Control Equipment and Materials, suggests an area of approximately

1,000 SF per vehicle. Based on the 26 present vehicles a building totalling approximately 50,000 SF would be adequate for vehicle and material storage (this area requirement will be verified in subsequent study). A south field location near the threshold of Runway 34L has been identified for the snow equipment storage facility.

Development of SASA

As seen from prior discussion, SASA is intended to accommodate several other future facility requirements (cargo, aircraft maintenance, possibly general aviation). The eventual development of this site for these uses will rely on certain factors. While the site remains an option for providing space for facilities that will be relocated or expanded as a result of continued growth, the following should be noted.

SASA is currently listed in the airport CIP for site design and construction beginning in 1999. However, it will be very expensive to develop, and incurring expensive site preparation costs would likely require the commitment of a major tenant/user such as a maintenance base or cargo facility operator. It is not likely that smaller operators, such as general aviation, would consider such an investment required for the initial development of SASA.

Also, the displacement of certain facilities identified in the Master Plan will not necessarily result in their eventual replacement. Final decisions to build replacement facilities will rest with private companies (airlines, operators, etc.) and other agencies. The required space to accommodate these facilities is protected in the Master Plan at the SASA location, but the actual build-out of SASA will depend on demands of operators who may or may not choose to build replacement facilities.

As envisioned in the SASA Final Environmental Impact Statement (FEIS) completed in March 1994, the relocation of Des Moines Creek and the related stormwater detention ponds must begin two years prior to SASA site work. Unless this requirement were to be altered through discussions with permitting agencies, there is a four-year lead time before the site would be available for aviation use.

Since the timing of SASA development is uncertain, where possible, alternative sites for certain relocations have been identified. This will permit relocations in the event that demands materialize before the development of SASA.

Westside Land Use

Should a new parallel runway be constructed, some vacant land would result in the acquisition area. This land would have excellent development potential for airport compatible uses (as noted on the official future airport layout plan. At this time the Port of Seattle does not have specific development plans for these areas and is coordinating with the City of SeaTac in the development of the West SeaTac Subarea Plan.

PHASING OF IMPROVEMENTS

The following identifies the general phasing schedule for Master Plan Update improvement projects (moving sidewalk alternative):

- Phase 1, 22-24 million passengers (1996-2000):
  - Acquisition of property for new runway and RPZs
  - Begin construction of the new parallel Runway 16X - 34X and associated taxiways and navaids. Construction will continue into Phase 2.

- Completion of RSA upgrades for existing runway ends
- Expansion of Concourse A
- Overhaul of Satellite Transit System (STS) and addition of STS vehicles (currently under study)
- Development of On-Airport hotel
- Relocation of Airport Surveillance Radar (ASR) and Airport Surface Detection Equipment (ASDE)
- Relocation of South 156th Way and 154th Street South
- Construction of the first phase of a midfield overnight aircraft parking apron between Runways 16R-34L and 16X-34X
- Potential relocation of Northwest aircraft maintenance facilities to SASA if necessary, depending on tenant needs and site availability.
- Potential relocation of Airborne cargo facilities for an alternate site for construction of a new Air Traffic Control Tower
- Construction of a new FAA Air Traffic Control Tower/TRACON
- Relocate general aviation and corporate aviation facilities if necessary to SASA or alternatively to an area between the RPZs of Runway 16L and 16X
- Development of new snow equipment storage site between the RPZs of Runways 34L and 34X
- Develop a site for ground support equipment
- Add spaces to Central Parking Structure for public and rental cars (about 1,700 spaces)
- Develop additional airport employee surface parking north of SR 518 west of 24th Avenue South
- Improve access and circulation roadways at the Main Terminal
- Development of a site for a new cargo facility on the south side of the main cargo apron

■ Phase 2, 24-27 million passengers (2001-2005):

- Expansion of Main Terminal at Concourse A
- Construction of second phase of the midfield aircraft overnight parking apron between Runways 16R-34L and 16X-34X
- Improve access and circulation roads at the Main Terminal, including a partial connection to the South Access Roadway scheme
- Add spaces to the Central Parking Structure for public and rental cars (about 1,500 spaces)
- Expand employee north parking lot
- Develop new airport maintenance facility
- Remove the existing airport maintenance facility

- Potentially relocate United Airlines maintenance facility to SASA, depending on tenant needs
- Redevelop main air cargo area by modifying and expanding existing cargo buildings, expanding hardstand areas and constructing new cargo buildings.

■ Phase 3, 27-31 million passengers (2006-2010):

- Development of the first phase of the new North Unit Terminal (South Pier)
- Development of the North Terminal roadways
- Additional improvements for the South Access Roadway connection scheme
- Extension of dual parallel Taxiways A and B to the south end of the existing terminal apron.
- Construct first phase of North Unit Terminal parking structure for public and rental cars (about 3,000 spaces)
- Expand employee north parking lot
- Develop an area for a new cargo facility east of the main cargo hardstand area and relocate United air cargo there or to SASA
- Provide upper roadway transit plaza at Main Terminal; restrict access from the SR 99 entrance/exit
- Relocate ARFF facility to the north of North Unit Terminal

■ Phase 4, 31-34 million passengers (2011-2015):

- Develop North Pier at North Unit Terminal and construct gates on south side of North Pier.
- Four additional taxiway exits on Runway 16L-34R
- Expand Central Terminal parking by about 500 spaces
- Expand north parking structure by about 1,800 spaces for public and rental cars
- Expand employee north parking lot
- Develop cargo and airline maintenance areas in SASA
- Relocate Delta cargo facilities to SASA
- Relocate the U.S. Airmail facility to SASA
- Develop connections to RTA system

■ Phase 5, 34-38 million passengers (2016-2020):

- Completion of North Unit Terminal (gates on north side of North Pier)
- Extend Runway 34R by 600 feet and extend dual parallel Taxiways A and B the full length of extended Runway 16L-34R and a taxiway bridge over 188th Avenue South
- Expand North Unit Terminal parking structure by about 1,800 spaces

- Expand employee north parking lot
- Expand SASA cargo facilities
- Complete connectors to south access roadway scheme.

The timing of Master Plan improvements will be triggered by passenger levels as identified above. The time periods indicated above correspond to the Master Plan Update forecasts. Passenger activity in 1994 exceeded the forecast as seen below:

Year	Total Passengers (Millions) Actual	Projected
1993	18.8	–
1994	21.0	19.5
2000	–	28.8

If this trend continues, improvements would be needed sooner than the time periods indicated.

CAPITAL COST ESTIMATES OF RECOMMENDED IMPROVEMENTS

Capital cost estimates for the recommended Master Plan improvements are shown in Table 5-2. Costs are shown for five phases represented by ranges of passengers to be accommodated. The corresponding time period is shown based on the Master Plan Update forecasts.

Costs include property acquisition, relocations and demolition, construction, engineering and architectural services and allowances for contingencies and other costs not specifically itemized. Costs are shown in 1994 dollars for the following categories: Property Acquisition and Relocations, Airside Elements, Passenger Terminal Elements, Satellite Transit System (STS) Improvements, Roadway and Vehicle Parking Elements, and Other Landside Elements.

Costs are shown in the table for two assumptions to estimate a low and a high cost range of satellite transit system (STS) improvements:

- ***Moving Sidewalk Alternative.*** The lower STS cost estimate assumes the new terminal areas would be served by moving sidewalks and expanded curbside shuttle service, rather than the extension of existing STS lines. The STS system would be upgraded in the first phase by a major overhaul of existing vehicles and the procurement of seven new vehicles to increase the capacity of the system.

- ***STS Expansion Alternative.*** The higher STS cost estimate assumes the STS system would be upgraded as described above and in addition the existing shuttle systems would be expanded to serve the new terminal areas, replacing moving sidewalks as the primary means of inter- and intra-terminal passenger movements.

As previously stated, the ultimate passenger conveyance systems will be determined from an independent study of the STS which is presently underway.

Note that not all costs reported here would likely be borne by the Port. Specifically, costs of a new air traffic control tower, TRACON facility and navaids are typically funded by the FAA through the FAA's Facilities and Equipment (F&E) program (although some navaids costs may be borne by the Port). These typical F&E costs, Items B10 and F5 in Table 5-2, are assumed to be funded totally by the FAA in the financial feasibility analysis, described in Section 6. Furthermore, all costs associated with the development of site improvements (such as roads and aprons, but not buildings) for new air cargo, aircraft maintenance, and corporate aviation facilities are conservatively included in Table 5-2 and the financial analysis,

TABLE 5-2

CAPITAL COST ESTIMATES FOR RECOMMENDED AIRPORT MASTER PLAN IMPROVEMENTS, 1996 TO 2020
(NORTH UNIT TERMINAL / 8,500-FOOT RUNWAY OPTION)
SEA-TAC INTERNATIONAL AIRPORT [a]

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
A	*PROPERTY ACQUISITION AND RELOCATIONS*						
A1	RUNWAY AREA [b]	91,420	91,420	0	0	0	0
A2	TERMINAL AREA	0	0	0	0	0	0
	ITEMIZED PROPERTY ACQUISITION AND RELOCATIONS COST	91,420	91,420	0	0	0	0
	CONTINGENCIES AND ADMINISTRATIVE / LEGAL COSTS (20%)	18,284	18,284	0	0	0	0
	TOTAL PROPERTY ACQUISITION AND RELOCATIONS COST	109,704	109,704	0	0	0	0
B	*AIRSIDE ELEMENTS*						
B1	MOBILIZATION	14,975	10,950	350		150	3,525
B2	RELOCATED ITEMS						
	Southwest Suburban Miller Creek Interceptor	1,962	1,962	0	0	0	0
	Sewer Dist Local Service Abandonment	38	38	0	0	0	0
	Seattle Water Dept Waterman Relocation	1,744	1,744	0	0	0	0
	Port of Seattle Sanitary Sewer Relocation	155	155	0	0	0	0
	Water Dist No 20 Local Service Abandonment	17	17	0	0	0	0
	Water Dist No 49 Local Service Abandonment	18	18	0	0	0	0
	Water Dist No 125 Local Service Abandonment	15	15	0	0	0	0
	Wash Natural Gas Local Service Abandonment	16	16	0	0	0	0
	Miller Creek	4,960	4,960	0	0	0	0
	Subtotal	8,924	8,924	0	0	0	0
B3	DEMOLITION						
	Demolition of Small Structures	838	838	0	0	0	0
	Demolition of Weyerhaeuser Hangar	179	179	0	0	0	0
	Demolition of Airfield Pavement	34	34	0	0	0	0
	Demolition of Streets and Roads	102	102	0	0	0	0
	Demolition of Miscellaneous Utilities	250	250	0	0	0	0
	Subtotal	1,402	1,402	0	0	0	0
B4	EARTHWORK						
	Clearing and Grubbing	220	220	0	0	0	0
	Erosion Control	150	150	0	0	0	0
	Common Excavation	9,300	9,300	0	0	0	0
	Borrow - Zone A	21,000	21,000	0	0	0	0
	Borrow - Zone B	69,200	69,200	0	0	0	0
	Borrow - Zone C	18,750	18,750	0	0	0	0
	Subtotal	118,620	118,620	0	0	0	0

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
B5	DRAINAGE						
	Conveyance System	6,893	3,447	3,447	0	0	0
	Flow Diversion	1,265	1,265	0	0	0	0
	Detention Ponds	20,456	10,228	10,228	0	0	0
	Subtotal	28,614	14,940	13,675	0	0	0
B6	ON-SITE WATER						
	Lateral Water Lines	108	108	0	0	0	0
	Trunk Water Lines	725	725	0	0	0	0
	Hydrants	5	5	0	0	0	0
	Subtotal	838	838	0	0	0	0
B7	ELECTRICAL						
	Restoration of Sea-Tac Third Metering Point	523	523	0	0	0	0
	Rerouting of Main Telephone Service	600	600	0	0	0	0
	Modifications to Airfield Lighting in Control Tower	100	100	0	0	0	0
	Modifications to Stop Bar in Control Tower	250	250	0	0	0	0
	Rearrangement of Control Panels in Control Tower	75	75	0	0	0	0
	Vault Building	150	150	0	0	0	0
	Vault Building Generators	280	280	0	0	0	0
	Vault Building Regulators	320	320	0	0	0	0
	Electrical System	1,300	650	650	0	0	0
	Runway Lighting	3,570	1,785	1,785	0	0	0
	Taxiway Lighting	3,653	1,596	1,597	0	276	184
	Stop Bar/Hold Bar Lighting	316	158	158	0	0	0
	Airfield Signs	665	0	665	0	0	0
	Utility Work	400	400	0	0	0	0
	Subtotal	12,202	6,887	4,855	0	276	184
B8	PAVING						
	Runway Pavement	5,668	2,834	2,834	0	0	0
	Taxiway Pavement	9,888	4,434	4,434	0	1,020	0
	Runway Shoulder Pavement	513	256	256	0	0	0
	Taxiway Shoulder Pavement	1,300	617	617	0	66	0
	Blast Pad Pavement	151	75	75	0	0	0
	Perimeter Road and Airfield Access Roads	308	308	0	0	0	0
	Parking Apron Pavement	4,800	2,400	2,400	0	0	0
	Apron Shoulder	78	39	39	0	0	0
	Road Relocations for Airfield Improvements	900	900	0	0	0	0
	Subtotal	23,605	11,863	10,655	0	1,086	0
B9	RUNWAY EXTENSION AND RSA IMPROVEMENTS						
	Runway 16L Safety Area and Road Relocation	5,000	5,000	0	0	0	0
	Runway 34R Safety Area and Road Relocation	9,350	9,350	0	0	0	0
	Runway 16R Safety Area and Road Relocation	12,250	12,250	0	0	0	0
	Runway 34L Safety Area and Road Relocation	0	0	0	0	0	0
	Extension of Runway 16L and Taxiways A & B (600')	13,740	0	0	0	0	13,740
	Subtotal	40,340	26,600	0	0	0	13,740

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
B10	RADAR AND NAVAIDS [c]						
	ASR Relocation	2,000	1,000	1,000	0	0	0
	ASDE Relocation	350	175	175	0	0	0
	North Approach Glide Slope	600	0	600	0	0	0
	South Approach Glide Slope	600	0	600	0	0	0
	North Approach Localizer	600	0	600	0	0	0
	South Approach Localizer	600	0	600	0	0	0
	RVR Facilities	300	0	300	0	0	0
	North Approach Markers (Outer)	175	0	175	0	0	0
	South Approach Markers (Outer)	175	0	175	0	0	0
	VASI	100	0	100	0	0	0
	Approach Lighting - North Approach (ALSF-2)	1,500	0	1,500	0	0	0
	Approach Lighting - South Approach (ALSF-1)	1,500	0	1,500	0	0	0
	Subtotal	8,500	1,175	7,325	0	0	0
B11	MISCELLANEOUS						
	Bridge Structures	750	750	0	0	0	0
	Retaining Walls	3,051	3,051	0	0	0	0
	Fencing	210	0	210	0	0	0
	Seeding	225	0	225	0	0	0
	Landscaping	40	0	40	0	0	0
	Subtotal	4,276	3,801	475	0	0	0
	ITEMIZED AIRSIDE ELEMENT COST	262,296	206,000	37,335	0	1,512	17,449
	ALL OTHER CONSTRUCTION ITEMS (20%)	50,759	40,965	6,002	0	302	3,490
	SUBTOTAL	313,055	246,965	43,337	0	1,814	20,939
	ENGINEERING AND CONTINGENCIES (15%)	45,683	36,869	5,402	0	272	3,141
	TOTAL AIRSIDE ELEMENT COST	358,738	283,834	48,739	0	2,086	24,080

Item No.		Description	Estimated Cost in Thousands of 1994 Dollars					
			Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
C		*PASSENGER TERMINAL ELEMENTS*						
	C1	EARTHWORK	4,153	0	210	2,105	995	843
	C2	DEMOLITION	18,280	7,000	1,280	2,640	7,360	0
MOVING SIDEWALK ALTERNATIVE	C3	TERMINAL CONSTRUCTION						
		New Construction	229,480	16,200	39,200	90,560	50,400	33,120
		Renovation	12,000	7,680	4,320	0	0	0
		Subtotal	241,480	23,880	43,520	90,560	50,400	33,120
	C4	TERMINAL APRON						
		Pavement	24,492	1,755	1,560	11,011	4,485	5,681
		Hydrant Fueling System	25,652	1,166	1,166	16,907	3,498	2,915
		Subtotal	50,144	2,921	2,726	27,918	7,983	8,596
	C5	SPECIAL EQUIPMENT						
		New Loading Bridges	14,520	660	660	9,570	1,980	1,650
		Inbound Baggage	6,000	0	900	3,000	0	2,100
		Outbound Baggage	10,560	0	960	6,960	1,440	1,200
		Moving Sidewalks	8,640	2,700	1,620	2,520	1,800	0
		FIDS/BIDS	3,388	154	154	2,233	462	385
		Security System	5,737	405	980	2,264	1,260	826
		Subtotal	48,845	3,919	5,274	26,547	6,942	6,163
		ITEMIZED PASSENGER TERMINAL ELEMENT COST	362,902	37,720	53,010	149,770	73,680	48,722
		CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (25%)	90,725	9,430	13,253	37,443	18,420	12,181
		SUBTOTAL	453,627	47,150	66,263	187,213	92,099	60,903
		ENGINEERING / ARCHITECTURAL SERVICES (10%)	45,363	4,715	6,626	18,721	9,210	6,090
		TOTAL PASSENGER TERMINAL ELEMENT COST	498,990	51,865	72,889	205,934	101,309	66,993
D		*SATELLITE TRANSIT SYSTEM (STS) IMPROVEMENTS*						
MOVING SIDEWALK ALT	D1	VEHICLE OVERHAUL/PURCHASE	35,210	35,210				
	D2	LINE EXTENSION	0					
	D3	MAINTENANCE FACILITY	0					
	D4	WAYSIDE AND CONTROL ROOM	20,000	20,000				
		ITEMIZED STS IMPROVEMENT COST	55,210	55,210	0	0	0	0
		CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (25%)	13,803	13,803	0	0	0	0
		SUBTOTAL	69,013	69,013	0	0	0	0
		ENGINEERING / ARCHITECTURAL SERVICES (10%)	6,901	6,901	0	0	0	0
		TOTAL STS IMPROVEMENT COST	75,914	75,914	0	0	0	0

Item No.		Description	Estimated Cost in Thousands of 1994 Dollars					
			Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
C		*PASSENGER TERMINAL ELEMENTS*						
	C1	EARTHWORK	3,431	0	210	1,704	674	843
	C2	DEMOLITION	18,280	7,000	1,280	2,640	7,360	0
	C3	TERMINAL CONSTRUCTION						
S		New Construction	208,680	16,200	39,200	79,040	41,120	33,120
T		Renovation	12,000	7,680	4,320	0	0	0
S		Subtotal	220,680	23,880	43,520	79,040	41,120	33,120
E	C4	TERMINAL APRON						
X		Pavement	24,492	1,755	1,560	11,011	4,485	5,681
T		Hydrant Fueling System	25,652	1,166	1,166	16,907	3,498	2,915
E		Subtotal	50,144	2,921	2,726	27,918	7,983	8,596
N								
S	C5	SPECIAL EQUIPMENT						
I		New Loading Bridges	14,520	660	660	9,570	1,980	1,650
O		Inbound Baggage	6,000	0	900	3,000	0	2,100
N		Outbound Baggage	10,560	0	960	6,960	1,440	1,200
		Moving Sidewalks	8,640	2,700	1,620	2,520	1,800	0
A		FIDS/BIDS	3,388	154	154	2,233	462	385
L		Security System	5,217	405	980	1,976	1,028	828
T		Subtotal	48,325	3,919	5,274	26,259	6,710	6,163
E								
R								
N		ITEMIZED PASSENGER TERMINAL ELEMENT COST	340,860	37,720	53,010	137,561	63,847	48,722
A								
T		CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (25%)	85,215	9,430	13,253	34,390	15,962	12,181
I								
V		SUBTOTAL	426,074	47,150	66,263	171,951	79,808	60,903
E								
		ENGINEERING / ARCHITECTURAL SERVICES (10%)	42,607	4,715	6,626	17,195	7,981	6,090
		TOTAL PASSENGER TERMINAL ELEMENT COST	468,682	51,865	72,889	189,146	87,789	66,993
D		*SATELLITE TRANSIT SYSTEM (STS) IMPROVEMENTS*						
	D1	VEHICLE OVERHAUL/PURCHASE	44,210	35,210		9,000		
S								
T	D2	LINE EXTENSION	37,200		10,510	26,690		
S								
	D3	MAINTENANCE FACILITY	2,000			2,000		
E								
X	D4	WAYSIDE AND CONTROL ROOM	27,500	20,000		7,500		
T								
E								
N		ITEMIZED STS IMPROVEMENT COST	110,910	55,210	10,510	45,190	0	0
S								
I		CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (25%)	27,728	13,803	2,628	11,298	0	0
O								
N		SUBTOTAL	138,638	69,013	13,138	56,488	0	0
A		ENGINEERING / ARCHITECTURAL SERVICES (10%)	13,864	6,901	1,314	5,649	0	0
L								
T		TOTAL STS IMPROVEMENT COST	152,501	75,914	14,451	62,136	0	0

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
E	*ROADWAY AND VEHICLE PARKING ELEMENTS*						
E1	MOBILIZATION	3,203	589	992	645	616	361
E2	DEMOLITION - PAVEMENT						
	Road Demolition	267	0	0	267	0	0
	Bridge Demolition	720	0	0	720	0	0
	Building Demolition	2,382	0	0	2,382	0	0
	Subtotal	3,370	0	0	3,370	0	0
E3	ROADWAYS						0
	Access / Circulation Road at Grade	1,787	65	1,078	644	0	0
	Circulation Road on Structure	51,700	2,520	34,280	14,900	0	0
	Subtotal	53,487	2,585	35,358	15,544	0	0
E4	RETAINING WALL	162	0	162	0	0	0
E5	VEHICLE PARKING						
	Public/Rental Parking - South Structure	0	0	0	0	0	0
	Public/Rental Parking - Central Structure	38,900	25,250	13,650	0	0	0
	Public/Rental Parking - North Structure	60,940	0	0	12,820	30,450	17,670
	Public/Rental Parking - North Lot	0	0	0	0	0	0
	Employee Parking - North Lot	3,288	1,604	441	520	343	380
	Subtotal	103,128	26,854	14,091	13,340	30,793	18,050
E6	TRANSIT PLAZAS						
	Lower Roadway Transit Plaza	182	0	0	182	0	0
	Upper Roadway Transit Plaza	6,050	0	0	6,050	0	0
	Subtotal	6,232	0	0	6,232	0	0
E7	SIGNAGE AND LIGHTING	13,068	2,402	4,048	2,632	2,513	1,473
E8	LANDSCAPING	3,267	601	1,012	658	628	368
	ITEMIZED ROADWAY AND VEHICLE PARKING ELEMENT COST	185,916	33,030	55,663	42,420	34,550	20,252
	CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (20%)	37,183	6,606	11,133	8,484	6,910	4,050
	SUBTOTAL	223,099	39,636	66,796	50,904	41,460	24,302
	ENGINEERING SERVICES (10%)	22,310	3,964	6,680	5,090	4,146	2,430
	TOTAL ROADWAY AND VEHICLE PARKING ELEMENT COST	245,409	43,600	73,476	55,994	45,606	26,732

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
F	*OTHER LANDSIDE ELEMENTS*						
F1	MOBILIZATION	617	43	467	1	72	35
F2	AIR CARGO AREA SITE IMPROVEMENTS						
	Demolition of Buildings	4,187	1,011	3,176	0	0	0
	Demolition of Parking Pavement	27	0	0	27	0	0
	Aprons	10,180	416	4,776	0	3,300	1,688
	Access Road	314	89	0	9	198	18
	Security Fence	89	6	0	0	0	83
	Lighting and Signage	838	59	381	3	286	109
	Subtotal	15,635	1,581	8,333	39	3,784	1,898
F3	AIRLINE MAINTENANCE AREA SITE IMPROVEMENTS						
	Apron	1,960	1,104	0	0	856	0
	Taxiway Extension	0	0	0	0	0	0
	Access Road Extension	86	45	0	0	41	0
	Lighting and Signage	120	48	0	0	72	0
	Subtotal	2,166	1,197	0	0	968	0
F4	AIRPORT RESCUE AND FIREFIGHTING (ARFF) IMPROVEMENTS						
	Demolition of Buildings	2,440	0	0	2,440	0	0
	Building	2,400	0	0	2,400	0	0
	Vehicle Parking	18	0	0	18	0	0
	Access Road	9	0	0	9	0	0
	Apparatus Ramp	56	0	0	56	0	0
	Fencing	20	0	0	20	0	0
	Lighting	155	0	0	155	0	0
	Subtotal	5,098	0	0	5,098	0	0
F5	AIR TRAFFIC CONTROL TOWER (ATCT) [c]						
	Demolition of Buildings	900	900	0	0	0	0
	Access Road	9	9	0	0	0	0
	Vehicle Parking	18	18	0	0	0	0
	ATCT Facility	10,000	10,000	0	0	0	0
	TRACON Facility	10,000	10,000	0	0	0	0
	Fencing	26	26	0	0	0	0
	Lighting	3	3	0	0	0	0
	Subtotal	20,956	20,956	0	0	0	0
F6	GENERAL AVIATION / FBO AREA SITE IMPROVEMENTS						
	Taxiway						
	Apron	356	356	0	0	0	0
	Access Road Extension	54	54	0	0	0	0
	Security Fence	26	26	0	0	0	0
	Lighting	26	26	0	0	0	0
	Subtotal	462	462	0	0	0	0
F7	CORPORATE AVIATION SITE IMPROVEMENTS						
	Apron	133	133	0	0	0	0
	Access Road	34	34	0	0	0	0
	Taxiway	267	267	0	0	0	0
	Lighting and Signage	51	51	0	0	0	0
	Subtotal	485	485	0	0	0	0

Item No.	Description	Estimated Cost in Thousands of 1994 Dollars					
		Total	Phase 1 (22-24 MAP)	Phase 2 (24-27 MAP)	Phase 3 (27-31 MAP)	Phase 4 (31-34 MAP)	Phase 5 (34-38 MAP)
F8	AIRPORT MAINTENANCE AREA IMPROVEMENTS						
	Building	8,000	0	8,000	0	0	0
	Access Road	9	0	9	0	0	0
	Fencing	600	0	600	0	0	0
	Vehicle Parking	48	0	48	0	0	0
	Lighting and Signage	693	0	693	0	0	0
	Subtotal	9,350	0	9,350	0	0	0
F9	SNOW EQUIPMENT STORAGE IMPROVEMENTS						
	Building	4,000	4,000	0	0	0	0
	Access Road	9	9	0	0	0	0
	Fencing	40	40	0	0	0	0
	Vehicle Parking / Ramp	240	240	0	0	0	0
	Lighting and Signage	343	343	0	0	0	0
	Subtotal	4,632	4,632	0	0	0	0
F10	GSE SITE IMPROVEMENTS						
	Taxiway Extension	332	332	0	0	0	0
	Access Road	162	162	0	0	0	0
	Lighting and Signage	39	39	0	0	0	0
	Subtotal	533	533	0	0	0	0
	OTHER ITEMIZED LANDSIDE ELEMENT COST	59,933	29,889	18,149	5,138	4,824	1,933
	CONTINGENCIES AND OTHER CONSTRUCTION ITEMS (30%)	17,980	8,967	5,445	1,541	1,447	580
	SUBTOTAL	77,913	38,856	23,594	6,679	6,271	2,513
	ENGINEERING SERVICES (10%)	7,791	3,886	2,359	668	627	251
	TOTAL OTHER LANDSIDE ELEMENT COST	85,704	42,741	25,953	7,347	6,898	2,765
	TOTAL ESTIMATED MASTER PLAN COSTS						
	MOVING SIDEWALK ALTERNATIVE						
A	PROPERTY ACQUISITION AND RELOCATIONS	109,704	109,704	0	0	0	0
B	AIRSIDE ELEMENTS	358,738	283,834	48,739	0	2,086	24,080
C	PASSENGER TERMINAL ELEMENTS	498,990	51,865	72,889	205,934	101,309	66,993
D	SATELLITE TRANSIT SYSTEM (STS) IMPROVEMENTS	75,914	75,914	0	0	0	0
E	ROADWAY AND VEHICLE PARKING ELEMENTS	245,409	43,600	73,476	55,994	45,606	26,732
F	OTHER LANDSIDE ELEMENTS	85,704	42,741	25,953	7,347	6,898	2,765
	TOTAL	1,374,459	607,658	221,056	269,275	155,900	120,570
	STS EXTENSION ALTERNATIVE						
A	PROPERTY ACQUISITION AND RELOCATIONS	109,704	109,704	0	0	0	0
B	AIRSIDE ELEMENTS	358,738	283,834	48,739	0	2,086	24,080
C	PASSENGER TERMINAL ELEMENTS	468,682	51,865	72,889	189,146	87,789	66,993
D	SATELLITE TRANSIT SYSTEM (STS) IMPROVEMENTS	152,501	75,914	14,451	62,136	0	0
E	ROADWAY AND VEHICLE PARKING ELEMENTS	245,409	43,600	73,476	55,994	45,606	26,732
F	OTHER LANDSIDE ELEMENTS	85,704	42,741	25,953	7,347	6,898	2,765
	TOTAL	1,420,738	607,658	235,508	314,624	142,379	120,570

[a] Source P & D Aviation.

[b] Includes costs for full acquisition of Runway Protection Zone property, rather than avigation easements.

[c] Costs for these items are typically funded by the FAA through its Facilities and Equipment Program.

although some of these improvements may be paid for by the tenant.

While demolition costs are included, costs to reimburse airport tenants for existing hangars, cargo facilities, flight kitchens and other tenant improvements which must be relocated to allow for new construction have not been included due to the uncertainty of these costs. Costs of new tenant improvements are also excluded.

Environmental remediation requirements have not been identified at this stage of planning, and therefore those costs are not included.

Specific assumptions regarding costs in each category are itemized below.

- Property Acquisition and Relocation
  - The property acquisition and relocations cost for runway construction was taken from Table 5-11 in Technical Report No. 6, Airside Options Evaluation.

    Full acquisition costs for property and businesses in the south Runway Protection Zone of the new runway are included in Table 5-2 and the financial feasibility analysis. Currently, the Port and FAA are investigating whether full acquisition (rather than avigation easements) will be necessary and consequently property acquisition costs could be lower than identified in Table 5-2.
  - The property acquisition and relocations cost for the South Unit Terminal construction were preliminary estimates provided by Landrum & Brown. These costs were based on assessed value plus 25 percent with an additional 25 percent for relocation costs of property owners.
- Airside Elements
  - Costs for airside elements were taken from Table 5-6 (North Unit Terminal Option) and Table 5-10 of Technical Report No. 6, Airside Options Evaluation. These costs were modified (a) to include parallel Taxiways A and B at the south end of Runway 16L-34R, (b) to reduce the extension of Runway 34R from 900 feet to 600 feet and (c) to relocate South 154th Street to the north and provide full Runway Safety Areas at the north ends of Runways 16L and 16R.
  - Contingencies and engineering costs are not applied to navaids because they are included in the unit navaid costs.
- Passenger Terminal Elements
  - The passenger terminal requirements are described in Technical Report No.7A, Terminal Options Evaluation.
  - Terminal element costs do not include RTA station construction but do include estimates for transit center and/or supporting special equipment for the conveyance of people and baggage to and from the terminal which were not included in the original facility program (Technical Report No. 7A).
- Satellite Transit System (STS) Improvements
  - The STS is a major component of the existing terminal's people-handling capability, and an overhaul of the existing system is needed. Future expansion of the STS system can be weighed against costs for moving sidewalks or other options. Short term STS

improvements included in the cost estimates are: (a) a major overhaul of the existing equipment, including the 24 vehicles, the wayside equipment and the control room and (b) increasing the existing fleet by seven vehicles to a total of 31 vehicles. Train size would be increased to three 3-car trains per existing loop and one 2-car train shuttle.

- The STS option involving extension of the STS line assumes increasing the fleet to a total of 39 vehicles and the extension of the shuttle line to the north to serve the new north unit terminal and to the south to serve the extension of Concourse A.

- Roadway and Vehicle Parking Elements

  - Roadway and vehicle parking improvements were described in Technical Report No. 7A, Terminal Options Evaluation (November 15, 1994) and Preliminary Traffic Study, Master Plan Update Impact Study Alternatives (January 30, 1995), although some revisions have been made since the publication of those documents. Parking improvements are described in Airport Parking System, Long Range Analysis, April 1995.

  - Roadway costs associated with airside improvements are included under Airside Elements. Access costs associated with airline maintenance, cargo and other tenant areas are included under Other Landside Elements.

  - Costs for the south access freeway tunnel (approximately 1,600 feet in length) are not included.

  - Expansion of the central parking structure Sections A, B, C and D to nine floors is assumed to occur in Phase 1.

- ***Other Landside Elements***

  - Cost estimates for the new air traffic control tower and TRACON facility are preliminary numbers supplied by the FAA. Costs of new equipment are not included due to the uncertainty of requirements at this time.

  - Access and site improvement costs for a new off-site regional ARFF training area are not included because a site has not yet been identified.

  - Costs associated with airline maintenance and air cargo facilities do not include tenant improvements such as buildings but include site improvements such as utilities, ground access and airside access (taxiway/taxilane and aircraft parking apron).

The cost estimates exclude the on-going capital improvement program. The development projects would be funded by airport operating revenues as well as private and Federal funding. Funding from the following sources may be sought: FAA grant from the Aviation Trust Fund, Special Facility Bonds, General Airport Revenue bonds, and airline capital expenditures. General Airport Revenue Bonds would be issued by the Port of Seattle. Funding from the Aviation Trust Fund would be requested for capacity and airfield related projects as well as all other projects eligible under the program. The Aviation Trust Fund is funded primarily by a nationwide airline passenger ticket tax and cargo air bill tax. The Port of Seattle also anticipates the collection of user fees to fund expansion projects, such as the Passenger Facility Charge (PFC).

The following section describes the results of a financial analysis to assess the feasibility of funding the recommended improvements.

Section 6
FINANCIAL ANALYSIS

SECTION 6
FINANCIAL ANALYSIS

INTRODUCTION

The premise of the baseline capital program (Table 5-2) is that demand for new facilities (discussed in detail in Technical Report #5) is the primary determinant of overall Master Plan phasing. In reality, however, the phasing of the development program will be determined by both demand and the financial capacity of the Port to provide these new facilities on a timely basis.

The purpose of this analysis is to test the financial implications of developing the Master Plan according to the demand-driven phasing schedule. The results are evaluated in the context of the Aviation Division's overall financial capacity and using conservatively defined financial constraints, potential alternative program scenarios will be discussed. Toward this end this section is organized as follows:

- Definition of Baseline Capital Program
- Financial Structure and Capital Financing Resources
- Financial Analysis of Baseline Capital Program
- Strategies to Address Potential Financial Constraints
- Financially Constrained Scenario, An Illustrative Example
- Summary of Findings

BASELINE CAPITAL PROGRAM

The baseline capital program assumes construction of the North Unit Terminal with the moving sidewalk circulation system and the 8,500 foot runway, phased according to the demand for new facilities. The relationship between the activity at the airport and the demand for new facilities is governed by the definition of acceptable levels of service. The demand-driven phasing program is based on the Master Plan forecast of activity growth and an assumption that a high level of service will be maintained throughout the planning horizon. If it were deemed acceptable to develop to a lower standard of service, the phasing plan would need to be adjusted accordingly.

Table 6-1 presents the capital funding requirements based on the cost estimate and project phasing for this Master Plan configuration. To evaluate the financial implications of accomplishing this program, the analysis must also account for the Port of Seattle capital facility needs that are beyond the scope of the Master Plan effort, since all capital projects will be competing for the same sources of capital funds.

The Master Plan identifies facilities that are required to accommodate the growth in demand at Sea-Tac International Airport. There are substantial capital needs beyond these expansion projects. The Port of Seattle has identified about $440 million worth of major maintenance that is required over the next 10 years to preserve existing infrastructure. Beyond the major maintenance needs, there are background capital project needs that are in addition to the items identified in the Master Plan, such as environmental and other regulatory related projects. Table 6-1 presents these items as Other Capital needs.

The cost estimate of the non-Master Plan portion of the capital program was estimated using the long-range Port of Seattle Capital Improvement Plan (CIP) cash flow projection.

TABLE 6-1
CAPITAL COST SUMMARY [a]
(IN THOUSANDS OF 1995 DOLLARS)

Master Plan Phase	Master Plan Items	Other Capital	Total Capital
Phase I (1996-2000)	$ 617,658	$458,930	$1,076,588
Phase II (2001-2005)	$ 241,057	$280,786	$ 521,843
Phase III (2006-2010)	$ 289,277	$ 30,907	$ 320,184
Phase IV (2011-2015)	$ 155,900	$ 8,957	$ 164,858
Phase V (2016-2020)	$ 120,569	$ 18,186	$ 138,755
Total Capital Needs	$1,424,462	$797,766	$ 222,228

[a] Source: Berk and Associates.

[b] Due to cost adjustments made during the planning process, there are negligible differences in master plan costs shown here and in Table 5-2. These differences are not large enough to affect the results of the analysis shown in Section 6.

TABLE 6-2
COST PER ENPLANEMENT PROJECTIONS
U.S. PEER AIRPORT COMPARISON [a]

Year	Los Angeles	San Francisco	Denver	Portland	Salt Lake City	Peer Facility Averages	
						with Denver	w/o Denver
Actual/Estimated							
1991	$0.90	$3.42	$5.50	$5.93	$4.10	$3.97	$3.59
1992	$0.55	$3.14	$5.50	$5.83	$3.92	$3.79	$3.36
1993	$3.38	$3.31	$5.50	$5.41	$3.66	$4.25	$3.94
1994	$3.43	$3.95	$20.00	$4.66	$3.46	$7.10	$3.88
1995	$3.26	$4.19	$20.00	$4.88	$3.77	$7.22	$4.03
Projected							
1996	$3.20	$4.91	$20.00	$5.75	$3.80	$7.53	$4.42
1997	$3.20	$6.33	$20.00	$6.12	$3.84	$7.90	$4.87
1998	$3.23	$7.35	$20.00	$7.26	$3.95	$8.36	$5.45
1999	$3.50	$10.36	$20.00	$7.08	$4.14	$9.02	$6.27
2000	$3.70	$12.30	$20.00	$6.91	$4.63	$9.51	$6.89

[a] Source: Port of Seattle, 1995.

This forecast of capital expenditures through the year 2020 identifies all capital requirements, including the Master Plan elements. By converting these annual expenditure forecasts to a constant dollar estimate and summing according to the phasing categories assumed in the Master Plan, the total capital needs were identified. The difference between the total needs and the Master Plan figures was assumed to be the non-Master Plan CIP projects. The result is an additional $800 million of capital needs over the 25-year planning horizon, with approximately $740 million worth of these projects coming in the first 10 years of the program.

The baseline capital program includes an allowance of $50 million for environmental mitigation. This allowance is a rough order-of-magnitude estimate of new environmental mitigation costs resulting from the development of the Master Plan elements and proposed in the Draft Environmental Impact Statement. These costs would be for mitigation requirements above and beyond the Port's existing mitigation programs and will be subject to refinement in the Final EIS and FAA Record of Decision. They also include provisions for additional noise mitigation, as well as wetlands and water resources remediation needs.

The single largest component of this mitigation allowance is a $35 million estimate for land acquisition within the Approach Transition Zone (ATZ) for the proposed new runway. This is a proposed program that would address low overflights in residential areas that are just beyond the proposed runway protection zones. The program would be voluntary, and for the purposes of this analysis, assumes that all eligible properties would participate. The $50 million allowance was distributed through the first 3 phases of program development, with $10 million in the first phase and $20 million in each of the following 2 phases. It is assumed that these costs would be escalated at an annual rate of 4.0%.

This is an aggressive program with a significant concentration of capital requirements in the first years of implementation. The timing and magnitude of the proposed investments will require careful financial management to ensure the Port's ability to fund this program.

FINANCING AVIATION IMPROVEMENTS

Aviation facilities have historically been developed and operated as public facilities. This is a result of the capital intensive nature of these facilities, their relative monopolistic characteristics and the relationship between airports and regional economic vitality. These facilities however, are for the primary use of private businesses. The airlines and other private tenants of the airport support the operation, maintenance and expansion of facilities through the fees and charges imposed under their respective lease agreements. As a result, there are often conflicting views in terms of the desire of the public for a first class public facility and the competing desire of the tenants who wish to maintain a low cost of operation.

Achieving a balance among the interests of the public constituencies and the private facility tenants will be a key challenge as the Port of Seattle begins to implement the recommendations of the Master Plan. This section provides an overview of the capital financing structure of the Port's Aviation Division, identifies the major sources of capital funding, and sets the overall context for the financial analysis chapter.

Financial Structure of the Port of Seattle Aviation Division

As discussed above, the airport is essentially a user supported enterprise, and as such there are two general sources of capital funding. The first are those supported by the operation of the

airport facilities, such as landing fees and parking revenues. These funds can either come from the issuance of revenue bonds, to be repaid through future operating revenues, or from the annual net income from operations. Net income is the cash left over after the costs of facility operations, maintenance, administration and debt service have been paid.

The second major source is dedicated capital funds such as federal and state grants or the locally generated passenger facility charges. These funds can be considered outside sources since they are not generated directly by the tenants of the facility. The Port has limited ability to influence the availability of these outside sources, and given the current fiscal environment at both the state and federal levels, it may be unrealistic to expect significant increases in grant funding.

Therefore, the ability of the Port to finance any capital development program will be primarily regulated by its capacity to generate additional net operating revenues, for capital spending or to cover the debt service on new debt. This can be accomplished by increasing gross user revenues and controlling annual operating and maintenance costs. The majority of operating revenues are derived from one of the following: landing fees and terminal rents paid by the airlines; concession revenues from non-airline tenants such as the retail and rental car operators; and, public parking fees at the Port owned facilities.

The Port has recently undergone a major business planning effort to identify opportunities to maximize operating revenues, increase the utilization of its facilities, and manage the growth in Port operating and management costs. As a result of this effort programs and strategies have been identified that will optimize the operations at the airport and enhance the Division's capital financing capacity. Because several of these strategies envision a significant departure from the traditional business environment at the airport, it was determined that to maintain an appropriately conservative approach, this analysis of financial implications should be based on more conservative, historically based assumptions.

Airline Agreement

The current Basic Airline Lease Agreement is structured according to a residual approach to rate making. As a result, any short-term gains in productivity and net revenues will accrue to the benefit of the airlines by effectively reducing the landing fees required. In effect, the landing fees are determined using a cost recovery methodology that allocates all remaining financial requirements not recovered through other fees and charges to the airlines. Therefore any increase in concession revenues will serve to reduce the residual value to be allocated through the landing fee.

The other side of the equation is that any increase in annual operating costs or capital financing requirements that are not covered by a commensurate increase in non-airline revenues will also be borne by the airlines. As a result the structure of the airline agreement gives the airlines a significant amount of control over the capital spending decision process. If the annual costs related to funding a capital program increase substantially faster than the Port's ability to generate net operating revenues from the non-airline sources, then the airlines will be asked to make up the balance through increased landing fees. Therefore, the Port's ability to pass these costs through to the airlines will be the primary consideration for the evaluation of the financial implications of program development.

The measure that is used to track the total costs borne by the airlines is a ratio of airline cost per

total enplanements. The cost per enplanement (CPE) figure provides a measure of the cost effectiveness of airport service delivery, since it relates the cost to the volume of activity. As a point of reference, the average cost per enplanement at Sea-Tac was $7.16 in 1993, dropped to $6.16 in 1994, and is estimated to be approximately $5.64 in 1995.

While the current airline agreement is in effect, the airlines have the ability to regulate capital spending to ensure an appropriate CPE is maintained. However the current agreement expires after 2001, at which time this relationship may be amended. Currently, the goal of the Port is to maintain CPE levels consistent with the midrange of competing peer-city airports in the western United States and Canada. Table 6-2 presents a summary of recent CPE experience and projected future CPE's at U.S. peer facilities. The policy target adopted by the Port Commission during the business planning process was to keep the CPE at or below $7.35 until the year 2000.

It should be noted that there are some significant limitations in the usefulness of the CPE as a measure of comparative airline costs among different airports. Because the CPE only measures the airline costs charged by the airport authority, an airport that has contracted a number of services to private operators will likely have a lower CPE than a comparable facility which provides these services directly. For example, Los Angeles has been very aggressive in its privatization efforts and as a result, the cost of some services such as baggage handling or terminal maintenance may be billed directly to the airline by a private operator and as such not included in the CPE calculation.

Aviation Operations

The Port of Seattle's Aviation Division is divided into 5 lines of business, each with particular responsibility over a key operating element of the airport. The following is a brief description of these lines of businesses.

- **Airfield.** The airfield line of business is responsible for the operation and maintenance of the airside elements at the airport. Over 95% of the operating revenues available for capital programming at Sea-Tac are generated through landing fee charges. The landing fees are assessed on the basis of the total landed weight and are paid by all commercial and general aviation operations.

- **Terminal.** The terminal line of business has primary responsibility for the airline portion of the terminal space, including the maintenance of gate areas, a share of general terminal operations and maintenance, and general airport security. The primary source of revenue is generated through lease income paid by the airlines.

- **Concessions.** The concessions line of business is responsible for the non-airline elements of the terminal areas, including retail concessions, rental car areas, non-airline office space and other service related spaces. The principal source of income is rent generated by the commercial users of the terminal space. The retail concessions are currently under an exclusive master agreement that expires in 2004, as a result the Port's ability to affect its share of these revenues is somewhat constrained by the parameters of this agreement.

- **Ground Access.** The ground access line of business is responsible for providing parking and access facilities for the airport. The principal source of revenue for this line of business is the parking fees generated in the Port-owned parking garage. Currently,

the Port meets approximately 50% of the total parking demand with its owned facilities. The Master Plan includes the necessary parking facility development to maintain this share of parking over the 25 year planning horizon.

- **Commercial Properties.** The commercial properties line of business includes all other business functions of the airport such as cargo facilities, real estate ventures, and aviation fueling and maintenance areas. Much of the aviation support revenues are in the form of lease income for land and facilities. This is an area that has been identified through the business planning process as having significant upside potential as the Port moves to maximize the utilization of its real estate assets.

Sources of Capital Funding

To stretch the Port's financial capacity while keeping airline costs consistent with Port policy, it is assumed that grant funding and outside sources of capital will be utilized to the maximum extent possible. The traditional outside sources include grant funds and other capital sources that are not tied to airline rates and charges. The following are the major sources of capital funding analysis assumed for the Master Plan financial analysis.

Airport Improvement Program (AIP). The Airport Improvement Program (AIP) is a federal program that provides capital funding assistance for airport planning, development, land acquisition and noise program implementation projects. Project eligibility is determined by the requirements called out in the federal Airport and Airway Improvement Act. In general, however, most aeronautical related projects that are consistent with local comprehensive plans and where local match funds have been identified are eligible for AIP grant funds. Exceptions include decorative landscaping, provision of art work, the construction of public parking facilities for passenger automobiles, and airplane hangars.

Passenger Facility Charges (PFC). The Passenger Facility Charge is a special fee authorized by the FAA and imposed on passengers using an airport facility. The fee is collected by the airlines and remitted to the airport development authority. Generally, the project eligibility requirements for PFC funds are the same as those in effect for AIP funds.

Aviation Development Fund (ADF). The Aviation Development Fund is a Port of Seattle capital development fund where annual net operating revenues are deposited and used for capital improvements. Due to the structure of the current airline agreement, the amount deposited into the ADF annually is roughly equal to the debt service coverage requirements of the outstanding revenue bonds.

Other Grant Sources. The financial analysis assumes that the Port will aggressively seek other grant funding sources in particular federal and state roadway and transit capital assistance. There are major roadway and transit investments called for in the Master Plan program, which will likely be eligible for federal and state assistance. The following are the major federal and state programs that are applicable.

- **Federal Transit Administration.** Capital and operating funds are available for transit projects in urban and rural areas and for the elderly and disabled. The main categories are Section 3, transit capital, and Section 9, transit formula funds for capital and operations. The transit elements of the Master Plan may be eligible for FTA funding.

- **Federal Highway Administration.** The

Surface Transportation Program (STP) is the most likely source of federal roadway assistance. Eligible projects include roads, transit, bicycle and pedestrian facilities, car and vanpool facilities, and marine and airport access. Within STP, funds are set aside for enhancements, roadway hazards, railway crossings, and flexible funding for a variety of uses. These federal funds are distributed by direct regional allocation. The process provides evaluation criteria to be used by local, regional and state agencies to share responsibility for prioritizing projects. All projects are ranked, and the most competitive projects are included in the Regional Transportation Improvement Plan (TIP), and eligible for federal assistance.

- **Central Puget Sound Public Transportation Account.** This fund was created by the 1990 Legislature as a new funding source specifically for public transportation in the Central Puget Sound area. Funds are allocated in a competitive process by a 21-member Multimodal Committee that includes representatives of cities, counties, transit, WSDOT and other interests. Since funds must be requested by a transit agency, a joint funding effort for the transit elements of the Master Plan could be undertaken, with King County Metro as the applicant for these funds.

- **Transportation Fund.** The Transportation Fund was also created by the 1990 Legislature. It was intended as a new general purpose transportation funding source not limited by the 18th Amendment to highway funding. The motor vehicle excise tax (MVET) is the source and the Fund is subject to legislative appropriation every two years. During the most recent two biennia, monies in the Transportation Fund were primarily dedicated to the Department of Transportation's Category C program to expand the capacity of state highways. Future allocations will be determined by legislative priorities, and the ground access transportation improvements could potentially qualify for funds from this source.

Transportation Improvement Board (TIB). The TIB is an independent agency founded in 1988 that distributes funds through the Urban Arterial Trust Account (UATA) and the Transportation Improvement Account (TIA). Competition for funding is fierce and projects are ranked based on specific criteria. The UATA funds city and urban county road and street projects to reduce congestion, improve safety, and address geometric and structural problems. The TIA funds projects to alleviate congestion resulting from economic development and population growth.

Revenue Bonds. The unfunded balance of the annual capital needs are assumed to be funded through the issuance of new revenue bonds. The debt is assumed to be offered at tax-exempt rates and repaid through operating revenues. While the current airline agreement is in force the debt coverage requirements are assumed to remain at 1.35. This ratio establishes that for every $1.00 of principal and interest owed in a given year there must be a minimum of $1.35 available for debt service. There are no other constraints placed on the Port's capacity to issue revenue bonds under the current airline agreement, as long as the existing bond covenants are met. This assumption does not address some of the practical issues, such as the acceptability of these debt loads on the part of the airlines. Some of these issues are incorporated in the analysis indirectly through the evaluation of CPE impacts. By testing the financial implications in terms of CPE, the practical limits of debt issuance will be included, since debt service is a major component of airline costs.

When the current airline agreement expires in 2001, the assumption is the Port of Seattle would move to some form of compensatory methodology to determine airline fees and charges. In a compensatory approach to rate making, the airport authority is free to negotiate rates with the airlines according to actual market conditions and policy guidance providing additional flexibility in financial management. The agreement no longer provides a guarantee of full cost recovery as in the residual approach. The advantage of this approach is any improvements in operating efficiency or non-airline revenues no longer accrue to the sole benefit of the airlines by reducing the landing fee requirements.

This change in approach would likely result in the need for a higher debt service coverage preserve the Port's high credit rating, since the airport's revenues would not be directly supported by language in the airline agreement. Therefore, for all ensuing years, it is assumed that a demonstrated debt coverage ratio of 1.5 will be maintained in the years following the expiration of the current airline agreement. The result of using a higher ratio is that the Port would have to generate more revenues to cover its debt service needs. The effect of this assumption will be to reduce the effective debt capacity of the airport ensuring that the financial analysis is appropriately conservative.

Trends in Aviation Finance

The Seattle-Tacoma International Airport serves a strong regional origin and destination market with service provided primarily by air carriers facing tough price competition. The long-term goal of the Port is to maintain a first rate facility and provide for the growing demands of the regional market for air transportation services. The significant activity growth projected for the airport combined with the continuing financial pressures facing the airline industry has resulted in new ways of thinking about how aviation facilities are developed and operated.

Since deregulation in the late 1970's, the airline industry has undergone substantial changes, as the large carriers faced competition from small upstarts and fare wars became a common marketing strategy. Over the years there has been a great deal of rationalization in the industry as airlines have adjusted to reduced profit margins and increased competition. Those that have survived, have generally done so by keeping costs down and equipment utilization up.

In this environment, airlines are looking to airport authorities to be partners in keeping airline costs manageable. As a result, a premium is placed on maximizing the return on the non-airline airport facilities and assets. This emphasis was a major catalyst for the recent aviation business planning efforts at the Port of Seattle. The outcome of this effort was to focus management resources on non-airline revenues. The following areas were identified:

- Development of Port real estate to its highest and best use.
- Maximize the utilization of current Port facilities.
- Establish an aggressive cost management program.
- Maximize the Port's share of terminal concession revenues.
- Enhance parking revenues by expanding the Port's share of the local parking market by developing additional parking facilities.

FINANCIAL ANALYSIS OF BASELINE CAPITAL PROGRAM

The goal of the financial analysis is to provide a reasonableness check of the Master Plan capital program and preliminary phasing plan relative to the financial capacity of Port. To accomplish this, the full capital program was assumed to be developed according to the demand at the assumed level of service. Since the Port's ability to pass costs to the airlines is the primary financial consideration, the impact of this development program on the costs to the airlines was estimated and compared to recent experience.

Restated, the purpose of this analysis is to establish the long-range financial capability of the Port to take on a capital program of the scale envisioned in the Master Plan. Once this threshold determination has been made, then the actual development of the program will be undertaken at a significantly greater level of detail as part of the Port's normal capital planning process. Thus the results of this analysis should only be considered valid in the context of the overall long-term financial capacity, and should not be interpreted as an evaluation of any specific financing plan for near-term capital improvements.

The benchmark test of the threshold capacity to fund the Master Plan program and the other aviation related capital needs is assumed to be the current Port policy of maintaining a CPE at or below $7.35 until the year 2000. This level of airline costs has been established by policy and as such is not an explicit limit on the Port's financial capacity. A capital program that resulted in greater CPE impacts could be undertaken with the concurrence of the Port Commission and the affected airlines. However, for the purposes of this analysis, the policy will be treated as an actual measure of financial capacity and acceptability.

Methodology

A sketch planning model was developed to analyze the financial implications of the Master Plan capital program. The model is based on existing Port of Seattle models including the aviation debt model, the capital funding model and the aviation business plan model. The debt model was modified for the 25-year Master Plan planning horizon and used as the core of the sketch model. Simplified versions of the capital improvement planning and business plan models were developed, and incorporated into the debt model structure. The result is a model framework that analyzes the CPE impact of alternative capital development scenarios at a conceptual level of detail appropriate for the purposes of this analysis.

For the most part the assumptions underlying the analysis are based on historical data. This was done to ensure that the analysis be appropriately conservative and that revenue forecasts be reasonably achievable. The following are the major assumptions used in the financial analysis.

Phasing of Capital Spending. The capital program is organized according to phases and defined in terms of constant dollar estimates. To analyze the financial implications of developing the projects according to the proposed schedule the program must be redefined in terms of annual capital expenditures reflecting general cost escalation. To accomplish this the dollar value estimate of each Master Plan phase was divided equally by the number of years in the phase and the resulting cash flow was inflated at an annual rate of 4.0%.

Capital Funding Sources. The specific assumptions about the availability of capital funding resources are discussed for each of the major sources of funds.

- ***Airport Improvement Program (AIP)***: The available AIP grant funds are assumed to be $20 million per year for the first 5 years. After the year 2000, it is assumed that AIP grants will be reduced to entitlements only. The estimate of AIP entitlements is taken directly from the Port of Seattle business plan up to the year 2005 when the AIP contribution reaches $5.0 million, subsequent years are inflated from this level assuming an annual rate of 4.0%. Since discretionary grant funds are not assumed after the first phase, a higher balance of capital projects must be funded through other sources, which will likely increase the estimated impact on the cost per enplanement. The result will be a conservative estimate of the financial implications.

- ***Passenger Facility Charges (PFCs)***. The projected PFC revenues are based on the growth in total enplanements. The estimated enplanements for a given year are multiplied by the rate of the PFC. Currently the Port receives an average of $2.45 per enplanement. This amount is assumed to remain constant with the exception of 2 future adjustments to the fee, the first in 2006 and the other in 2016. These adjustments are assumed to account for the loss of purchasing power due to inflation. Inflation is assumed to be an average of 4.0% per year. As a result the PFC is increased to an average of $3.63 per enplanement in 2006 and $5.37 in 2016.

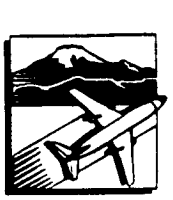
- ***Aviation Development Fund***. The projection of available ADF funds is determined by the annual cash available after all other operating, maintenance and debt service expenditures have been addressed. Thus ADF funds are equal to the net income from operations. The assumptions about operating revenues and expenses are discussed below.

- ***Other Grant Revenues***. The other grant sources that are assumed to be available include: federal and state roadway and transit sources. For the purposes of this analysis it is assumed that the Port of Seattle will qualify for matching grants for all of the roadway and transit elements of the Master Plan. The amount of these grant funds is assumed to be 50% of the construction costs. Given the relatively small share of total capital requirements that would be eligible for these funds, the impact is not expected to be substantial.

- ***Use of Revenue Debt***. The balance of the annual capital needs are assumed to be funded through the issuance of aviation revenue debt. All new debt is amortized at 8.0% per year for a period of 25 years. As previously discussed, the debt service coverage requirement will be 1.35 for remaining years of the basic airline agreement. For all ensuing years the coverage requirement is assumed to be 1.5.

Airline Revenues. As discussed earlier, the key financial indicator is the change in airline costs. In this analysis, the airline costs are estimated by forecasting the future revenues from the airline-related Port businesses. The forecast of these revenues is based on the methodologies established in the current basic airline agreement. After 2001, adjustments were made to these methodologies consistent with a shift to a compensatory approach to rate making. The following are the specific assumptions underlying the revenue estimate for the 2 classes of airline supported revenues:

- ***Airfield***. The airfield revenues are predominantly derived from landing fees. The landing fee is calculated as a residual value until 2001. For these years, all costs that



have not been accounted for from other aviation revenues are recouped through the landing fee. After 2001, the landing fee is determined as the larger amount between using the current residual approach or an inflation adjusted minimum compensatory rate of $2.10 per 1,000 lbs of landed weight. The minimum landing fee is inflated using a 3.0% annual escalation rate.

- ***Terminal***. The terminal revenues are based on the three-part rental charge currently in use. The rental rate provides the Port with a return on its terminal assets, its land assets and a recovery of terminal operating and maintenance costs. The terminal return is determined by the annualized value of the Port's investment (amortized over 40 years at 8.5%) divided by the total rentable square feet of terminal space. The investments in facilities are updated annually based on the construction program. The land component of the terminal rental rate is based on the increase in the value of the land under the terminals. The annual charge is determined by applying an 8.5% return to the value of the land. Finally, the O&M charge is based on the total terminal operating costs less the terminal concession revenues, up to a maximum of 75% of the operating costs. The only change after 2001, is to increase the recovery of the O&M expenses, by assuming full recovery of the airline's share of terminal operating and maintenance expenditures.

Non-Airline Revenues. Since the key financial issue is the Port's ability to fund capital needs while minimizing the increase in the rates and charges to the airlines, the most important determinant of the overall financial capacity to fund the Master Plan improvements is the projection of non-airline revenues. The greater the funding share that comes from non-airline sources, the greater the financial capacity. The following are the key assumptions underlying the projections of non-airline revenues:

- ***Ground Access***: The ground access revenues are tied to the growth in the number of available parking spaces. A ratio of the current total revenues per available parking stall was derived. This estimate of gross parking yield per stall was assumed to continue throughout the planning horizon, adjusted for inflation using a conservative escalation factor of 2.5%. The per stall revenue yield is applied to the number of parking stalls available in each year. Growth in the number of available stalls is tied to the development program. Revenues associated with the employee parking at the airport were estimated using a cost recovery approach to the required investment in these facilities.

- ***Concessions***: The concession revenues are based on a factor relating gross terminal non-airline concessions with total enplanements. Concession revenues are expected to increase as a result of enplanement growth, inflation, and an emphasis on improving the current concession yields. As a result, for the first 10 years, the current revenue per enplanement figure was increased for both inflation and to reflect the Port's commitment to optimizing its concession yields. For the years after 2005, the only growth in the per enplanement income factor is due to price inflation, which for the purposes of this analysis is assumed to be a conservative 2.5% per year. In each forecast year, the per enplanement figure is applied to the number of enplanements to estimate gross revenues.

- ***Commercial Properties***: The commercial properties revenue projections are based on

analysis developed during the current business planning process for the period 1996-2005, which project an average annual growth rate of 10.3%. For the subsequent years, annual growth in revenues is assumed to be 6.3% per year. This assumes that the commercial properties line of business would directly provide all relevant facilities and services called out in the Master Plan. One of the key business planning strategies calls for turning some of these facilities and services over to private interests, which would reduce the revenues accruing to this line-of-business in exchange for outside investment in Port facilities. This issue is discussed in greater detail later in this section.

Aviation Division Operating Costs. The annual net operating income is a key factor in the funding capacity of the Aviation Division. As such, the projections of annual operating costs are a key element in the estimation of the overall financial capacity. The estimates of annual operating costs are based on the current business planning assumptions for 1996-2000. Consistent with Port policy, these estimates assume that all administrative cost categories remain constant at current levels throughout this period, while other costs grow by an annual rate of 3.5%. The current cost breakdown by cost center is presented in Table 6-3 along with the assumed escalation factors throughout the planning horizon.

For the cost centers where no cost escalation is assumed for 1996-2000, costs are increased by 3.5% per year to the year 2020, the same rate of inflation assumed for the non-administrative functions. The overhead allocation, including the Pier 69 allocation, is assumed to remain constant, consistent with Port policy goals. The costs of debt service account for both the current outstanding debt and all new issues to fund the Master Plan and other improvements. These cost assumptions are based on an aggressive cost management program and will require ongoing management scrutiny in order to ensure adequate levels of service are provided to accommodate the projected demand. Since these goals are integral to the Port's general management policies they are appropriate for planning purposes.

Distribution of Costs. The distribution of costs to each of the lines of business is an important assumption, since some of the revenues are based on cost recovery mechanisms. The distribution of operating costs is shown in Table 6-4. Overhead allocations are distributed differently than aviation operating and maintenance costs. These assumptions are consistent with current Port Business Planning assumptions and Port policy direction.

Capital Funding Program

Attempting to fund the demand-driven Master Plan schedule would result in the capital funding program presented in Table 6-5. As is shown, the total capital program would require approximately $3.3 billion over the next 25 years to fund the Master Plan items and the other non-Master Plan projects. The difference between this figure and the total capital program estimates presented in Table 6-1, is due to the cost of general inflation (assumed to be 4.0% per year).

The source of the largest share of capital funding, over $1.1 billion, is estimated to come from the issuance of new revenue debt. An almost equal share of the capital requirements, just over $1 billion, would be raised through the passenger facility charges. Combining these sources with the ADF funds of over $800 million, means that almost $3 billion would be generated or supported by the users and tenants of the airport over the 25 year period. This amounts to over 90% of the total capital funding

TABLE 6-3
OPERATING COST SUMMARY
(IN THOUSANDS) [a]

Operating Expenses	1995 Budget	Escalating Assumed	
		1996-2000	2001-2020
Administration	$1,010	0.0%	3.5%
Communications	955	0.0%	3.5%
Marketing	1,922	0.0%	3.5%
Airport Environmental Engineering	60	0.0%	3.5%
Operations	10,265	3.5%	3.5%
Fire	4,968	3.5%	3.5%
Police	8,962	3.5%	3.5%
Planning	1,861	0.0%	3.5%
Property Management	5,457	3.5%	3.5%
Facilities and Maintenance	26,613	3.5%	3.5%
Sub-total O&M Expenses	**$62,073**	—	—
Allocated Administrative Overhead	12,175	0.0%	0.0%
Aviation Debt Service	39,919	—	—
Pier 69 Allocation	1,012	0.0%	0.0%
Total Aviation Operating Expenses	**$115,179**	—	—

[a] Source: Berk and Associates.

TABLE 6-4
OPERATING COST DISTRIBUTION BY LINE OF BUSINESS [a]

Line of Business	O&M Cost Centers	Allocations
Airfield	28.2%	30.1%
Terminal	32.8%	30.5%
Concessions	12.8%	11.6%
Ground Access	17.6%	16.7%
Commercial Properties	8.5%	11.1%

[a] Source: Berk and Associates.

TABLE 6-5
ESTIMATED CAPITAL FUNDING PROGRAM
DEMAND DRIVEN SCENARIO (IN THOUSANDS) [a]

Master Plan Phase	Total Capital Spending	AIP Funds	PFC Funds	ADF Funds	Other Grant Funds	Debt Financing	Percent Debt Funded
Phase I	$1,235,464	$100,000	$136,207	$153,653	$1,514	$844,089	68.3%
Phase II	733,447	23,861	157,032	276,726	25,201	250,627	34.2%
Phase III	555,309	28,249	263,568	244,608	18,884	0	0.0%
Phase IV	347,865	34,370	217,262	96,233	0	0	0.0%
Phase V	356,219	41,816	245,774	68,629	0	0	0.0%
Total	**$3,228,303**	**$228,296**	**$1,019,843**	**$839,848**	**$45,599**	**$1,094,717**	**33.9%**

[a] Source: Berk and Associates.

TABLE 6-6
FINANCIAL IMPLICATIONS OF MASTER PLAN DEVELOPMENT [a]

Year	Total Airline Fees (thousands)	Total Enplanements (thousands)	Cost per Enplanement (CPE)	
			Inflated Dollars	Constant Dollars (1995 base)
Actual				
1993	$68,044	9,385	$7.16	$7.74
1994	$59,706	9,706 [b]	$6.16	$6.41
1995	$62,626	10,039 [b]	$5.64	$5.64
Projected				
1996	$ 73,991	10,383	$ 7.13	$6.85
1997	$ 87,443	10,738	$ 8.14	$7.53
1998	$101,093	11,106	$ 9.10	$8.09
1999	$113,881	11,487	$ 9.91	$8.47
2000	$127,635	11,880	$10.74	$8.83
2001	$128,051	12,183	$10.51	$8.31
2002	$136,303	12,493	$10.91	$8.29
2003	$136,027	12,811	$10.62	$7.76
2004	$111,825	13,137	$ 8.51	$5.98
2005	$116,469	13,471	$ 8.65	$5.84
2010	$153,228	15,275	$10.03	$5.57
2015	$188,624	17,067	$11.05	$5.04
2020	$228,106	19,069	$11.96	$4.49

[a] Source: Berk and Associates.

[b] The constant dollar CPE estimate is based on a cost deflator which assumes future inflation of 4.0% per year and a base year of 1995.

requirements, with the balance coming from grant sources.

The phasing of the demand-driven scenario requires a substantial portion of the capital program to be funded in the early years of the program. However, new debt is only needed to make up funding shortfalls in only the first 10 years. After 2005, the program is funded entirely using available cash sources.

Impact on Airline Costs

To fund such a program will require a significant increase in the revenues generated by the activities at the airport. As discussed earlier, any costs which cannot be met through increases in the net income from non-airline activities will pass through to the airlines in the form of increased landing fees. Figure 6-1 graphically presents the projected operating revenues required to fund the demand-driven scenario.

As Figure 6-1 demonstrates, a large share of the capital requirements in the early years are recouped through airline fees and charges. In fact the proportion of operating revenues paid by the airlines increases from approximately 50% to 56% by the year 2000, before returning to lower levels. Once the initial spike in the capital program is addressed, the airline share of operating revenues gradually declines until it reaches approximately 44% in 2020.

Table 6-6 focuses directly on the financial impact to the airlines resulting from the development of the demand-driven capital program. This table presents the projected airline fees required and the resulting cost per enplanement impacts. The CPE is shown in both inflated dollar terms and constant dollar terms, adjusted for a base year of 1995.

Funding the baseline program would result in an increase in the airlines' CPE, above the Port's target of $7.35, measured in inflated dollar terms and after adjusting for the effects of inflation. The estimated CPE for the Year 2000 of $10.74 is $3.39 above the current policy target.

As Table 6-6 shows, the airline costs are growing faster than enplanements. This is reflected in the large increases in the CPE over the first 5 years of program development as compared to subsequent years. These values are gradually reduced over the next 5-year period, and finally return to current levels by the year 2005. The large drop in CPE between 2003 and 2004 is due to the retirement of existing revenue bonds, which reduces the debt service requirements substantially.

While the baseline program would result in a CPE that is significantly higher than the target level, it is not beyond levels experienced at other airports. Thus, if the CPE impact of the demand driven scenario could not be substantially lessened, then the Port could, with the concurrence of the airlines, proceed with the baseline Master Plan program. However, it is the policy of the Port to provide an appropriate level of service at a reasonable cost to its airline tenants, therefore, the following section explores the options for reducing the CPE impact of the Master Plan.

FINANCIAL STRATEGIES

Relative to the current CPE of $5.64 and the Port's target of $7.35 the funding picture presented in the demand-driven scenario involves a significantly higher cost impact to the airlines. As a result, to achieve the policy target the gap between the current CPE and the levels projected under the baseline conditions needs to be narrowed. Since the financial constraint appears to be more of a function of the timing of program development, the solution could lie with strategies that would reduce the

Figure 6-1
Projected Operating Revenues
Demand-Driven Scenario

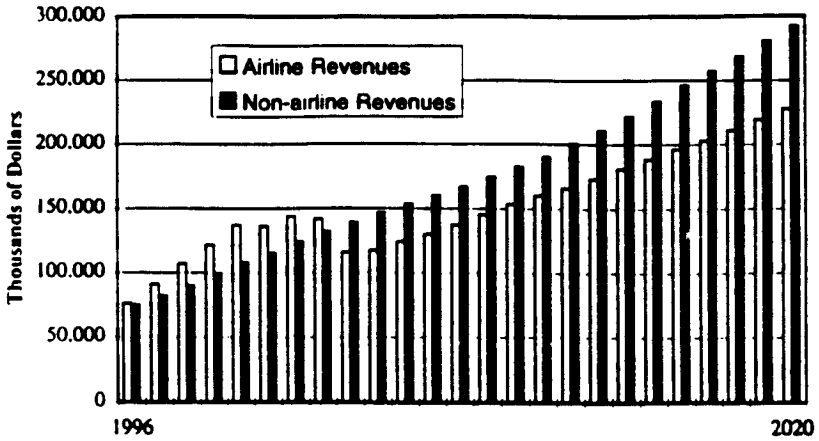
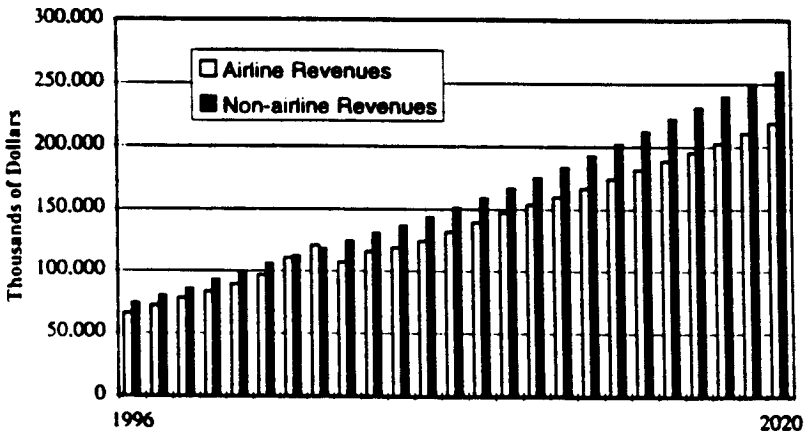
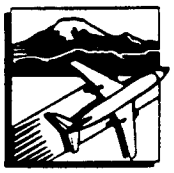


Figure 6-2
Projected Operating Revenues
Financially-Constrained Scenario





cost impact during the early phases, by reducing the scale of the program, deferring costs, or increasing available resources.

There are a number of potential mechanisms that would accomplish these goals. This section discusses some of the strategies that could be employed to reduce the impact on the airlines, and provides an evaluation of the potential impact on projected CPE levels. Many of these strategies are currently part of the Aviation Business Plan, but were not assumed in the baseline analysis to ensure the approach was appropriately conservative, defensible and consistent with previous Master Plan reports.

In the CPE comparisons presented in this section, the constant dollar (1995$) trend is used. This estimate provides the best opportunity to compare future CPE levels with current experience and with respect to the baseline assumptions, since the effects of the capital program are isolated and the impact of general inflation is removed. As a result, the real effect of each strategy can be evaluated without the distorting effects of when the CPE impact occurs.

Program Cost Reductions

One of the areas which may provide opportunities to reduce the cost of facility development is in the definition of the program. The following are examples of strategies that could be employed to achieve program cost savings.

- ***Design Changes***. The cost estimates presented in the Master Plan assume a level of design and architectural finish that is consistent with the Port's desire for a high quality public facility. There may be opportunities to reduce the costs of the program during the next phase of design development by reducing the level of architectural finish or engineering complexity for some projects. In addition, the current estimates assume generous design and construction contingencies, which may overstate the final construction cost amounts.

- ***Use Existing Fill Material***. A substantial element of the airside costs can be attributed to the need to purchase fill material for the grading under and near the third runway area. A strategy which could reduce this cost element would be to look for possible fill material on existing Port properties. In addition, the costs assumed for the fill were based on known rates. Given the large volume required, those costs are likely to vary and could be lower depending on sources and suppliers.

- ***Scheduling***. Stretching the program development could offer opportunities to reduce the costs of some aspects of the program. For example, longer construction schedules could reduce the need for long work shifts and provide some cost efficiencies. Another potential area for savings would be the increased flexibility in timing for the purchase of fill material, which would allow for greater price competition and reduce the influence of seasonal price fluctuations.

- ***Changes in Program Elements***. Another way to reduce the scale of the program is to choose lower cost development options. For example, rather than building in the ability to expand concourse "A" to accommodate international service, the program could be reduced to only accommodate the needs of domestic flights. By selecting a lower cost option, the impact to the airlines would be reduced.

To illustrate the maximum sensitivity of the CPE analysis to changes in program elements a scenario was run which assumes the construc-

tion of a 7,500 foot runway instead of the baseline assumption of 8,500 feet. Since the investment in the third runway is one of the largest capital elements in the Master Plan program, this scenario would represent the largest potential cost difference resulting from changes in the early phases of the Master Plan. This approach would reduce the airfield related costs by approximately $54 million in the first phase of the program. Individual reductions to other program elements would have a smaller impact, though a series of program changes could be implemented that would have a similar CPE impact.

Table 6-7 compares the constant dollar (no inflation effects) CPE in the Baseline scenario with the estimated constant dollar CPE assuming the lower runway costs. The constant dollar estimates are used so that impacts from changes in different years will be comparable. As the table shows the reduction in the cost per enplanement reaches a maximum of $0.45 in the year 2000, which represents an improvement in that year of approximately 5.0%.

To evaluate the effect on the CPE relative to the policy target of $7.35 the effects of inflation must be considered. The CPE in the year 2000, measured in inflated dollars, is estimated to be $10.19, or above the current policy target.

Program Phasing

Another strategy for reducing the cost impacts to the airlines is to change the timing of the new development activity. As was shown in the baseline analysis, most of the financial capacity issues arise early in the development program, where over $1 billion is required in the first phase alone. Once this initial burden is overcome, there is excess financial capacity in the later years of the program. Therefore, mechanisms that would serve to delay the need for certain projects, defer costs to later phases, or extend capital outlays over a longer period of time, would likely reduce the CPE impacts of the program during the initial phases.

- ***Improved Facility Utilization.*** One method of delaying the need for new facilities is to improve the utilization of existing facilities. This has been identified by Port staff as a major short term objective. An example of this approach include the expansion of the Federal Express facility which will enhance operating revenues without affecting the capacity of the airfield, since most of these flights occur during the off-peak periods where significant excess capacity exists.

- ***Defer Costs.*** Potentially the most effective mechanism available to reduce the costs in the early years is to defer projects to later phases. The result of this would likely be a reduction in the level of service, as congestion in the peak periods would strain the terminal and airside capacity of existing facilities. In addition, the cost of the deferred projects would likely increase due to the effects of inflation. Therefore, the implied tradeoff is between the comfort and level of service in the terminal spaces and the short-term financial impact to the airlines. Projects that are needed to maintain the safety and security of the airport facilities would receive top priority and not be subject to deferral.

To evaluate the potential impact resulting from changes in program phasing, a deferred cost scenario was developed. As with the program elements analysis, a scenario was developed whereby runway construction costs were extended over a longer period of time. Due to the magnitude of the airfield costs requirements, this scenario likely represents the outside range of the sensitivity of the CPE analysis to the deferral of projects, relative to the demand-

TABLE 6-7
IMPACT OF POTENTIAL PROGRAM REDUCTIONS
7,500 FOOT RUNWAY SCENARIO [a]

Year	Cost per Enplanement (CPE)		Reduction/ (increase) in CPE
	Baseline Constant Dollars	Adjusted Constant Dollars	
1996	$6.85	$6.73	$0.12
1997	$7.53	$7.31	$0.22
1998	$8.09	$7.78	$0.31
1999	$8.47	$8.09	$0.39
2000	$8.83	$8.38	$0.45
2001	$8.31	$7.89	$0.42
2002	$8.29	$7.87	$0.42
2003	$7.76	$7.37	$0.39
2004	$5.98	$5.98	$0.00
2005	$5.84	$5.84	$0.00
2010	$5.57	$5.57	$0.00
2015	$5.04	$5.04	$0.00
2020	$4.49	$4.49	$0.00

[a] Source: Berk and Associates.

driven Master Plan. The total deferred Master Plan costs resulting from this change amount to over $170 million, or approximately 17% of the baseline Phase I program. The balance of the program is assumed to be phased as in the baseline scenario.

In addition to the deferred cost items in the Master Plan program, projects in the background capital program were also identified for deferral. Of the $459 million of "Other Capital" projects in Phase 1, approximately $67 million were determined to be appropriate for deferral. Therefore the total value of projects deferred from Phase 1 to Phase 2 is approximately $287 million.

Table 6-8 presents the results of using the deferred cost scenario. This option provides greater cost relief than the shorter runway length in the previous example. The maximum cost savings occur in the year 2000 where the constant dollar CPE is reduced by $1.84, which represents a savings of approximately 20%. The CPE in the year 2000, measured in inflated dollars, is estimated to be $8.51, or $1.16 above the current policy target.

The airline costs are projected to be marginally higher in the later years when the deferred projects are added. However, since the financial capacity is greater in these years the impact is small, as evidenced by the small increase in the CPE and especially when compared to the savings in the early years. While the option of deferring projects offers the potential of significant cost relief, service levels may not be acceptable if this were the only method used to bring the CPE costs down to the $7.35 level.

Non-airline Revenue Enhancements

Since the total costs that can be passed through to the airlines is the major consideration in determining financial capacity to fund the Master Plan program, increasing the non-airline generated operating revenues would provide additional financial capacity for capital development. This was one of the key objectives identified in the Port's Business Planning efforts. As such some of the non-airline revenue enhancement strategies have already been accounted for in the baseline revenue forecasts though to maintain a conservative posture, many of the Business Plan strategies were not included. The following are some examples of potential strategies which could be employed to improve the performance of the non-airline lines of business. The Business Plan has evaluated these and many more potential strategies and Port staff are currently in the process of implementing those which offer promising returns.

- ***Pricing of Port Provided Public Services.*** The Port could look to raise non-airline revenues through increases in prices charged for Port provided services. Price adjustments for public on-site parking is perhaps the best opportunity to achieve significant benefit from this option, though it would likely come at a public relations cost.

- ***Front-load Revenues from Leases.*** Another strategy that could be used to enhance the non-airline revenues would be to structure future leases to achieve more up-front revenues, most likely in the form of tenant provided capital improvements. If these improvements were programmed, then capacity would be freed up for other capital needs.

- ***Improve Retail Concession Revenues.*** Under the current master concession agreement the Port is allowed to retain earnings to pay for capital projects. To optimize the revenues generated by retail concessions and increase the potential for

TABLE 6-8
IMPACT OF DEFERRED COST PROGRAM [a]

Year	Cost per Enplanement (CPE)		Reduction/(Increase) in CPE
	Baseline Constant Dollars	Adjusted Constant Dollars	
1996	$6.85	$6.37	$0.48
1997	$7.53	$6.63	$0.90
1998	$8.09	$6.83	$1.27
1999	$8.47	$6.91	$1.57
2000	$8.83	$7.00	$1.84
2001	$8.31	$7.08	$1.23
2002	$8.29	$7.53	$0.76
2003	$7.76	$7.54	$0.22
2004	$5.98	$6.23	($0.24)
2005	$5.84	$6.41	($0.57)
2010	$5.57	$5.57	$0.00
2015	$5.04	$5.04	$0.00
2020	$4.49	$4.49	$0.00

[a] Source: Berk and Associates.

retained earnings, the Port has proposed instituting a monitoring program to track pricing and service levels for retail concessions. Another strategy that has been proposed is to develop a comprehensive concessions master plan to evaluate the types of retail activities offered and to optimize revenues by improving the mix of activities.

- ***Accelerate the Development of Parking Facilities.*** The Port-owned public parking facilities are the most significant, directly controlled, contributor to non-airline revenues. As a result, the Port has an opportunity to enhance the non-airline revenues by accelerating the development of new parking facilities and capturing more of the projected parking demand. The tradeoff for this strategy is that it requires substantial up-front capital investments to achieve these higher revenues.

To evaluate the potential impact of enhanced non-airline revenues, the accelerated parking development scenario was analyzed for its effects on total airline costs. The baseline parking program was adjusted by moving half of the number of parking stalls in each phase up to the previous phase. The total number of stalls would remain the same, only the rate of construction is accelerated.

Table 6-9 shows the impact on airline costs of accelerating parking development is relatively small. The maximum savings in the first 10 years occurs in 2001 where $0.13 is reduced from the baseline CPE, which represents a 1.5% savings. If measured on a percentage basis the benefit increases somewhat after 2001, as the total impact remains at a minimum of $0.12 per enplanement until 2003 while the total CPE continues to decline throughout these years. However, this does not appear to provide a significant opportunity to reduce the airline cost burden. The CPE in the year 2000, measured in inflated dollars, is estimated to be $10.63, or $3.28 above the current policy target and only $0.11 better than the baseline scenario.

Other Financing Mechanisms

The final category of financial strategies addresses non-traditional financing mechanisms to stretch the Port's capacity to fund capital improvements. This collection of strategies includes a number of privatization options that either provide an opportunity to attract outside financing, or provide an opportunity to reduce the cost of project development or operation, which would in turn provide additional capital financing capacity. The following are some of the potential public-private ventures that could be considered.

Third Party Developers. One mechanism which has been proven to attract outside investment is a Build-Operate-Transfer (BOT) approach to project development that brings private financing. In this case, a project with a clearly identifiable market could be turned over to a private entity with responsibility to finance and build the project. The private concern would then have the opportunity to recoup its capital and earn a return on the investment by operating the facility for a finite period of time, after which, the facility would be transferred to the Port. The hydrant fueling system is an example of a project that might be a candidate for this type of mechanism. The advantage of this approach is that needed improvements are funded by outside sources, which extends the Port's capacity to address other needs. The disadvantage is that, from the airlines point of view, this mechanism may simply transfer the costs associated with this service to another entity which may not provide an actual reduction in airline costs.

Special Facility Financing. The use of special

TABLE 6-9
IMPACT OF ACCELERATED PARKING DEVELOPMENT [a]

Year	Cost per Enplanement (CPE)		Reduction/(Increase) in CPE
	Baseline Constant Dollars	Adjusted Constant Dollars	
1996	$6.85	$6.87	($0.02)
1997	$7.53	$7.52	$0.01
1998	$8.09	$8.05	$0.04
1999	$8.47	$8.41	$0.06
2000	$8.83	$8.74	$0.09
2001	$8.31	$8.18	$0.13
2002	$8.29	$8.17	$0.12
2003	$7.76	$7.64	$0.12
2004	$5.98	$5.98	$0.00
2005	$5.84	$5.84	$0.00
2010	$5.57	$5.57	$0.00
2015	$5.04	$5.04	$0.00
2020	$4.49	$4.49	$0.00

[a] Source: Berk and Associates.

facility financing is similar to the previous example, in that the proposed facility is financed independently based on its revenue generating capacity. To be effective, the Port would need to demonstrate that revenues that would otherwise be available to support existing debt obligations were being diverted to this new project. The most likely candidate projects would involve a single large tenant with solid corporate credit, since this source of financing may require the tenant to use its corporate credit as security for the debt issue. Essentially the tenant would be providing recourse to the bondholders, in the event that debt service commitments were not met. The Port would continue to own the facilities, however, the tenant would be providing credit support for the financing. In return for putting up this security, the tenant would gain access to tax-exempt financing rates.

Turnkey Project Development. A privatization option which may provide opportunities to reduce the cost of project development is the turnkey approach, which involves the private sector in the design, construction and possibly the operation of the facility. The turnkey approach assumes that the Port would prepare a Request for Proposals to design, build and possibly operate a candidate facility. The RFP would contain general design and performance parameters and some preliminary engineering analysis, to allow the bidders a reasonable understanding of the design, construction and operations expectations and potential constraints. The successful bidder would then negotiate a contract with the Port's expectations regarding the facility they are buying in exchange for a guaranteed maximum price from the bidder. The only reason to pursue this approach is if it could be demonstrated that a private entity could build the facility at a lower cost than the Port, even after the successful bidder is compensated for their efforts.

Management Contract. Another mechanism that may offer opportunities for enhanced capital finance capacity through cost savings is contract management. The public operation and maintenance of facilities can be hampered by inflexible civil service provisions, labor agreements and cumbersome hiring and recruiting regulations. These tendencies can increase the cost of providing services. As with the turnkey option, if cost savings could be demonstrated as a result of a contracting for services that would otherwise be performed by Port staff, the financial capacity of the Port would enjoy marginal benefits.

To evaluate the potential impact of improving the financial capacity through the use of third party financing mechanisms, a scenario was developed whereby certain projects that offer the potential to attract interest from outside investors where assumed to be funded through one of these mechanisms. A total of 10 projects valued at $250 million were identified. All of these projects are scheduled to be completed during the first 2 phases, with the majority of the investment required in the first phase of program development where the greatest financial capacity improvement is possible.

Since it is assumed that funds would be available from outside sources, these projects were simply removed from the capital funding analysis. If this were the only change in the analysis then it is obvious that this would significantly reduce the impact on airline costs. However, since these projects are turned over to private interests to finance, build and operate, the Port will lose the operating revenues that would have been generated by these facilities. As a result, the operating revenues must also be reduced by an amount approximately equal to the Port's expected return on these investments.

After making adjustments for the reduced capital needs and the offsetting reductions in

operating revenues the impact on the CPE was evaluated. Table 6-10 presents the results of this analysis, and compares this scenario with the baseline conditions.

The net effect of turning these projects over to the private sector is a significant improvement in the overall financial capacity to accomplish the Master Plan according to the demand driven phasing schedule. The airline costs are reduced in all years, peaking in 2000 with a savings of $0.84 per enplanement, a 9.5% reduction over the baseline CPE. The maximum CPE, measured in constant dollars terms, is reduced from $8.83 to $7.99. The CPE in the year 2000, measured in inflated dollars, is estimated to be $9.72, still substantially above the current policy target of $7.35.

The basic financial benefit from using these non-traditional financing mechanisms is to trade income that would be earned in the future, where there is projected excess financial capacity, for up-front capital financing during the period of maximum capacity constraints. Given the development schedule, this approach is particularly effective in reducing the cost impacts on the airlines.

FINANCIALLY CONSTRAINED SCENARIO, AN ILLUSTRATIVE EXAMPLE

The financial strategies discussed in the previous section all provided some improvement in the overall capacity of the Port to undertake the capital program envisioned in the Master Plan. None of the strategies that were evaluated were sufficient to independently allow for the completion of the capital development plan without a substantial increase in the historic cost per enplanement in constant dollar terms or within the current policy parameters. However, combining some of these strategies may provide a scenario that meets these objectives.

To evaluate such a scenario, the baseline Master Plan was adjusted to reflect following changes: assume the deferred cost plan; provide parking facilities based on an accelerated development schedule; and, assume the maximum use of outside financing. This scenario maintains the 8,500 foot runway option.

Capital Funding Program

Developing the Master Plan improvements assuming the application of the financial strategies defined for the financially constrained scenario would yield the funding plan presented in Table 6-11. As is shown, the total capital program needs are slightly less than $3 billion, over the next 25 years, with the largest share of these funds, more than $1 billion, coming from passenger facility charges. The next largest share of funds is estimated to be from the issuance of almost $1 billion of new revenue debt, or 32.4% of the program costs. The total capital program that is supported through the operating income of the facilities is over $2.7 billion, with the balance coming from grant sources. This table does not include the $250 million of projects that were assumed to be funded through outside sources.

Impact on Airline Costs

As with the baseline scenario, a majority of the capital program needs are met through growth in operating revenues. Figure 6-2 graphically presents the projections of operating revenues for both airline and non-airline sources. As is shown the proportion of total revenues raised through fees and charges to the airlines increases during the first phase of the program, and gradually returns to levels more consistent with current experience. However, the short-term financial impact is substantially lower than was projected in the demand-driven scenario.

Looking at these projected revenues from a CPE

TABLE 6-10
IMPACT OF MAXIMUM THIRD PARTY FINANCING [a]

Year	Cost per Enplanement (CPE)		Reduction/(Increase) in CPE
	Baseline Constant Dollars	Adjusted Constant Dollars	
1996	$6.85	$6.56	$0.30
1997	$7.53	$7.04	$0.48
1998	$8.09	$7.47	$0.63
1999	$8.47	$7.73	$0.75
2000	$8.83	$7.99	$0.84
2001	$8.31	$7.50	$0.80
2002	$8.29	$7.48	$0.81
2003	$7.76	$7.09	$0.67
2004	$5.98	$5.72	$0.26
2005	$5.84	$5.58	$0.26
2010	$5.57	$5.34	$0.23
2015	$5.04	$4.84	$0.20
2020	$4.49	$4.31	$0.18

[a] Source: Berk and Associates.

TABLE 6-11
ESTIMATED CAPITAL FUNDING PROGRAM
FINANCIALLY CONSTRAINED SCENARIO
(in thousands)

Master Plan Phase	Total Capital Spending	AIP Funds	PFC Funds	ADF Funds	Other Grant Funds	Debt Financing	Percent Debt Funded
Phase I	$773,517	$100,000	$136,207	$114,610	$1,514	$421,185	54.5%
Phase II	972,532	23,861	157,032	222,745	25,201	543,693	55.9%
Phase III	575,489	28,249	263,568	264,788	18,884	0	0.0%
Phase IV	330,067	34,370	217,262	78,435	0	0	0.0%
Phase V	326,279	41,816	245,774	38,689	0	0	0.0%
Total	$2,977,884	$228,296	$1,019,843	$719,268	$45,599	$964,878	32.4%

[a] Source: Berk and Associates.

point of view yields the results presented in Table 6-12. The cumulative effect of implementing these financing mechanisms and strategies is to reduce the constant dollar CPE to the point where it generally stays within a range consistent with recent airline experience at Sea-Tac. The airline cost savings relative to the demand-driven scenario are significant as demonstrated in the table, which presents the constant dollar difference between these options.

Due to the significant improvements in the cost per enplanement figures, the financially constrained scenario comes very close to meeting the Port policy target of $7.35 in the Year 2000 falling short by only $0.01. Given the proximity to the policy target, it appears that the basic capacity check could easily be achieved by incorporating more of the strategies and mechanisms discussed earlier in this chapter.

The key financial concept in this analysis has been the ability of the Port to pass costs through to the airlines. The threshold of level of airline costs for planning purposes is set by policy direction and is measured in terms of the airline cost per enplanement. There is another potential financial constraint that must be considered. The level of indebtedness that would be required to fund this program must be within the Port's overall debt capacity. Since the Master Plan would require almost $1 billion in new debt and the Marine Division is anticipating significant capital outlays as well, it is possible that the Portwide capacity may be an issue.

Based on preliminary analysis of the current Port debt obligations, marine and aviation capital programs and Port financial policies, it appears that the level of indebtedness assumed could maximize the Port's overall financial capacity. If the Port maintains a constant levy rate, as is the current policy, the overall debt service coverage would drop below the adopted policy level. This would likely result in a downgrade in the Port's bond rating and increase the Port's cost of funds, however, this would not necessarily make the program unfundable. The debt service coverage of 1.6, though not optimal for revenue debt, is still within reasonable financial parameters.

Should the Port decide to maintain is current bond rating during the initial phase of the Master Plan it could improve the debt coverage by increasing the levy rate or replacing some of the revenue debt with general obligation debt. It is important to note that these financing considerations are based on preliminary, conservative and conceptual level analyses. There are a number of details that remain to be evaluated, including additional financing options which could affect the actual debt capacity of the Port.

The previous analysis shows that the Master Plan program can be developed within the financial constraints at the Port of Seattle. It is important to reiterate, however, that the analysis presented in this chapter is a conceptual level evaluation and is not intended as a plan of finance. The details of individual project funding will be addressed by the Port during the implementation of the Master Plan and subject to Commission review and approval.

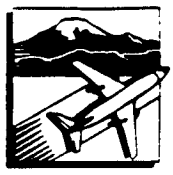
SUMMARY OF FINDINGS

The implication of this analysis is that while the program is quite ambitious, there are mechanisms available that could reduce the program cost impacts on the airlines and bring the Master Plan program within the Port's current policy and financial parameters. No financial fatal flaws were identified, though the implementation of the Master Plan program will require careful management to balance the tradeoffs between level of service, capital

TABLE 6-12
FINANCIAL IMPLICATIONS OF MASTER PLAN DEVELOPMENT
FINANCIALLY CONSTRAINED SCENARIO [a]

Year	Total Airline Fees (thousands)	Total Enplanements (thousands)	Cost per Enplanement (CPE)		
			Inflated Dollars	Constant Dollars (1995 base)	Savings over Baseline
Actual					
1993	$68,044	9,385	$7.16	$7.74	n/a
1994	$59,706	9,706 [b]	$6.16	$6.41	n/a
1995	$62,626 [b]	10,039 [b]	$5.64	$5.64	n/a
Projected					
1996	$65,796	10,383	$6.34	$6.09	$0.76
1997	$71,233	10,738	$6.63	$6.13	$1.40
1998	$76,981	11,106	$6.93	$6.16	$1.93
1999	$81,732	11,487	$7.12	$6.08	$2.39
2000	$87,488	11,880	$7.36	$6.05	$2.78
2001	$94,469	12,183	$7.75	$6.13	$2.18
2002	$108,324	12,493	$8.67	$6.59	$1.70
2003	$118,078	12,811	$9.22	$6.73	$1.02
2004	$106,886	13,137	$8.14	$5.72	$0.26
2005	$112,258	13,471	$8.56	$5.63	$0.21
2010	$146,978	15,275	$9.62	$5.34	$0.23
2015	$181,020	17,067	$10.61	$4.84	$0.20
2020	$218,855	19,069	$11.48	$4.31	$0.18

[a] Source: Berk and Associates.



spending and airlines cost impacts.

The Port has already begun the difficult task of addressing the financial implications of the Master Plan. During its recent short-term Business Planning effort many of the strategies discussed in this chapter were identified. The integration of the Master Plan into the normal capital development process is underway. Financial management and implementation options to address the short-term financial capacity issues are being evaluated in substantially greater detail than was possible in this effort.

The following summarizes other key findings of the financial analysis of the Master Plan development program.

The demand-driven Master Plan development program as currently defined would significantly impact the cost to the airlines as measured by the CPE. The net effect is a sharp near-term increase in the costs passed through to the airlines.

There is adequate financial capacity to fund the Master Plan improvements, however, much of the capacity is in the later years of the planning horizon. The demand-driven schedule would require a substantial investment in the early years of program implementation causing airline costs to rise from a current CPE of $5.64 to $10.74 in the year 2000.

Based on preliminary analysis of the Port's overall debt obligations, the debt required under the financially constrained scenario may result in a downgrade in the Port's bond rating and increase the Port's cost of funds. However, while the estimated debt service coverage of 1.6, is below the Port's financial policy standard, it is still within reasonable financial parameters. In addition the Port could improve the debt coverage by increasing the levy rate or replacing some of the revenue debt with general obligation debt. As a result, the proposed level of spending does not appear to be outside the Port's ability to issue new capital debt.

The Port of Seattle has established aggressive operating cost management goals, which are reflected in the financial analysis of Master Plan options. If the Aviation Division were to experience higher than expected cost escalation, then the estimated impact to the airline costs would be understated.

Deferring costs from the baseline demand-driven scenario is a necessary component of a capital program that meets the current policy of keeping the CPE below a target of $7.35 until the year 2000. Strategies for increasing the utilization of existing facilities to help maintain an acceptable level of service will be key components of a successful cost deferral program.

By itself the $60 million savings resulting from assuming the 7,500 foot runway instead of the 8,500 foot alternative provides marginal cost relief for the airlines.

While the PFC's are a major contributor to the overall funding program in each scenario evaluated, the assumption of increased PFC charges does not have a significant bearing on the issue of financial capacity. The first time the PFC is assumed to be adjusted for the effects of inflation is in the year 2006, well after the principal financial capacity concern is addressed. In fact, in the years after the retirement of Port debt, in 2003 there generally is excess financial capacity relative to the Master Plan requirements.

The greatest potential for reducing the impact on the airlines, is through the utilization of non-traditional sources of capital. In particular, the attraction of private capital may offer the best

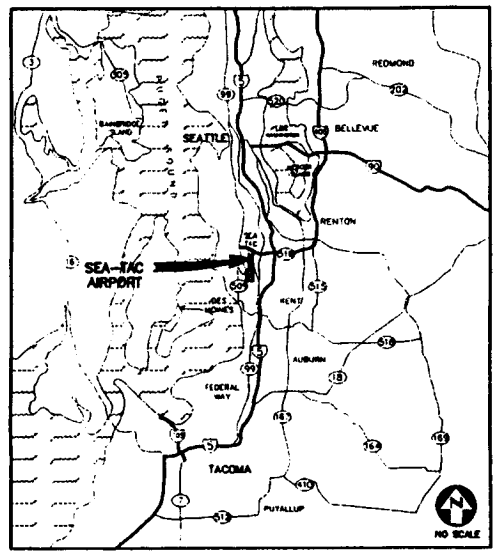
opportunity to meet both the service objectives and extend the fiscal capacity of the Port. The use of these mechanisms should be carefully considered, however, since in some cases a perceived reduction in airline costs may actually result in a transfer of costs from fees charged by the airport to fees charged by the new third-party operator. Privately operated facilities, however are increasing common in the airport industry, which is one of the reasons that CPE comparisons between airports are difficult.

SEATTLE - TACOMA INTERNATIONAL AIRPORT

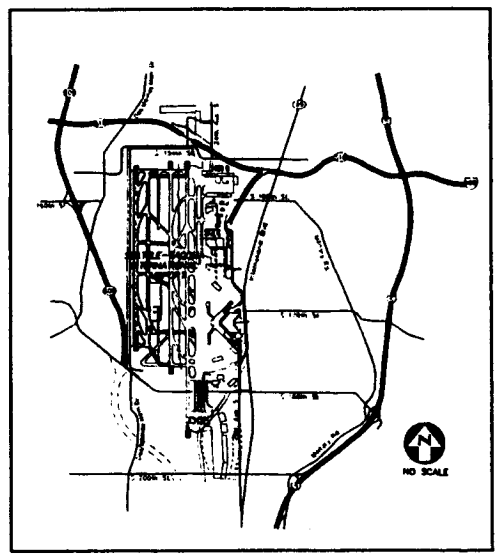
Attachment C
to Resolution No. 3212, as Amended

AIRPORT MASTER PLAN
(8,500' OPTION FOR RUNWAY 16X-34X)

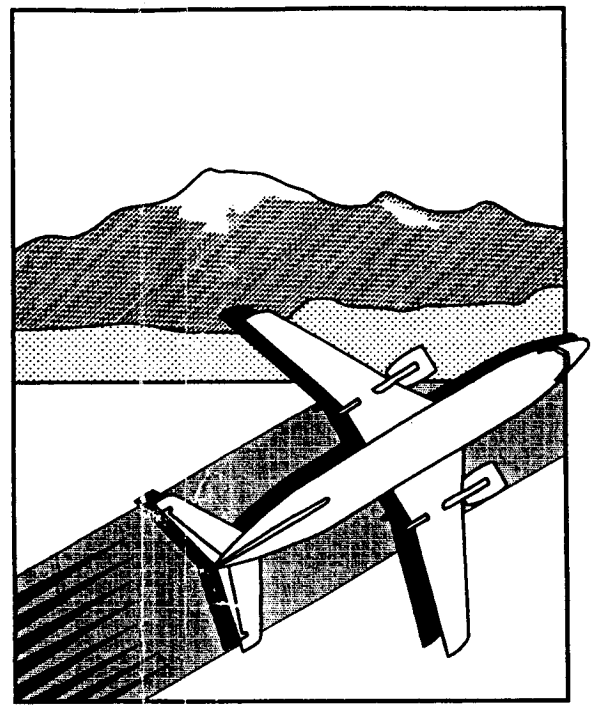
DRAFT



LOCATION MAP



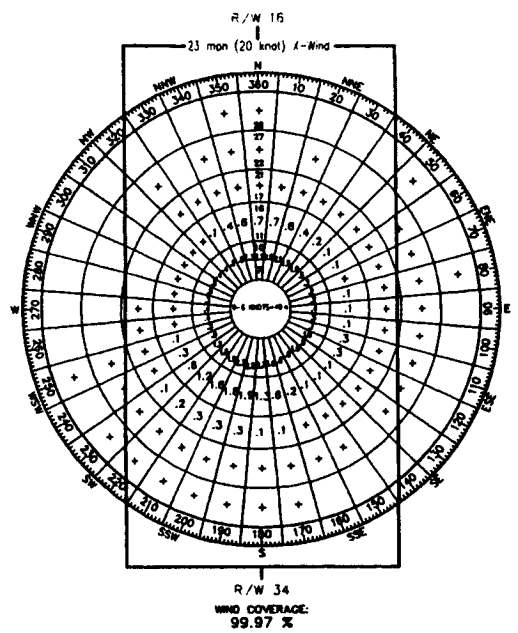
VICINITY MAP



INDEX OF DRAWINGS

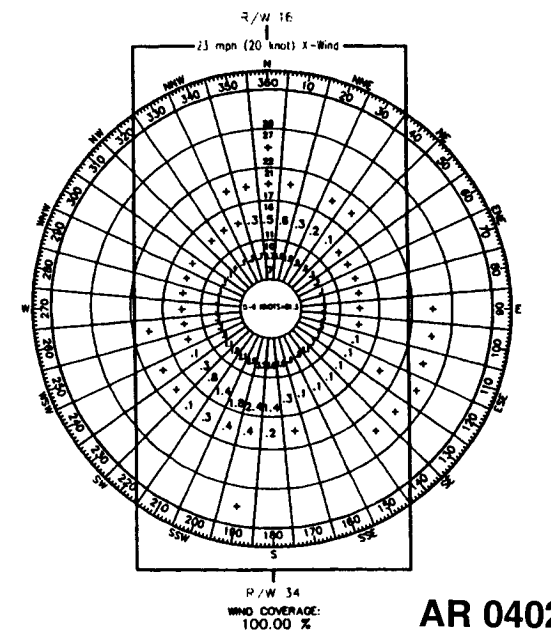
DWG. No.	TITLE
1.	Title Sheet
2.	Airport Layout Plan
3.	Terminal Area Plan
4.	Airport Land Use Plan - Existing Land Uses
5.	Airport Land Use Plan - Future Land Uses
6.	Airport Airspace Plan
7.	Approach Zone Profiles - Runway 16L - 34R
8.	Approach Zone Profiles - Runway 16R - 34L
9.	Approach Zone Profiles - Runway 16X - 34X
10.	Runway Protection Zone Plan and Profiles - Runway 16L - 34R
11.	Runway Protection Zone Plan and Profiles - Runway 16R - 34L
12.	Runway Protection Zone Plan and Profiles - Runway 16X - 34X
13.	Surface Movement and Guidance System

P&D Aviation



ALL-WEATHER
WIND ROSE

SOURCE: BASED ON 90,550 OBSERVATIONS TAKEN AT SEATTLE-TACOMA INTERNATIONAL AIRPORT FOR THE YEARS 1948-1978. NATIONAL CLIMATIC DATA CENTER.



AR 040229

IFR
WIND ROSE

LEGEND

	EXISTING	ULTIMATE
AIRFIELD PAVEMENT	—	—
AIRPORT BOUNDARY	—	—
AIRPORT REFERENCE POINT (ARP)	—	—
BUILDINGS	—	—
AIRCRAFT PARKING RESTRICTION LINE (APRL)	APRL	SAME
GROUND CONTOURS		
FENCE	—	—
ROAD/VEHICLE PARKING		—
RUNWAY SAFETY AREA (RSA)	RSA	SAME
PRINCIPAL DRAINAGE FLOW		—
RUNWAY OBJECT FREE AREA (ROFA)	ROFA	SAME
ALTERNATE FUTURE ATCT SITE	—	SAME
FUTURE UNDERGROUND FACILITY	—	SAME
GS AND LOC CRITICAL AREAS	—	SAME
BUILDING RESTRICTION LINE	BRL	SAME
RUNWAY PROTECTION ZONE	RPZ	SAME

RUNWAY END DATA

RUNWAY		EXISTING	ULTIMATE	EXIST. ELEV. *	ULT. ELEV. *
16L DEPARTURE THRESHOLD	LATITUDE	47°27'50"N	SAME	428.72'	SAME
	LONGITUDE	122°18'23"W	SAME		
16L LANDING THRESHOLD	LATITUDE	47°27'45"N	-	428.5'	-
	LONGITUDE	122°18'23"W	-		
34R	LATITUDE	47°25'53"N	47°25'47"N	342.93'	338.5
	LONGITUDE	122°18'25"W	122°18'25"W		
16R	LATITUDE	47°27'50"N	SAME	426.2'	SAME
	LONGITUDE	122°18'35"W	SAME		
34L	LATITUDE	47°26'17"N	SAME	359.4'	SAME
	LONGITUDE	122°18'38"W	SAME		
16X	LATITUDE	-	47°27'50"N	-	411.1'
	LONGITUDE	-	122°19'03"W		
34X	LATITUDE	-	47°26'25"N	-	350.8'
	LONGITUDE	-	122°19'0"W		

* HIGHEST AND LOWEST ELEVATIONS OF ALL RUNWAYS ARE AT RUNWAY ENDS.

AIRPORT DATA

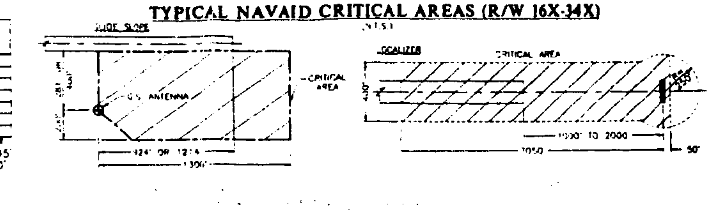
		EXISTING	ULTIMATE
AIRPORT ELEVATION		428.72' MSL	SAME
AIRPORT REFERENCE POINT (ARP) COORDINATES	LATITUDE	47°26'38"N	47°26'58"N
	LONGITUDE	122°18'29"W	122°19'37"W
MEAN MAX. TEMP. OF HOTTEST MONTH		74.4°	SAME
AIRPORT AND TERMINAL NAVAIDS		ASR, VORTAC, ASDE, ILS, MLS	SAME
AIRPORT REFERENCE CODE		D-V	SAME
AIRPORT WIND COVERAGE % (23 MPH)		99.7	SAME
MISCELLANEOUS FACILITIES		ATCT	SAME
TAXIWAY LIGHTING		HTL, SMGCS	SAME
NPIAS ROLE		LARGE HUB	SAME
AIRPORT CODE		SEA	SAME

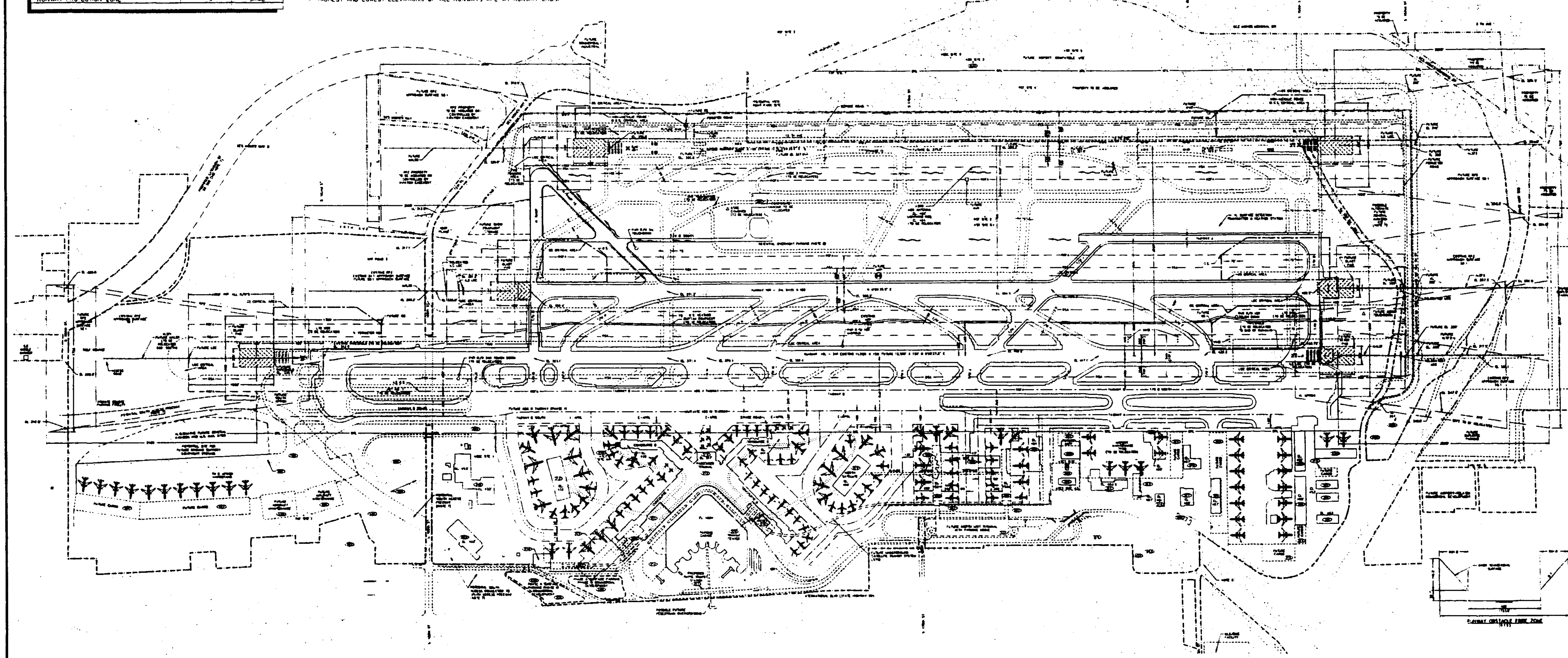
EXISTING SAFETY AREAS BEYOND RUNWAY ENDS

RUNWAY	WIDTH	LENGTH
16L	500'	700'
34R	500'	535'
16R	**	*
34L	500'	1000'
16X	500'	1000'
34X	500'	1000'

* IRREGULAR LENGTH - VARIES 325' TO 645'
** IRREGULAR WIDTH - VARIES 110' TO 500'

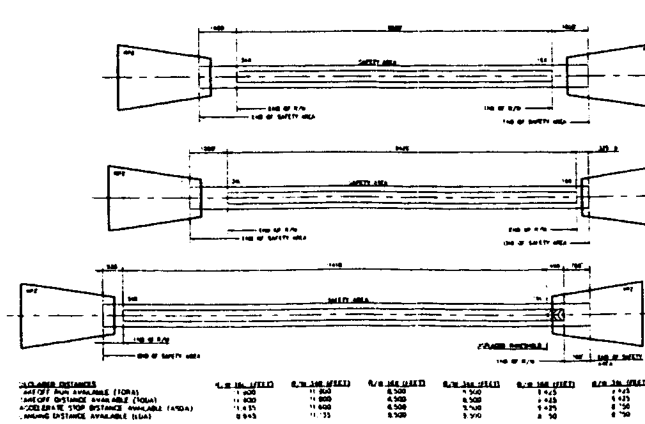
TYPICAL NAVAID CRITICAL AREAS (R/W 16X-34X)





RUNWAY DATA

		RUNWAY 16L/34R EXISTING	RUNWAY 16L/34R ULTIMATE	RUNWAY 16R/34L FUTURE R/W 16C/34C EXISTING	RUNWAY 16R/34L FUTURE R/W 16C/34C ULTIMATE	RUNWAY 16X/34X FUTURE R/W 16R/34L EXISTING	RUNWAY 16X/34X FUTURE R/W 16R/34L ULTIMATE
EFFECTIVE GRADIENT (IN %)		0.72	SAME	0.71	SAME	-	0.71
PAVEMENT STRENGTH (X 1000 LBS.)		200 (D), 350 (DT), 880 (DDT)	SAME	200 (D), 350 (DT), 880 (DDT)	SAME	-	200 (D), 350 (DT), 880 (DDT)
RUNWAY LIGHTING		HIRL, ℄, TDZ, THR	HIRL, ℄, TDZ, THR	HIRL, ℄, THR	SAME	-	HIRL, ℄, TDZ, THR
RUNWAY MARKING		ALL WEATHER	SAME	ALL WEATHER	SAME	-	ALL WEATHER
INSTRUMENT APPROACH AIDS	R/W 16	RVR, MLS	ILS(I,II,III),MLS RVR	ILS(I,II,III),RVR	ILS(I), RVR, GPS	-	ILS(I,II,III), RVR
	R/W 34	ILS(I), RVR	ILS(I), RVR, GPS	ILS(I)	ILS(I), GPS	-	ILS(I), GPS
VISUAL AIDS	R/W 16	MALSF, VASI-3	ALSF2, PAPI	ALSF2	SAME	-	PAPI, ALSF2
	R/W 34	ALSF1	MALSR, PAPI	MALSR, VASI	SAME, PAPI	-	PAPI, MALSR
WIND COVERAGE % (23 MPH)		99.7	SAME	99.7	SAME	-	99.7
AIRPLANE DESIGN GROUP		D-V	SAME	D-V	SAME	-	D-V
APPROACH SURFACES		50:1/50:1	SAME	50:1/34:1	50:1/50:1	-	50:1/50:1
MAXIMUM ELEV. ABOVE MSL		428.72	SAME	426.2	SAME	-	411.1
RUNWAY LENGTH		11,900'	12,500'	9,425'	SAME	-	8,500'
RUNWAY WIDTH		150'	SAME	150'	SAME	-	150'
RUNWAY SAFETY AREA (RSA) WIDTH		500'	SAME	110'-500'	500'	-	500'
RSA LENGTH 500' WIDE BEYOND R/W		700'/535'	1,000	325'/1000'	1,000	-	1,000'
OBSTACLE FREE ZONE (OFZ) WIDTH		400'	SAME	400'	SAME		400'
OFZ LENGTH BEYOND RUNWAY END		200'	SAME	200'	SAME	-	200'
OBJECT FREE AREA (OFA) WIDTH		800'	SAME	800'	SAME	-	800'
OFA LENGTH BEYOND RUNWAY END		1,000'	SAME	1,000'	SAME	-	1,000'
PAVEMENT TYPE		PCC/AC OVERLAY	SAME	PCC	SAME	-	PCC
CRITICAL AIRCRAFT (D-V)		B747-400	SAME	B747-400	SAME	-	B747-400
LINE OF SIGHT STANDARDS MET		YES	SAME	YES	SAME	-	YES



MODIFICATIONS TO DESIGN STANDARDS

1. REF AC 150/5300-13 AIRPORT DESIGN
   - PAVEMENT CROWN ON RUNWAY 16L-34R IS OFFSET 25 FEET OR 50 FEET EAST OF THE RUNWAY CENTERLINE INSTEAD OF ON THE RUNWAY CENTERLINE
   - THIS MODIFICATION IS DATED 9-24-87 AND MAKES REFERENCE TO CANCELED AC 150/5200-12 AND TO ADG VI WHICH HAS BEEN REVISED TO ADG V IN THE CURRENT AC 150/5300-13. THE SEPARATION DISTANCE AND WIDTH OF SAFETY AREA STANDARDS CITED IN THE MODIFICATION ARE NO LONGER VALID SINCE THE STANDARDS FOR ADG V ARE LESS THAN ADG VI. TAXIWAY CENTERLINE SEPARATION DISTANCE TO FIXED OR MOVABLE OBJECT FOR A B747-400 (ADG V) IS 160' VS ACTUAL DISTANCE OF 154' ON TAXIWAY A EAST AT A RETAINING WALL. TAXIWAY SAFETY AREA WIDTH STANDARD IS 214' VS ACTUAL OF 211' ON TAXIWAY A EAST.
2. SEE SHEET 13 SURFACE MOVEMENT AND GUIDANCE SYSTEM FOR ADDITIONAL MODIFICATIONS TO DESIGN STANDARDS INVOLVING AC 150/5340-1G, 150/5340-19 AND 150/5340-1F
3. RUNWAY SAFETY AREAS
   R/W 16R - ODD SHAPE 500'x645' NOT FULL WIDTH/LENGTH ALL
   R/W 34L - 500'x1000'
   R/W 16L - 500'x535'
   R/W 34R - 500'x700'
   EXCEPT FOR THE 500'x1000' SAFETY AREA ON RUNWAY 34L, THE REMAINING EXISTING RUNWAY SAFETY AREAS DO NOT MEET DESIGN STANDARDS. SAFETY AREAS FOR RUNWAY 16L IS 500'x700', FOR RUNWAY 34R, 500'x535' AND FOR RUNWAY 16R, AN ODD NON-RECTANGULAR SHAPE WITH A WIDEST WIDTH OF 500' AND A LONGEST LENGTH OF 645' AND AVERAGE LENGTH OF 325'. MASTER PLAN RECOMMENDATIONS INCLUDE ALL SAFETY AREAS TO MEET DESIGN STANDARDS.

NOTES:

1. Existing facilities and topography based on aerial photogrammetry from 1994.
2. All elevations given are in feet MSL.
3. Final location of navaids to be determined by FAA Airway Facilities Division.
4. Property earmarked for transfer to City of Seatac in exchange for street vacations.
5. When Runway 16X/34X is constructed, runway designations will be changed as shown on Runway Data table.
6. Bridge owned by Port of Seattle
7. Subject to further study.
8. The final configuration of the overnight apron and the size of the aircraft that will use it are subject to further study.
9. See sheet 3 of 13 for description of facilities identified by numbers 101 to 502 on this sheet.
10. See OC582 dated November 1993 for location of obstruction lights.

SCALE IN FEET: 400 0 200 400 800 1600

True / Magnetic — Annual Rate of Change: -5.5 min/year

The preparation of this plan was financed in part through a grant from the Federal Aviation Administration as provided under Section 505 of the Airport and Airway Improvement Act of 1982, as amended. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this plan by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws.

DRAFT

REVISIONS

NO	DATE	BY	DESCRIPTION	APP'D	NO	DATE	BY	DESCRIPTION	APP'D

P&D Aviation
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PROJECT MANAGER: R. AHLFELDT
PLANNER: S. ALLISON
CADD OPERATOR
SCALE: 1"=400'
DATE: 1-22-96
CHECKED BY

AR 040230

PORT OF SEATTLE

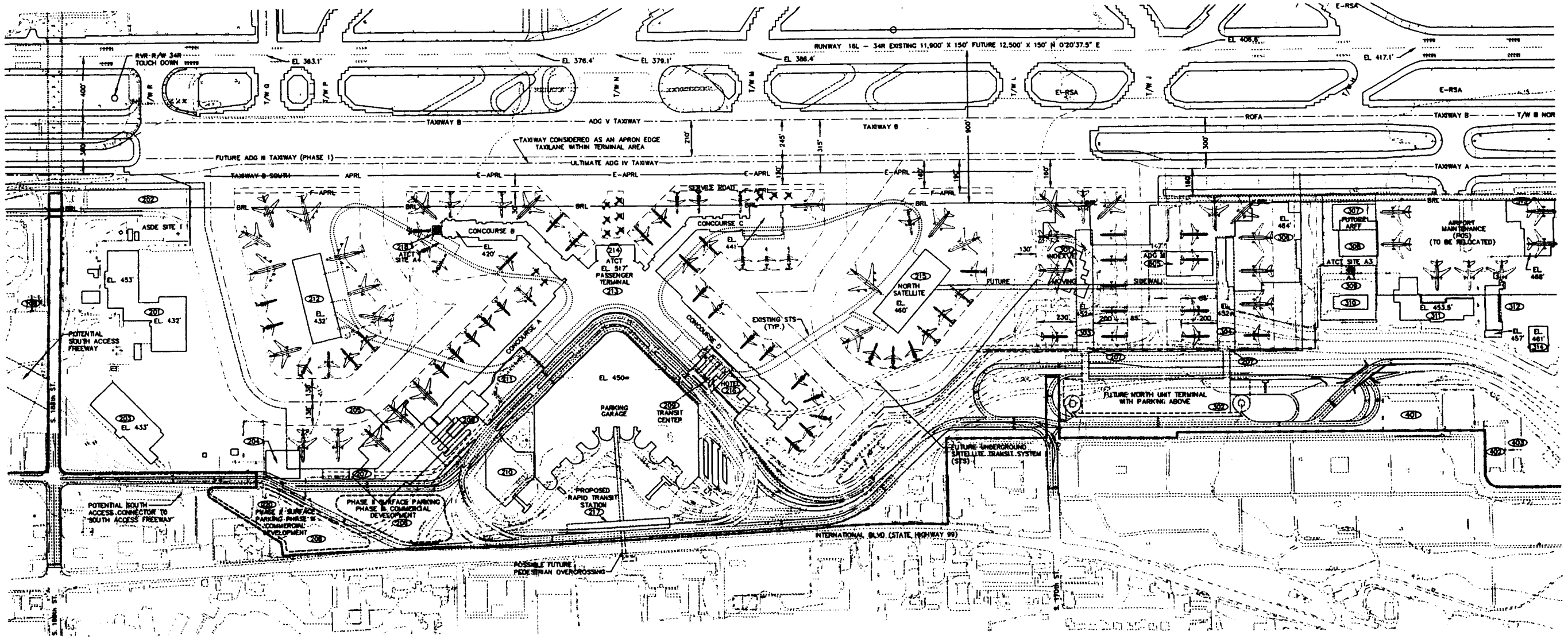
PORT OF SEATTLE APPROVAL

SEA-TAC INTERNATIONAL AIRPORT

AIRPORT LAYOUT PLAN

SHEET 2 OF 13

DRAFT



BUILDING DATA TABLE

No.	Existing use	Roof Elev.	Future Use (PHASE)	No.	Existing use	Roof Elev.	Future Use (PHASE)
101	Golf Course Club House	N/A **	To Be Removed / Relocated (Phase IV)	301	Airport Rescue And Fire Fighting	*	To Be Removed / Relocated (Phase III)
102	Employee Parking	N/A **	To Be Removed / Relocated (Phase IV)	302	Open / Circulation	N/A	North Unit Terminal (Phase III) / Parking (Phases III - V)
103	Alaska Airlines Flight Center	* **	Same	303	Various	N/A	South Concourse (Phase III)
104	South Remote Parking Facility	N/A **	To Be Removed / Relocated (Phase IV)	304	Various	N/A	North Concourse (Phases IV - V)
105	Fuel Storage Area	N/A **	Same	305	Delta Air Cargo	*	To Be Removed / Relocated (Phase IV)
106	Electrical Substation	N/A **	Same	306	U.S. Air Mail Facility	*	To Be Removed / Relocated (Phase IV)
107	Various	N/A **	Air Cargo (Phases IV And V)	307	Various	N/A	Airport Rescue And Fire Fighting (Phase III)
108	Various	N/A **	Aircraft Maintenance (Phase IV)	308	United Airlines Cargo	*	To Be Removed / Relocated (Phase III)
201	Alaska Airlines Maintenance	432,456	Same	309	Various	N/A	Alternate ATCT Site (Phase I)
202	General Aviation Ramp	N/A	To Be Removed / Relocated (Phase I)	310	Airborne Freight	*	Potentially Removed / Relocated (Phase I)
203	Delta Airlines Maintenance	433	Same	311	Alaska Airlines Cargo	453.5	Same
204	Northwest Airlines Flight Kitchen	*	To Be Removed / Relocated (Phase I)	312	Air Freight Center	457	Same
205	Northwest Airlines Maintenance	*	To Be Removed / Relocated (Phase I)	313	Airport Maintenance (Port Of Seattle)	468	To Be Removed / Relocated (Phase II)
206	Open / Circulation	N/A	Parking (Phase II) / Commercial (Phase III)	314	Emery Air Freight	481	Same
207	Various	N/A	STS Station (Phase III)	315	Various	N/A **	Air Cargo (Phases I - V)
208	Various	N/A	Concourse A Extension (Phase I)	316	United Airlines Maintenance	487 **	To Be Removed / Relocated (Phase II)
209	Various	N/A	Transit Center (Phase III)	317	Sabo	* **	Same
210	Various	N/A	Parking Garage Expansion (Phases I - IV)	318	Pump House	N/A **	Same
211	Open	N/A	Passenger Terminal Expansion (Phase II)	319	Federal Express	N/A **	Same
212	South Satellite	432	Same	320	AFCO Air Cargo	* **	Same
213	Passenger Terminal	*	Same	321	Transglobe Air Cargo	* **	Same
214	Air Traffic Control Tower	480	Terminal Ramp Control (Phase I)	401	United Flight Kitchen	*	Same
215	North Satellite	N/A	Save	402	Cater Air Flight Kitchen	*	To Be Removed / Relocated (Phase II)
216	Various	N/A	Hotel (Phase I)	403	Various	N/A	Airport Maintenance (Port Of Seattle) (Phase II)
217	Open / Circulation	N/A	Rapid Transit Station (Phase IV)	404	Cater Air Flight Kitchen	* **	Same
218	Various	N/A	Alternate ATCT Site (Phase I)	405	Flying Food Services	* **	Same
219	Delta Fuel Storage	N/A	Same	501	Weyerhaeuser Hangar	N/A **	To Be Removed / Relocated (Phase I)
220	Northwest Fuel Storage	N/A	To Be Removed / Relocated (Phase II)	502	Various	N/A **	Alternate Site For Acc-9 (Phase I)

NA - NOT APPLICABLE
* ELEVATIONS UNAVAILABLE. FURTHER STUDY NEEDED TO DETERMINE IMPACTS ON OPERATIONS
** SEE NOTE 5

NOTES:

1. Existing facilities and topography based on aerial photogrammetry from 1994.
2. All elevations given are in feet MSL.
3. Final location of navaids to be determined by FAA Airway Facilities Division.
4. Property to be obtained by Port of Seattle in trade.
5. See sheet 2 of 13 for location of facilities 101 to 108, 315 to 321 and 404 to 502.

LEGEND

	EXISTING	ULTIMATE
AIRFIELD PAVEMENT		
AIRPORT BOUNDARY		
AIRPORT REFERENCE POINT (ARP)	⊕	⊕
BUILDINGS		
APPROACH PARKING RESTRICTION LINE (APRSL)	APRSL	SAME
GROUND CONTOURS	440	
FENCE		
AUTOMOBILE PARKING		
RUNWAY SAFETY AREA (RSA)	RSA	SAME
PRINCIPAL DRAINAGE FLOW		
RUNWAY OBJECT FREE AREA (ROFA)	ROFA	SAME

True Magnetic — Variation 16°E (1994)

Annual Rate of Change: -9.3 min/year

300 0 100 200 400 800

SCALE IN FEET

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R. WINFIELD	NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D
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S. ALLISON										
CADD OPERATOR										
S.K.H.										
SCALE										
1" = 200'										
DATE										
1-22-96										
CHECKED BY										

AR 040231

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT

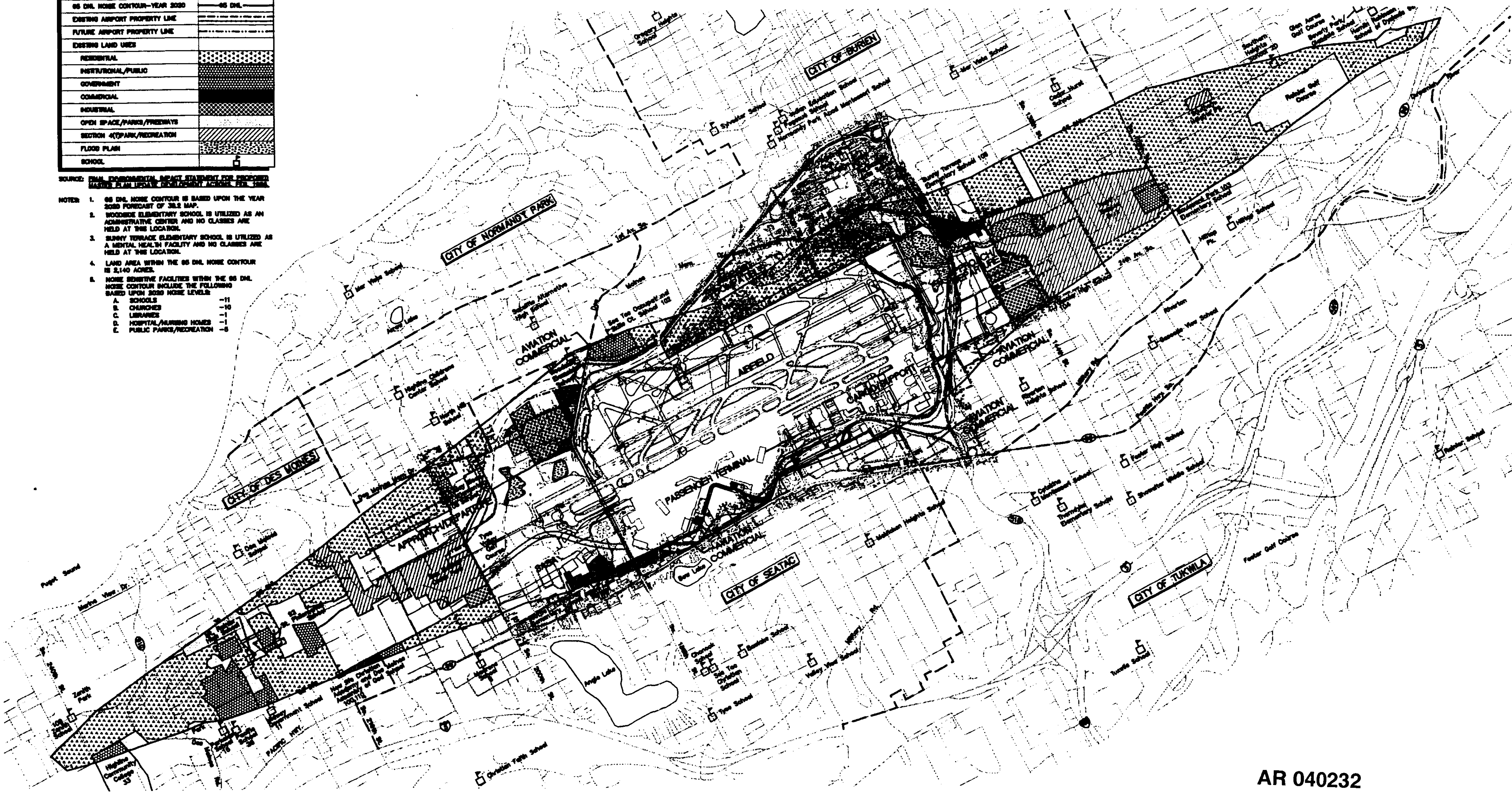
TERMINAL AREA PLAN

SHEET 3 OF 13

AURA GROUP NO.

CONSULTANT'S NO.

PORT OF SEATTLE NO.



LEGEND

JURISDICTIONAL BOUNDARY	
65 DNL NOISE CONTOUR–YEAR 2020	65 DNL
EXISTING AIRPORT PROPERTY LINE	
FUTURE AIRPORT PROPERTY LINE	
EXISTING LAND USES	
RESIDENTIAL	
INSTITUTIONAL/PUBLIC	
GOVERNMENT	
COMMERCIAL	
INDUSTRIAL	
OPEN SPACE/PARKS/FREEWAYS	
SECTION 4(f)PARK/RECREATION	
FLOOD PLAIN	
SCHOOL	

SOURCE: FINAL ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED MASTER PLAN UPDATE DEVELOPMENT ACTIONS, FEB. 1996.

NOTES:
1. 65 DNL NOISE CONTOUR IS BASED UPON THE YEAR 2020 FORECAST OF 38.2 MAP.
2. WOODSIDE ELEMENTARY SCHOOL IS UTILIZED AS AN ADMINISTRATIVE CENTER AND NO CLASSES ARE HELD AT THIS LOCATION.
3. SUNNY TERRACE ELEMENTARY SCHOOL IS UTILIZED AS A MENTAL HEALTH FACILITY AND NO CLASSES ARE HELD AT THIS LOCATION.
4. LAND AREA WITHIN THE 65 DNL NOISE CONTOUR IS 2,140 ACRES.
5. NOISE SENSITIVE FACILITIES WITHIN THE 65 DNL NOISE CONTOUR INCLUDE THE FOLLOWING BASED UPON 2020 NOISE LEVELS:
   - A. SCHOOLS –11
   - B. CHURCHES –10
   - C. LIBRARIES –1
   - D. HOSPITAL/NURSING HOMES –1
   - E. PUBLIC PARKS/RECREATION –5

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1,000 0 500 1,000 2,000 4,000
SCALE IN FEET

True North / Magnetic North
Annual Rate of Change: –0.3 min/year

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PROJECT MANAGER	R. AHLFELDT
PLANNER	S. ALLISON
CADD OPERATOR	S.R.H.
SCALE:	1"=1,000'
DATE:	1-22-96
CHECKED BY	

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT
AIRPORT LAND USE PLAN
EXISTING LAND USES
SHEET 4 OF 13

BURE CHOLE NO	
CONSULTANT'S NO	
PORT OF SEATTLE NC	

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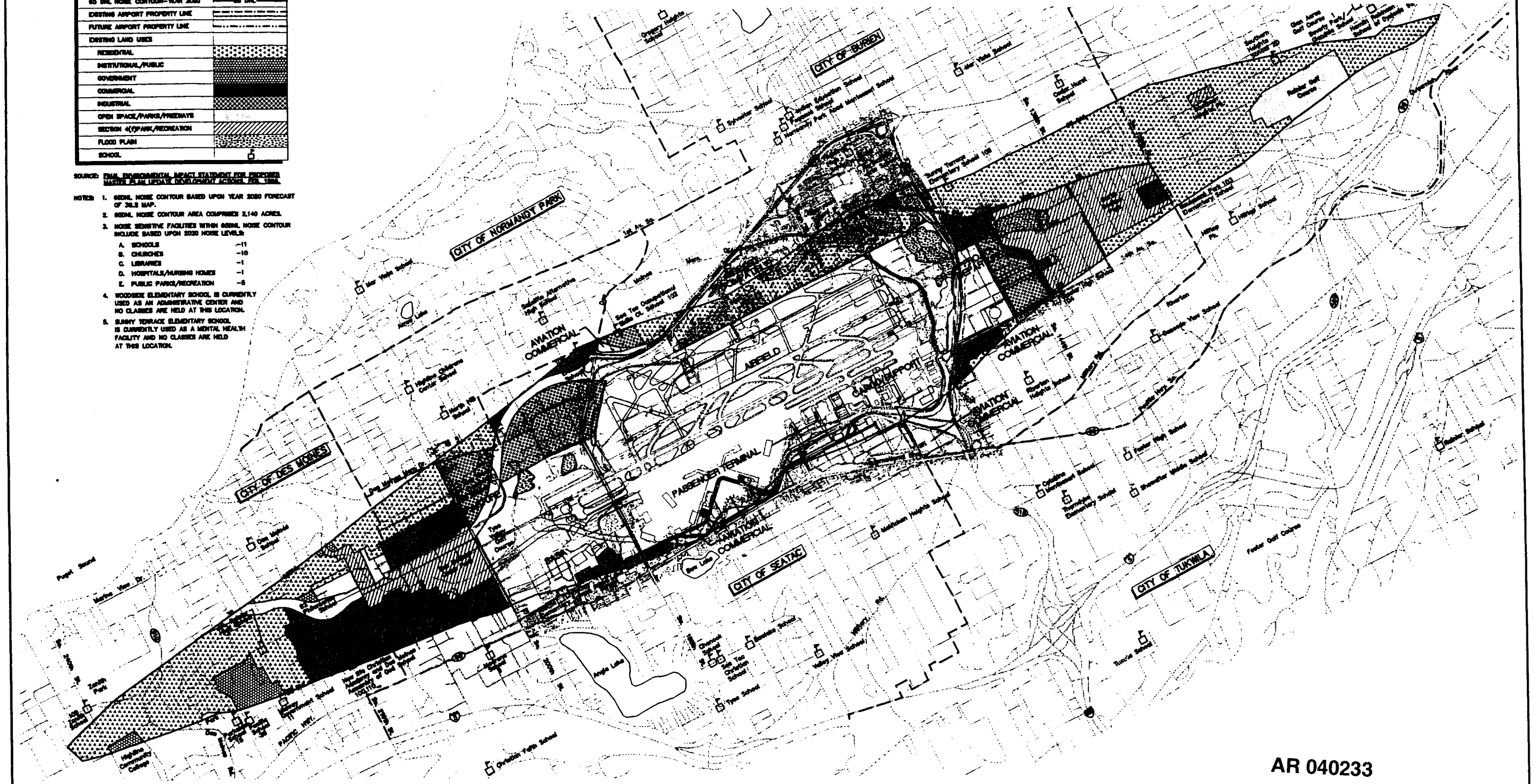
DRAFT

LEGEND	
JURISDICTIONAL BOUNDARY	
65 DNL NOISE CONTOUR--YEAR 2000	65 DNL
EXISTING AIRPORT PROPERTY LINE	
FUTURE AIRPORT PROPERTY LINE	
EXISTING LAND USES	
RESIDENTIAL	
INSTITUTIONAL/PUBLIC	
GOVERNMENT	
COMMERCIAL	
INDUSTRIAL	
OPEN SPACE/PARKS/FREEWAYS	
SECTION 4(f)PARK/RECREATION	
FLOOD PLAIN	
SCHOOL	

SOURCE: FINAL ENVIRONMENTAL IMPACT STATEMENT FOR PROPOSED MASTER PLAN UPDATE DEVELOPMENT ACTIONS, FEB. 1996.

NOTES:
1. 65DNL NOISE CONTOUR BASED UPON YEAR 2000 FORECAST OF 38.2 MAP.
2. 65DNL NOISE CONTOUR AREA COMPRISES 2,140 ACRES.
3. NOISE SENSITIVE FACILITIES WITHIN 65DNL NOISE CONTOUR INCLUDE BASED UPON 2000 NOISE LEVELS:
   - A. SCHOOLS -11
   - B. CHURCHES -10
   - C. LIBRARIES -1
   - D. HOSPITALS/NURSING HOMES -1
   - E. PUBLIC PARKS/RECREATION -6
4. WOODSIDE ELEMENTARY SCHOOL IS CURRENTLY USED AS AN ADMINISTRATIVE CENTER AND NO CLASSES ARE HELD AT THIS LOCATION.
5. SUNNY TERRACE ELEMENTARY SCHOOL IS CURRENTLY USED AS A MENTAL HEALTH FACILITY AND NO CLASSES ARE HELD AT THIS LOCATION.



AR 040233

SCALE IN FEET

Annual Rate of Change -0.3 min/year

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PROJECT MANAGER: A. MAYEUX
PLANNER: S. ALLISON
CADD OPERATOR: L.H.H.
SCALE: 1" = 1,000'
DATE: 1-22-96
CHECKED BY:

REVISIONS										
NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

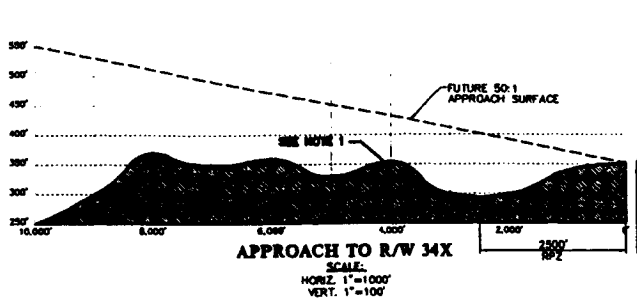
PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY:

SEA-TAC INTERNATIONAL AIRPORT
AIRPORT LAND USE PLAN
FUTURE LAND USES
SHEET 5 OF 13

WORK ORDER NO.
CONSULTANT'S NO.
PORT OF SEATTLE NO.



APPROACH TO R/W 34X

SCALE:
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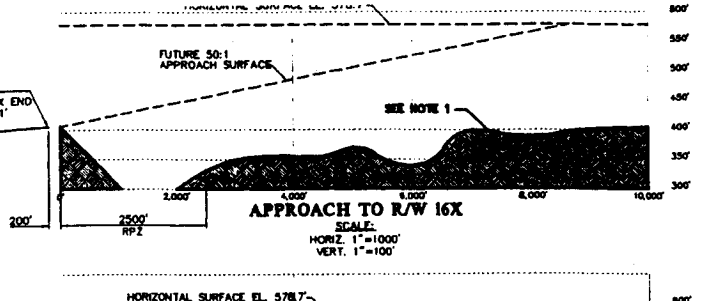
VERT. 1"=100'



APPROACH TO R/W 16X

SCALE:
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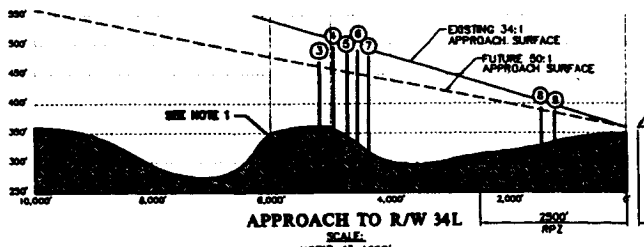
VERT. 1"=100'



APPROACH TO R/W 34L

SCALE:
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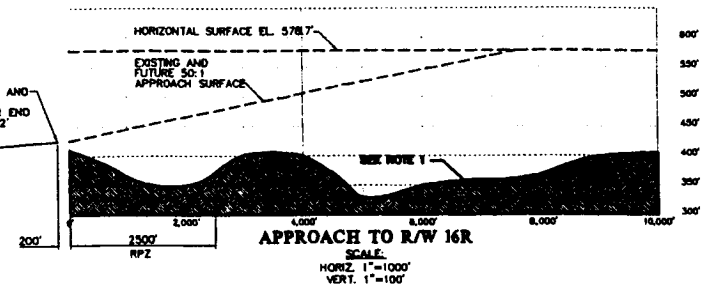
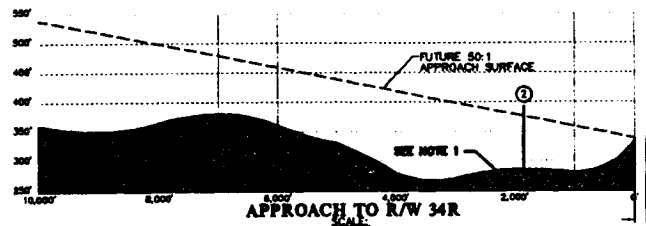
VERT. 1"=100'



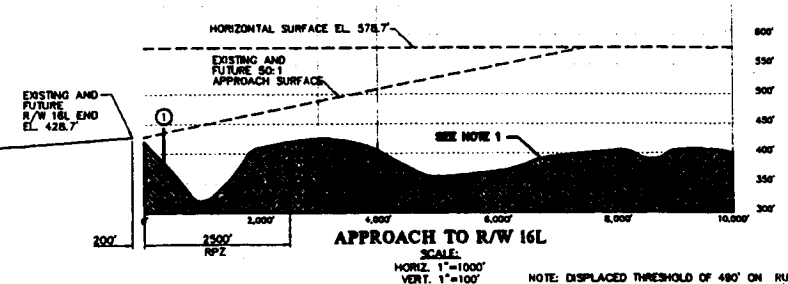
APPROACH TO R/W 16R

SCALE:
HORIZ. 1"=1000'
VERT. 1"=100'



APPROACH TO R/W 34R

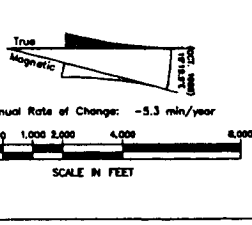
SCALE:
HORIZ. 1"=1000'
VERT. 1"=100'

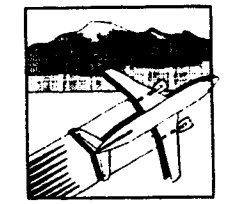


APPROACH TO R/W 16L

SCALE:
HORIZ. 1"=1000'
VERT. 1"=100'

NOTE: DISPLACED THRESHOLD OF 480' ON RUNWAY 16L NOT SHOWN SINCE IT WILL BE ELIMINATED IN SHORT TERM DEVELOPMENT PROGRAM





OBSTRUCTION IDENTIFICATION

RUNWAY NO.	OBSTRUCTION NO.	DESCRIPTION	OBST. ELEV. (MSL)	PENETRATION	PROPOSED ACTION
16L	1	TREE	445'	8'	TRIM OR REMOVE
34R	2	TREE	384'	2'	TRIM OR REMOVE
16R	NONE				
34L	3				
	4	TREE	473'	6'	TRIM OR REMOVE
	5	TREE	469'	16'	TRIM OR REMOVE
	6	TREE	465'	31'	TRIM OR REMOVE
	7	TREE	491'	41'	TRIM OR REMOVE
	8	TREE	450'	11'	TRIM OR REMOVE
	9	TREE	433'	8'	TRIM OR REMOVE
	10	TREE	384'	2'	TRIM OR REMOVE
16X	NONE				
34X	NONE				

NOTE: SOME NAVIGATIONAL AIDS NECESSARY FOR AIRPORT OPERATION PENETRATE RUNWAY PRIMARY AND APPROACH SURFACES.

SOURCE OF OBSTRUCTION INFORMATION: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, OBSTRUCTION CHART OC582, NOVEMBER 1993 (SURVEYED APRIL 1993)

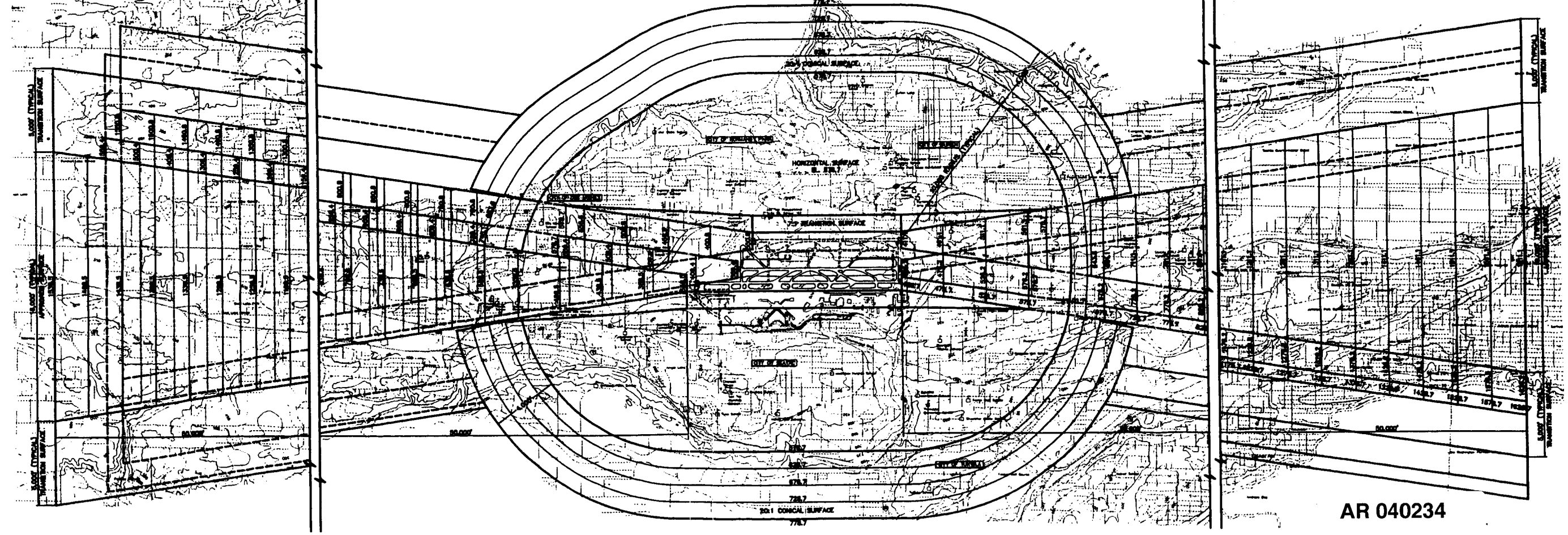
HEIGHT RESTRICTION ZONING OF JURISDICTIONS IN PART 77 AREA

JURISDICTION	PART 77 HEIGHT RESTRICTION ZONING IN EFFECT
AUBURN	NO
BURIEN	NO
DES MOINES	NO
FEDERAL WAY	NO
KENT	NO
KING COUNTY	YES
NORMANDY PARK	NO
SEATAC	YES
SEATTLE	NO
TUKWILA	NO

NOTES

1. GROUND PROFILES ARE COMPOSITES OF THE HIGHEST ELEVATION ACROSS THE WIDTH OF THE APPROACH SURFACE.
2. SEE SHEETS 7, 8 AND 9 FOR COMPLETE APPROACH ZONE PROFILES FOR RUNWAYS 16L-34R, 16R-34L AND 16X-34X
3. ESTABLISHED AIRPORT ELEVATION: 428.7' MSL

DRAFT



AR 040234

P&D Aviation
A Division of
P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92868

PROJECT MANAGER: R. MAYFIELD
PLANNER: S. ALLISON
CADD OPERATOR: S.K.H.
SCALE: 1"=2,000'
DATE: 1-22-96
CHECKED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO	DATE	BY	DESCRIPTION	APP'D

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

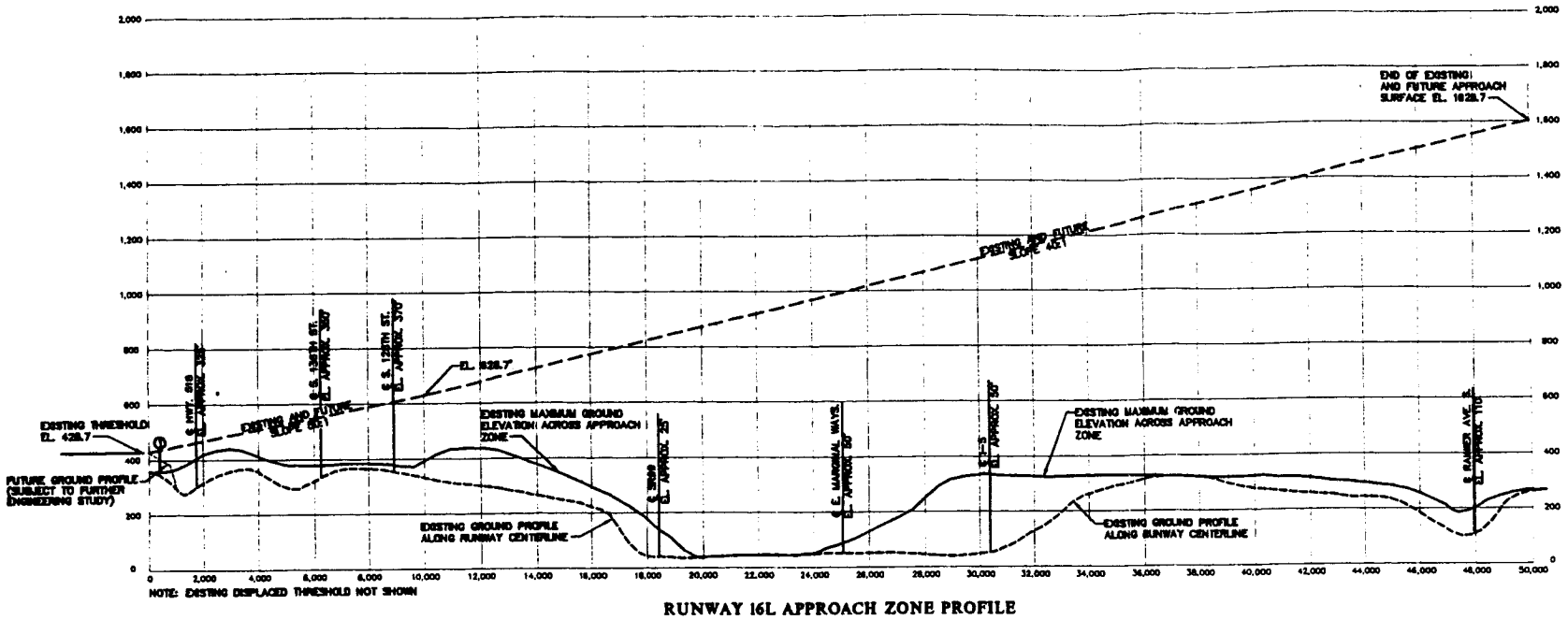
APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT

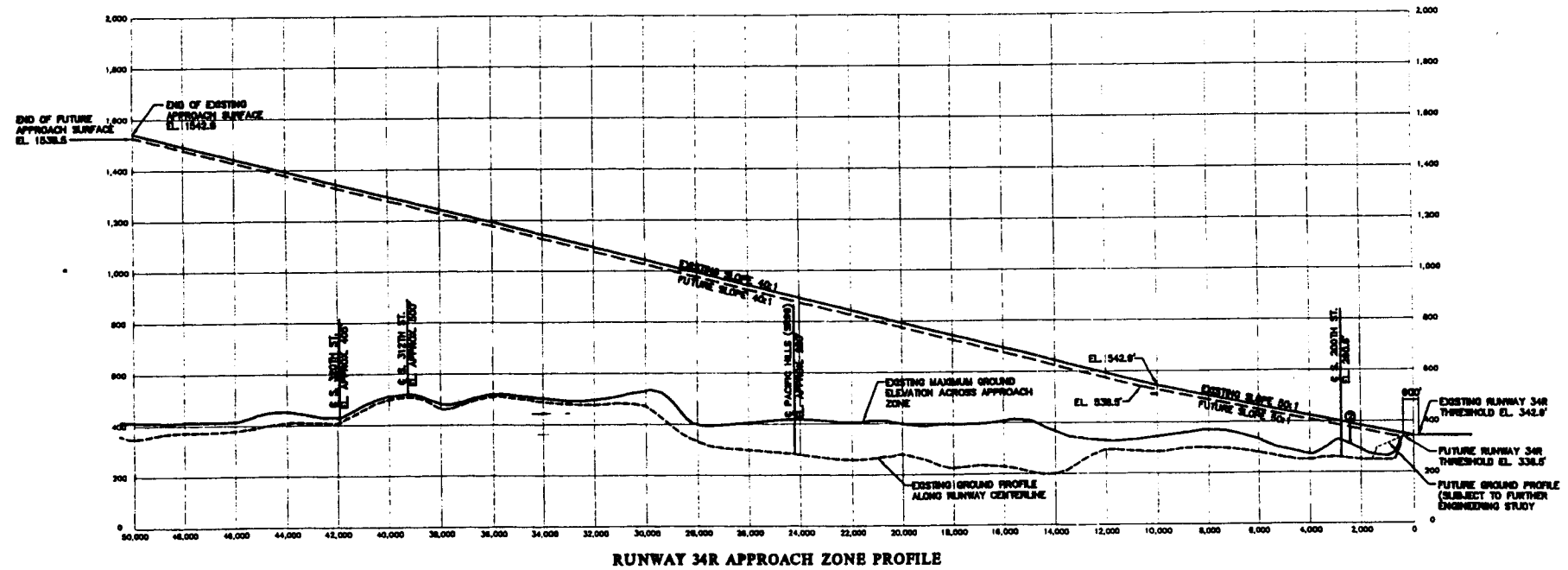
AIRPORT AIRSPACE PLAN

SHEET 6 OF 13

AIRPORT OWNER NO
CONSULTANT'S NO
PORT OF SEATTLE NO



RUNWAY 16L APPROACH ZONE PROFILE



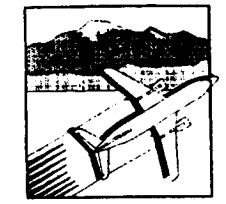
RUNWAY 34R APPROACH ZONE PROFILE

OBSTRUCTION IDENTIFICATION

RUNWAY NO.	OBSTRUCTION NO.	DESCRIPTION	OBS. ELEV. (MSL)	PENETRATION	PROPOSED ACTION
16L	1	TREE	445'	7'	TRIM OR REMOVE
34R	2	TREE	394'	2'	TRIM OR REMOVE

NOTE: SOME NAVIGATIONAL AIDS NECESSARY FOR AIRPORT OPERATION PENETRATE RUNWAY PRIMARY AND APPROACH SURFACES.

SOURCE OF OBSTRUCTION INFORMATION: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, OBSTRUCTION CHART OC56Z, NOVEMBER 1993 (SURVEYED APRIL 1993)



DRAFT

AR 040235

VERTICAL
SCALE IN FEET

HORIZONTAL
SCALE IN FEET

P&D Aviation
A Division of
P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92668

PROJECT MANAGER: R. MAYFIELD
PLANNER: S. ALLISON
CADD OPERATOR: S.A.H.
SCALE: 1" = 2,000'
DATE: 3-25-96
CHECKED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

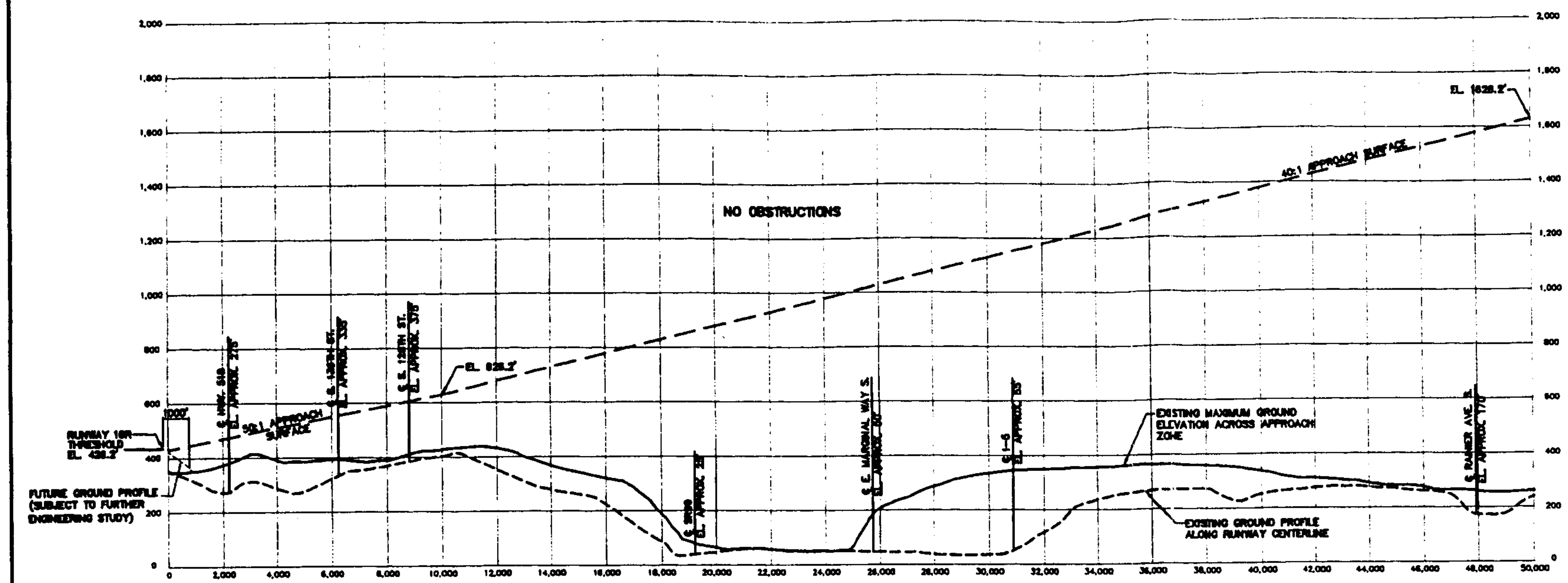
PORT OF SEATTLE

PORT OF SEATTLE APPROVAL
APPROVED BY

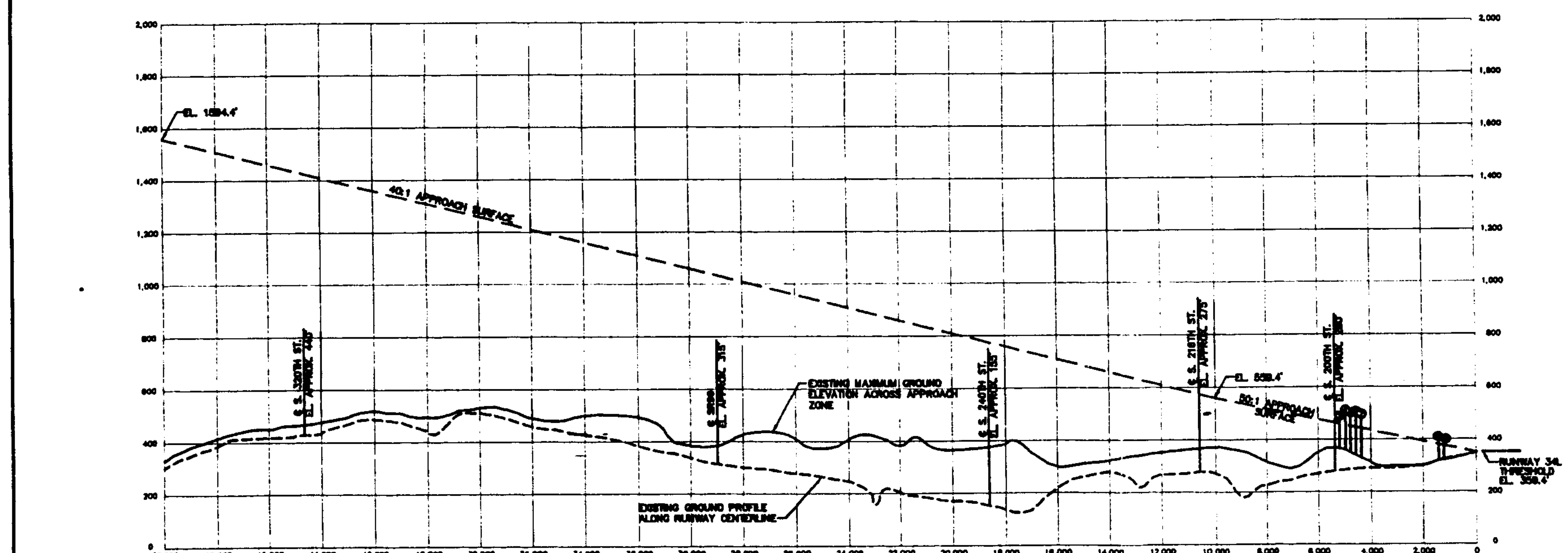
SEA-TAC INTERNATIONAL AIRPORT
APPROACH ZONE PROFILES
RUNWAY 16L - 34R
SHEET 7 OF 13

WORK ORDER NO.
CONSULTANT'S NO.
PORT OF SEATTLE NO.

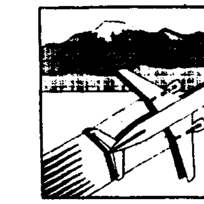
DRAFT



RUNWAY 16R APPROACH ZONE PROFILE



RUNWAY 34L APPROACH ZONE PROFILE



OBSTRUCTION IDENTIFICATION

RUNWAY NO.	OBSTRUCTION NO.	DESCRIPTION	OBS. ELEV. (MSL)	PENETRATION	PROPOSED ACTION
16R	NONE				
34L	3	TREE	472'	9'	TRIM OR REMOVE
	4	TREE	497'	39'	TRIM OR REMOVE
	5	TREE	485'	31'	TRIM OR REMOVE
	6	TREE	491'	41'	TRIM OR REMOVE
	7	TREE	480'	33'	TRIM OR REMOVE
	8	TREE	394'	6'	TRIM OR REMOVE
	9	TREE	386'	2'	TRIM OR REMOVE

NOTE: SOME NAVIGATIONAL AIDS NECESSARY FOR AIRPORT OPERATION PENETRATE RUNWAY PRIMARY AND APPROACH SURFACES.

SOURCE OF OBSTRUCTION INFORMATION: NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION, OBSTRUCTION CHART OC582, NOVEMBER 1993 (SURVEYED APRIL 1993)

AR 040236

VERTICAL
200 0 100 200 400 800
SCALE IN FEET

HORIZONTAL
2,000 0 1,000 2,000 4,000 8,000
SCALE IN FEET

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Orange, CA 92668

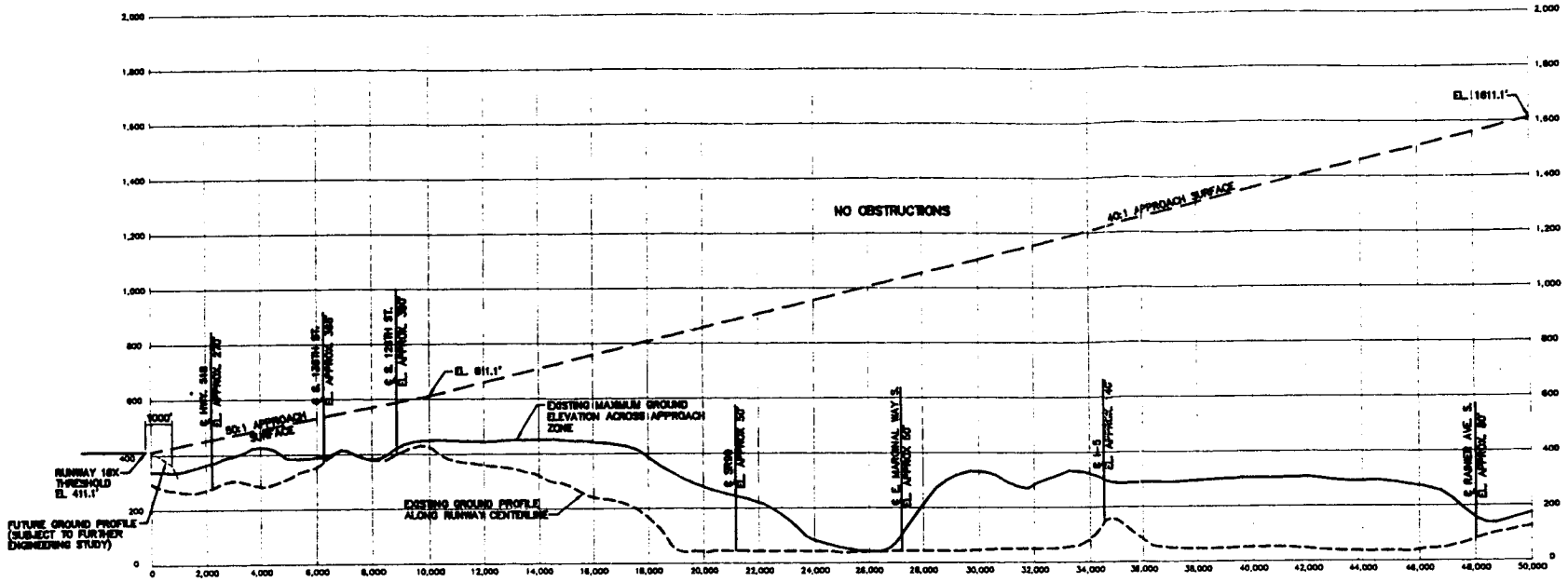
REVISIONS									
NO	DATE	BY	DESCRIPTION	APP'D	NO	DATE	BY	DESCRIPTION	APP'D

PORT OF SEATTLE

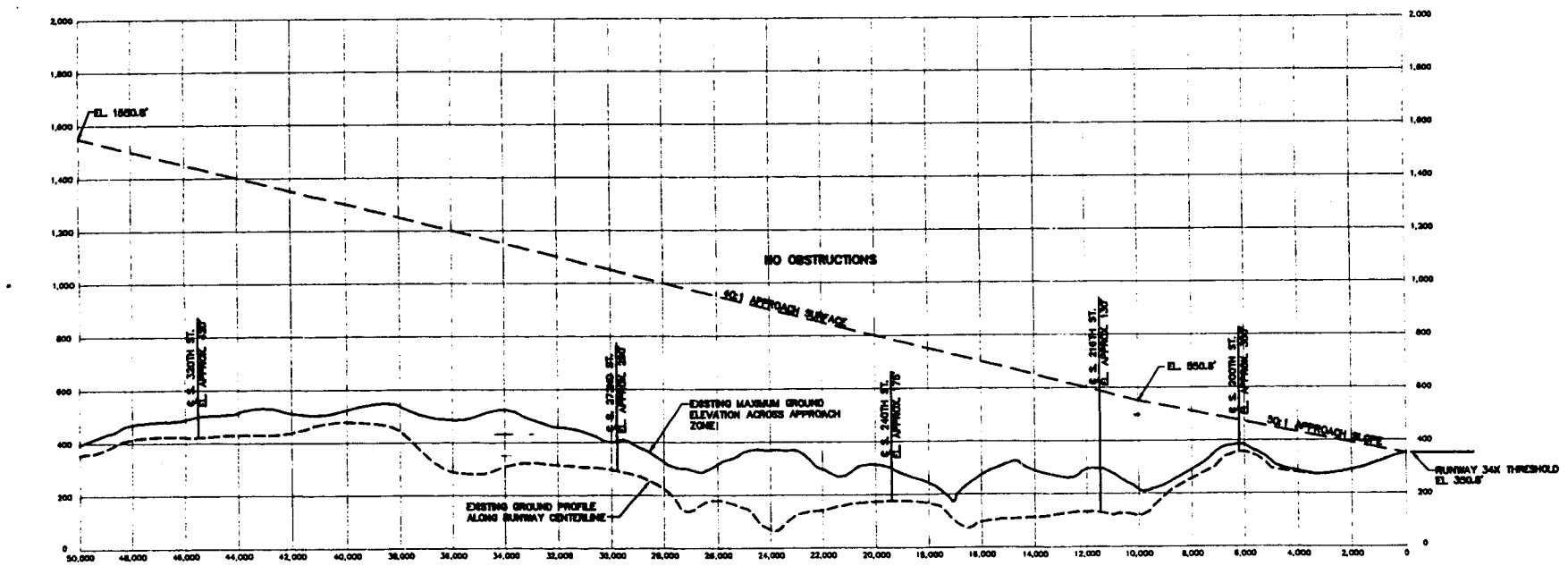
PORT OF SEATTLE APPROVAL

APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT
APPROACH ZONE PROFILES
RUNWAY 16R - 34L
SHEET 8 OF 13



RUNWAY 16X APPROACH ZONE PROFILE



RUNWAY 34X APPROACH ZONE PROFILE

DRAFT

AR 040237

VERTICAL
SCALE IN FEET

HORIZONTAL
SCALE IN FEET

P&D Aviation
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P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92668

PROJECT MANAGER	P. WHITELEY
PLANNER	S. ALLISON
CADD OPERATOR	S.K.H.
SCALE	1"=2,000'
DATE	3-25-98
CHECKED BY	

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

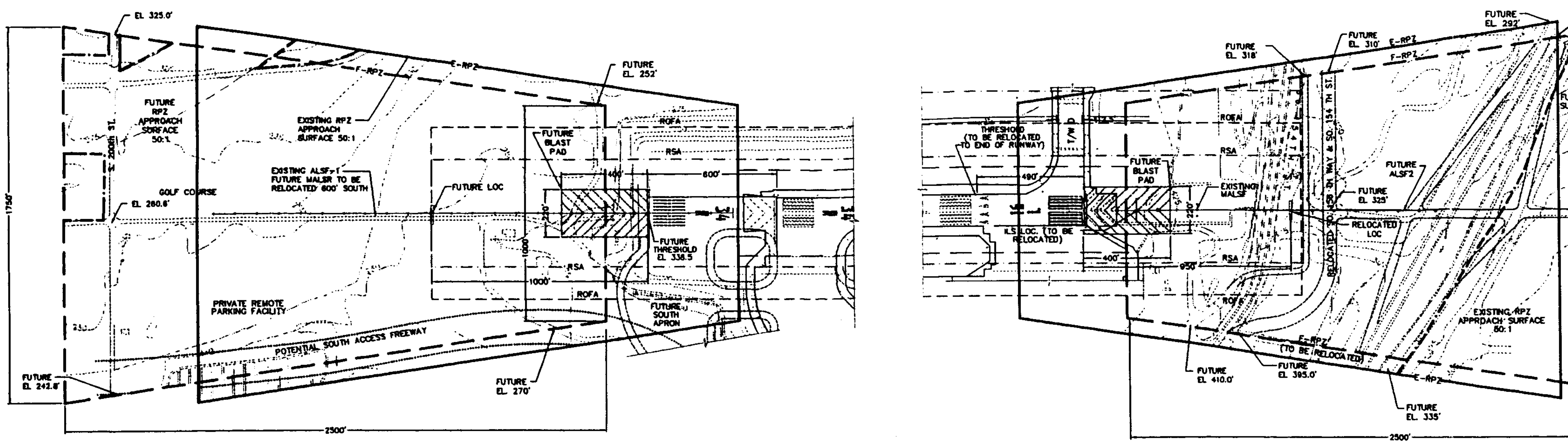
PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY

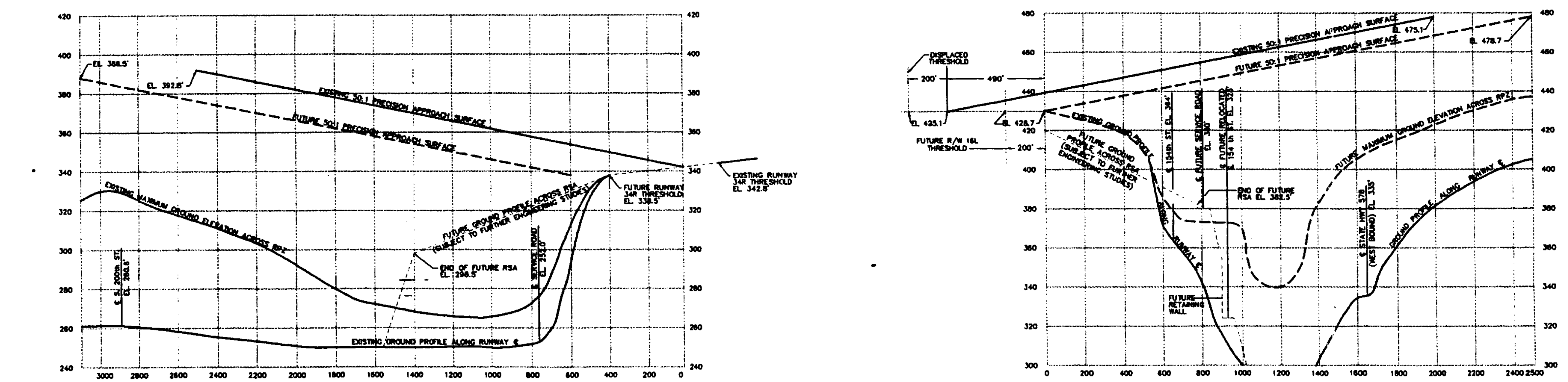
SEA-TAC INTERNATIONAL AIRPORT
APPROACH ZONE PROFILES
RUNWAY 16X - 34X
SHEET 9 OF 13

WORK ORDER NO.
CONTRACT NO.
PORT OF SEATTLE NO.



NOTE: DISPLACED THRESHOLD TO BE RELOCATED TO EXISTING RUNWAY END AFTER FULL LENGTH RUNWAY SAFETY AREA IS COMPLETED.
SEE SHEET 7 FOR OBSTRUCTIONS IN RPZ

RUNWAY PROTECTION ZONE PLANS



RUNWAY PROTECTION ZONE APPROACH PROFILES

AR 040238

DRAFT

Annual Rate of Change: -5.3 min/year

HORIZONTAL SCALE IN FEET

VERTICAL SCALE IN FEET

The preparation of this plan was financed in part through a grant from the Federal Aviation Administration as provided under Section 505 of the Airport and Airway Improvement Act of 1982, as amended. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this plan by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws.

LEGEND

	EXISTING	ULTIMATE
AIRFIELD PAVEMENT		
AIRPORT BOUNDARY		
AIRPORT REFERENCE POINT (ARP)		
BUILDINGS		
AIRCRAFT PARKING RESTRICTION LINE (APRL)	APRL	SAME
GROUND CONTOURS		
FENCE		
ROAD/VEHICLE PARKING		
RUNWAY SAFETY AREA (RSA)	RSA	SAME
PRINCIPAL DRAINAGE FLOW		
RUNWAY OBJECT FREE AREA (ROFA)	ROFA	SAME

ABBREVIATIONS

- ALSF Approach Lighting System With Sequenced Flashing Lights
- ℄ Centerline
- GS Glide Slope
- LOC Localizer
- MALSF Medium Intensity ALSF
- MSL Mean Sea Level
- OFA Object Free Area
- OFZ Object Free Zone
- ROFA Runway Object Free Area
- RPZ Runway Protection Zone
- RSA Runway Safety Area

P&D Aviation
A Division of
P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92668

PROJECT MANAGER: R. AHLFELDT
PLANNER: S. ALLISON
CADD OPERATOR: S.K.H.
SCALE: 1"=240'
DATE: 1-25-96
CHECKED BY

REVISIONS									
NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

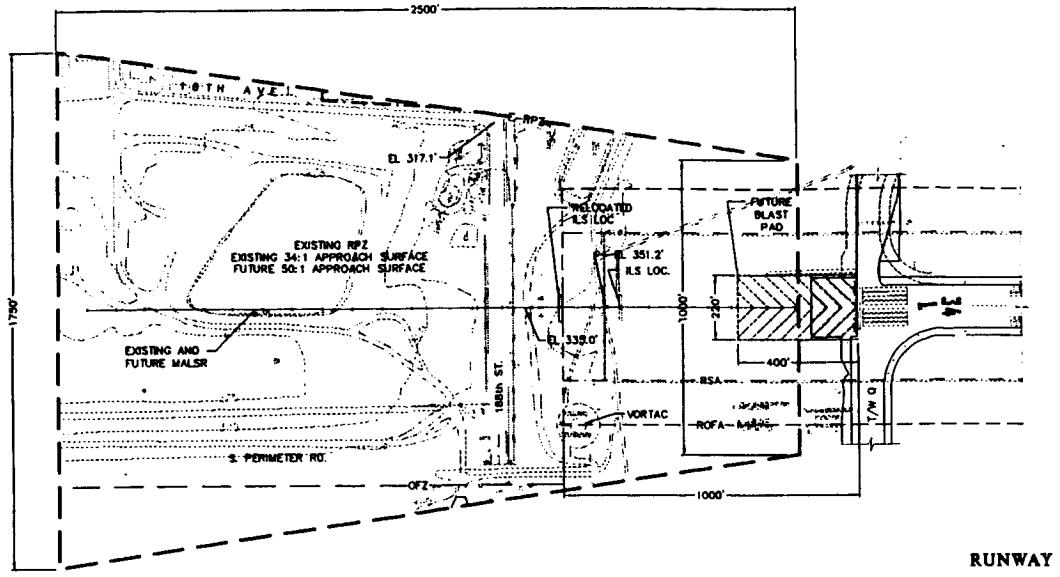
PORT OF SEATTLE

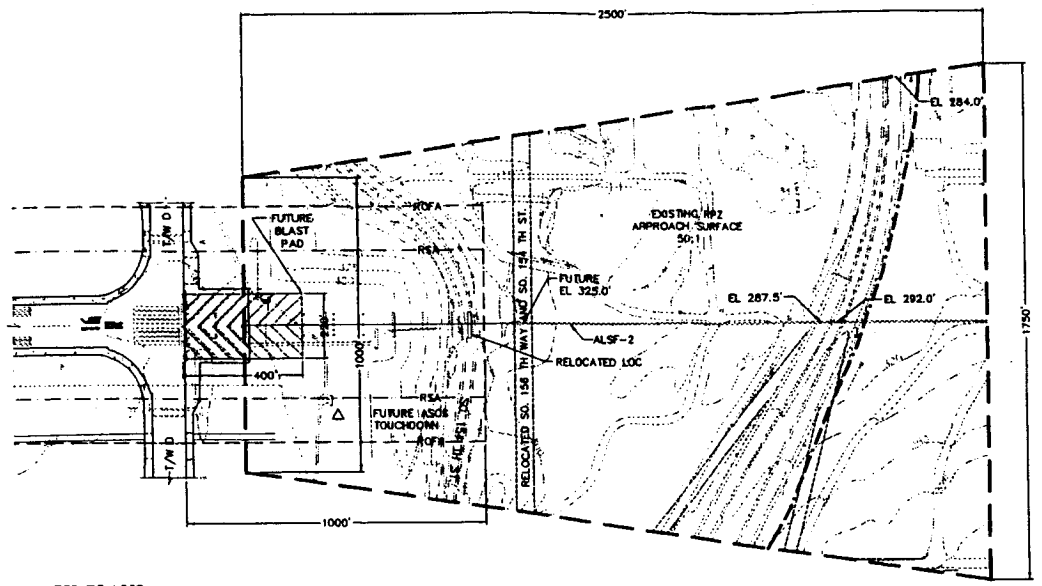
PORT OF SEATTLE APPROVAL

APPROVED BY

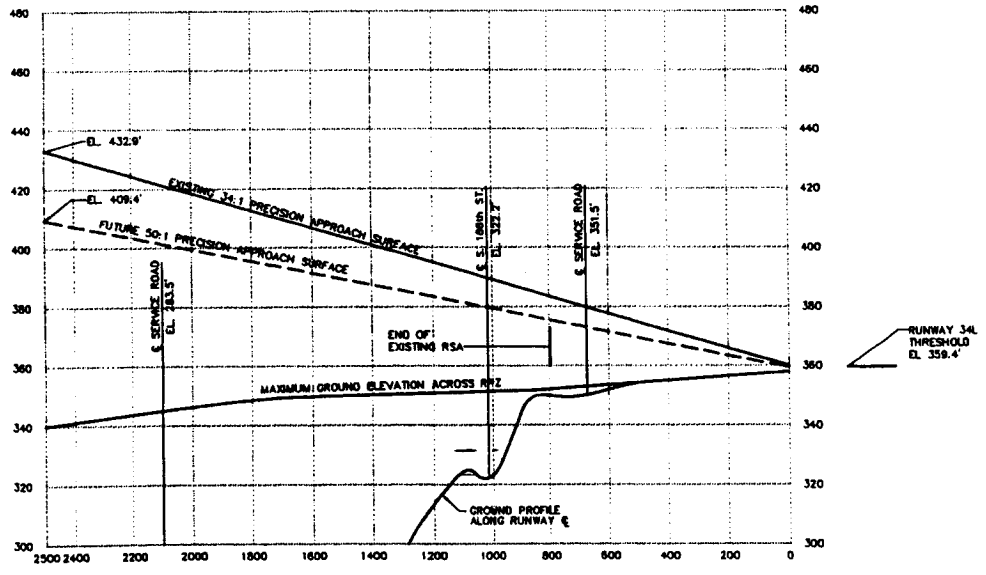
SEA-TAC INTERNATIONAL AIRPORT
RUNWAY PROTECTION ZONE PLANS AND PROFILES
RUNWAY 16L - 34R
SHEET 10 OF 13

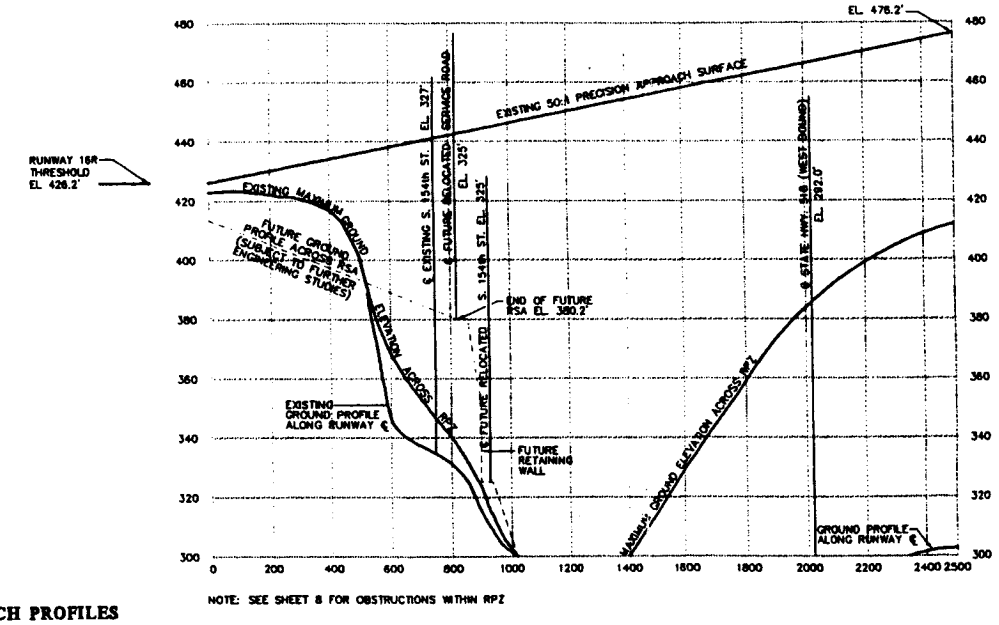
HOME ORDER NO.
CONSULTANT'S NO.
PORT OF SEATTLE W/





RUNWAY PROTECTION ZONE APPROACH PLANS





NOTE: SEE SHEET 8 FOR OBSTRUCTIONS WITHIN RPZ

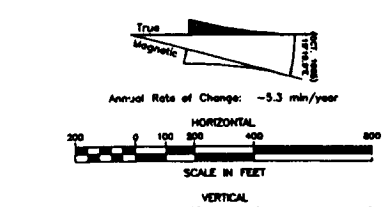
RUNWAY PROTECTION ZONE APPROACH PROFILES

AR 040239

LEGEND	EXISTING	ULTIMATE
AIRFIELD PAVEMENT		
AIRPORT BOUNDARY		
AIRPORT REFERENCE POINT (ARP)	●	
BUILDINGS		
AIRCRAFT PARKING RESTRICTION LINE (APRL)	APRL	SAME
GROUND CONTOURS		
ROAD		
ROAD/VEHICLE PARKING		
RUNWAY SAFETY AREA (RSA)	RSA	SAME
PRINCIPAL DRAINAGE FLOW		
RUNWAY OBJECT FREE AREA (ROFA)	ROFA	SAME

ABBREVIATIONS

ALSF	Approach Lighting System With Sequenced Flashing Lights
℄	Centerline
GS	Glide Slope
LOC	Localizer
MALSF	Medium Intensity ALSF
MSL	Mean Sea Level
OFA	Object Free Area
OFZ	Object Free Zone
ROFA	Runway Object Free Area
RPZ	Runway Protection Zone
RSA	Runway Safety Area



The preparation of this plan was financed in part through a grant from the Federal Aviation Administration as provided under Section 505 of the Airport and Airway Improvement Act of 1982, as amended. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this plan by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws.

P&D Aviation
A Division of
P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92668

PROJECT MANAGER: R. AMSFELDT
PLANNER: S. ALLISON
CADD OPERATOR: SKH
SCALE: 1" = 200'
DATE: 1-22-96
CHECKED BY:

REVISIONS

NO.	DATE	BY	DESCRIPTION	APP'D	NO.	DATE	BY	DESCRIPTION	APP'D

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT
RUNWAY PROTECTION ZONE PLANS AND PROFILES
RUNWAY 16R - 34L
SHEET 11 OF 13

WORK ORDER NO
CONSULTANT'S NO
PORT OF SEATTLE NO

DRAFT

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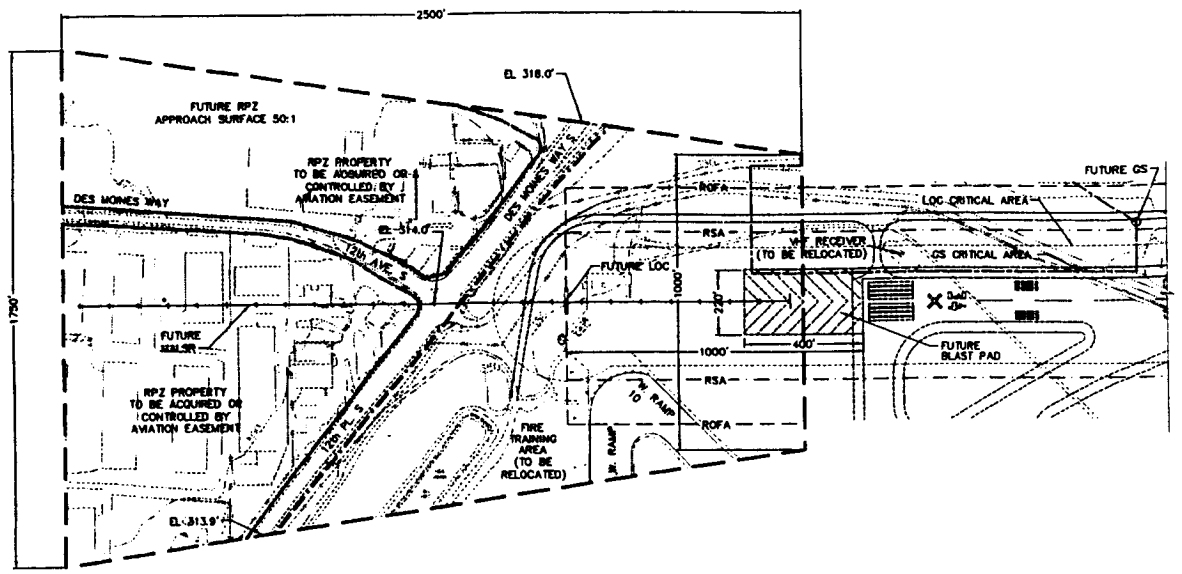
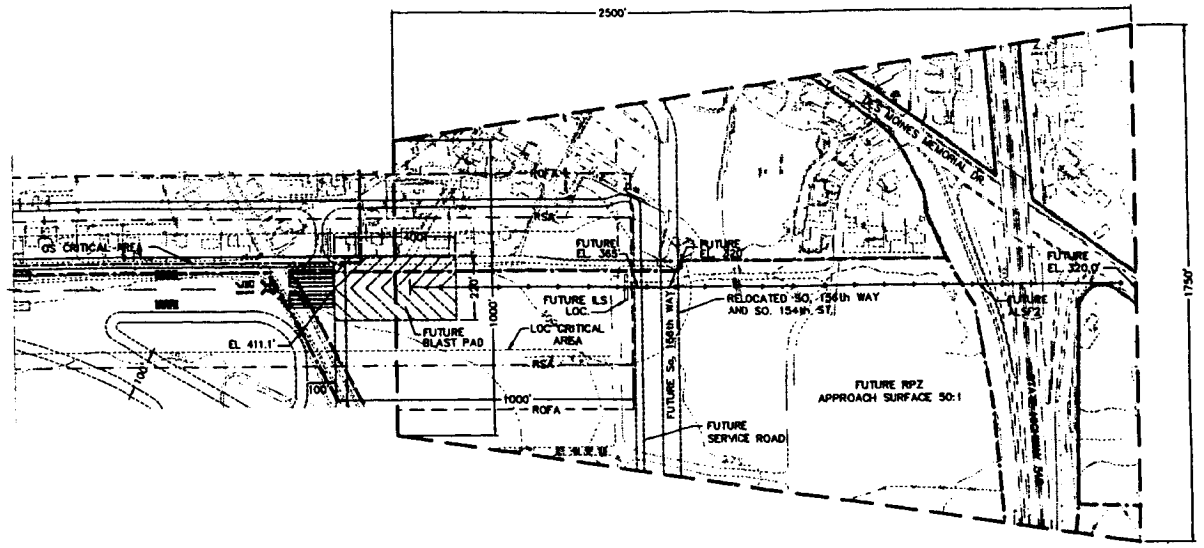
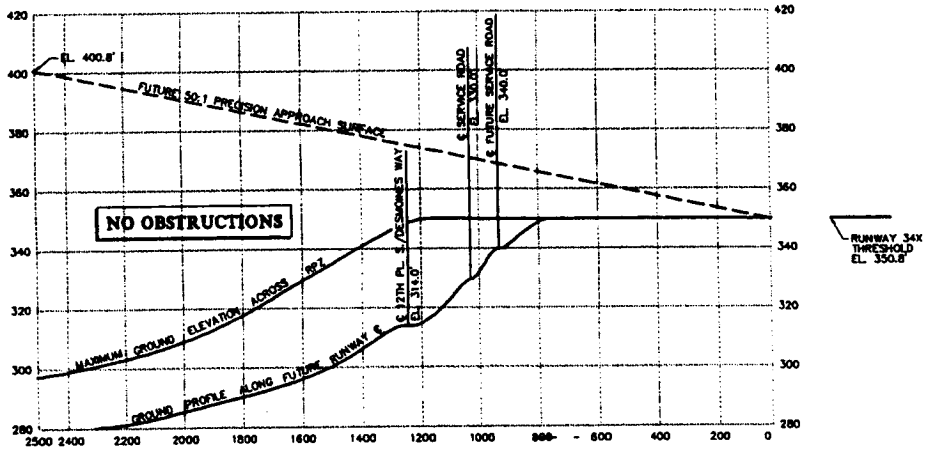
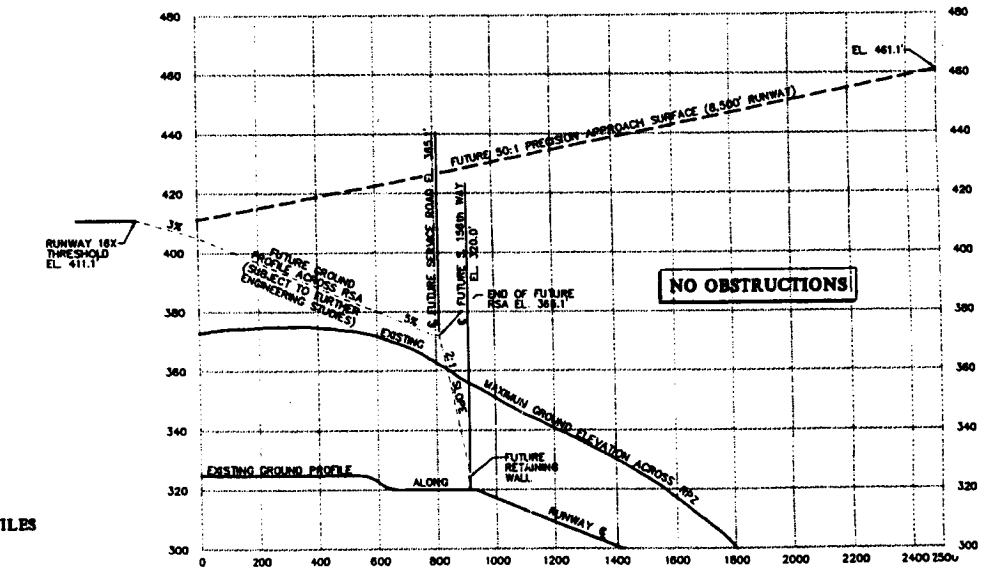


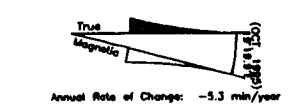


RUNWAY PROTECTION ZONE PLANS

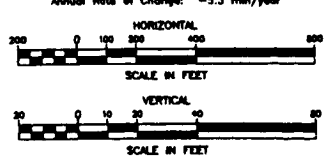




RUNWAY PROTECTION ZONE APPROACH PROFILES



Annual Rate of Change: −5.3 min/year



LEGEND	EXISTING	ULTIMATE
AIRFIELD PAVEMENT		
AIRPORT BOUNDARY		
AIRPORT REFERENCE POINT (ARP)	⊕	⊕
BUILDINGS		
RUNWAY PARKING RESTRICTION LINE (APRIL)	APRIL	SAME
GROUND CONTOURS	520	
ROAD		
ROAD/VEHICLE PARKING		
RUNWAY SAFETY AREA (RSA)	RSA	SAME
PRINCIPAL DRAINAGE FLOW		
RUNWAY OBJECT FREE AREA (ROFA)	ROFA	SAME

ABBREVIATIONS

ALSF	Approach Lighting System With Sequenced Flashing Lights
℄	Centerline
GS	Glide Slope
LOC	Localizer
MALSF	Medium Intensity ALSF
MSL	Mean Sea Level
OFA	Object Free Area
OFZ	Object Free Zone
ROFA	Runway Object Free Area
RPZ	Runway Protection Zone
RSA	Runway Safety Area
R/W	Runway
T/W	Taxiway

AR 040240

The preparation of this plan was financed in part through a grant from the Federal Aviation Administration as provided under Section 505 of the Airport and Airway Improvement Act of 1982, as amended. The contents do not necessarily reflect the official views or policy of the FAA. Acceptance of this plan by the FAA does not in any way constitute a commitment on the part of the United States to participate in any development depicted therein nor does it indicate that the proposed development is environmentally acceptable in accordance with appropriate public laws.

P&D Aviation
A Division of
P&D Consultants, Inc.
1100 Town & Country Rd., 300
Orange, CA 92668

PROJECT MANAGER: R. SHUFELDT
PLANNER: S. ALLISON
LEAD OPERATOR: S.R.H.
SCALE: 1" = 200'
DATE: 1-23-96
CHECKED BY:

REVISIONS

NO	DATE	BY	DESCRIPTION	APP'D	NO	DATE	BY	DESCRIPTION	APP'D

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

APPROVED BY

SEA-TAC INTERNATIONAL AIRPORT
RUNWAY PROTECTION ZONE PLANS AND PROFILES
RUNWAY 16X - 34X

SHEET 12 OF 13

WORK ORDER NO
CONSULTANT'S NO
PORT OF SEATTLE NO

DRAFT

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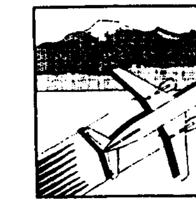
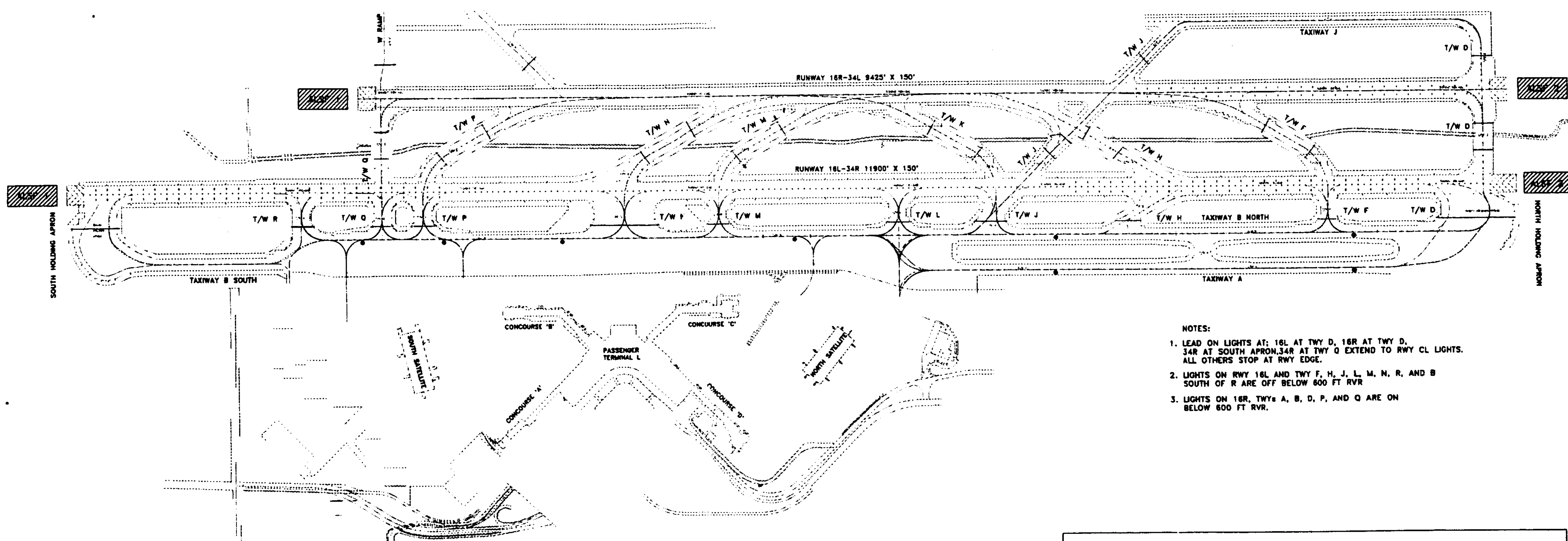
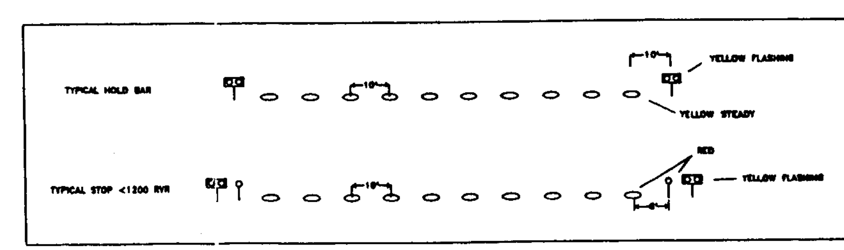




NOTES:
1. LEAD ON LIGHTS AT; 16L AT TWY D, 16R AT TWY D, 34R AT SOUTH APRON,34R AT TWY Q EXTEND TO RWY CL LIGHTS. ALL OTHERS STOP AT RWY EDGE.
2. LIGHTS ON RWY 16L AND TWY F, H, J, L, M, N, R, AND B SOUTH OF R ARE OFF BELOW 600 FT RVR
3. LIGHTS ON 16R, TWYs A, B, D, P, AND Q ARE ON BELOW 600 FT RVR.



AR 040241

SCALE IN FEET

Annual Rate of Change: -5.3 min/year

NOTES:

MODIFICATIONS TO DESIGN STANDARDS (AC 150/5340-1G AIRPORT MARKING)
1. "GEOGRAPHIC POSITION MARKINGS" FOLLOW CURVE FOR TAXIWAYS A & B INSTEAD OF LOCATION PRIOR TO CURVE.
2. "ROAD ZIPPER LINE" IS ONE-FOOT BY THREE-FEET INSTEAD OF ONE-FOOT BY FOUR-FEET.

MODIFICATIONS TO DESIGN STANDARDS (AC 150/5340-19 TAXIWAY CENTERLINE LIGHTING SYSTEM)
1. TAXIWAY CENTERLINE LIGHTING AT TAXIWAY 'D' ENTRANCE TO RUNWAY 16L AND RUNWAY 16R AND SOUTH HOLDING APRON TO RUNWAY 34R EXTEND TO RUNWAY CENTERLINE AT DISPLACED THRESHOLD (R/W 16L) INSTEAD OF STOPPING AT RUNWAY EDGE.

MODIFICATIONS TO DESIGN STANDARDS (AC 150/5340-1F MARKING OF PAVED AREAS ON AIRPORTS)
1. HOLDING POSITION MARKINGS ON TAXIWAYS B-2 (H) AND B-3 (J) ARE PARALLEL TO RUNWAY CENTERLINE INSTEAD OF PERPENDICULAR TO TAXIWAY CENTERLINE.

DRAFT

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Orange, CA 92668

REVISIONS

PORT OF SEATTLE

PORT OF SEATTLE APPROVAL

SEA-TAC INTERNATIONAL AIRPORT
SURFACE MOVEMENT AND GUIDANCE SYSTEM
SHEET 13 OF 13

ATTACHMENT D TO PORT COMMISSION RESOLUTION NO. 3212, AS AMENDED

Mitigating Measures Relating to Port Commission Resolution No. 3212, As Amended

Set forth below is a list of mitigating measures that shall be implemented in conjunction with the actions authorized in Port Commission Resolution No. 3212, As Amended. This list is limited to mitigating measures related to Resolution 3212, As Amended, and does not include a complete list of all mitigating measures that could be required for implementation of the Master Plan Update. As the Port Commission continues to consider and approve actions to implement the Master Plan Update, additional mitigating measures may be required. A more complete list of possible mitigating measures is included in the Final EIS for Proposed Master Plan Update Development Actions and are summarized in Attachment A to Resolution 3212, As Amended. The mitigating measures set forth below are subject to further refinement and revision as plans are finalized and permitting processes are completed.

The noise and land use mitigation items discussed below are in addition to, or complement, the noise reduction measures called for by the Puget Sound Regional Council (PSRC) in the Metropolitan Transportation Plan. The noise measures called for by PSRC are included as Attachment E to Commission Resolution No. 3212, As Amended.

(1) **Noise and Land Use**.

- Continue implementation of sound insulation programs as described in Port Commission Resolution 3125, As Amended, Section 1 (c), including: (1) acoustical insulation of eligible single family residences on the waiting list as of December 31, 1993, before commencing construction of the new runway; (2) acoustical insulation of remaining eligible single family residences on the waiting list, prior to operation of the new runway; (3) acoustical insulation of all single family residences that become eligible as a result of actions taken based on the Master Plan Update EIS and are on the waiting list as of December 31, 1997, prior to operation of the new runway; and (4) amendment of the acoustical insulation program to include multi-family residences, schools, and other institutional uses.

- Continue implementation of the existing Noise Abatement and Noise Remedy Programs, including but not limited to the Noise Budget, Nighttime Stage 2 Aircraft Limitations, Ground Noise Control, Flight Corridor Noise Abatement Procedures, and Flight Track and Noise Monitoring. Expand the Noise Abatement and Noise Remedy Programs to include the following additional elements:

- Initiate acoustical insulation for appropriate noise level compatibility of the long-term future use for the five

significantly noise impacted buildings identified in Chapter IV, Section 2(4)(C) of the FEIS, if the owners consent.

- Initiate sound audits of certain residences located west of the current flight tracks and provide additional directional soundproofing if appropriate.

- Update the Airport's FAR Part 150 Noise Compatibility Plan to consider potential improvements and to evaluate potential residential acquisition in the Approach Transitional Zones of the new runway.

- Continue to work with local jurisdictions to communicate land use and planning information and to support local zoning and construction controls that promote compatible development.

(2) **Water Quality**.

a. Construction Erosion and Sedimentation Control Plan. Prepare a construction erosion and sedimentation control plan for the construction of the new runway. The plan shall require use of Best Management Practices including but not limited to the following:

- Erosion control measures such as use of mulching, silt fencing, sediment basins, and check dams that are properly applied, installed, and maintained pursuant to agreements with contractors.

- Spill containment areas to capture and contain spills at construction sites and prevent their entry into surface or ground waters. Install proper temporary fuel storage areas and maintenance areas to reduce the potential for spills and contamination.

- Phasing of construction activities to minimize the amount of area that is disturbed and exposed at any one time.

- Where feasible, use of temporary and permanent terraces for fillslopes and cutslopes to reduce sheet and rill erosion and reduce transport of eroded materials from the construction site.

- Install gravel and wheel wash facilities on construction equipment access roads and encourage covering of loads to minimize sediment transport onto nearby roads.

b. Stormwater Management Plan. Prepare a stormwater management plan for the new runway that includes the following:

- Detention criteria should be based upon Department of Ecology standards limiting 2-year peak flow rates from the developed portions of the site to 50% of the existing 2-

year rate, limiting the developed 10-year rate to the existing 10-year rate, and limiting the developed 100-year flow rate to the existing 100-year rate. Stormwater detention should comply with the requirements of the *King County Surface Water Design Manual*.

- Design stormwater facility outlets to reduce channel scouring, sedimentation and erosion, and improve water quality. Where possible, flow dispersion and outlets compatible with stream mitigation should be incorporated into engineering designs.

- Maintain existing and proposed new stormwater facilities. Stormwater management facilities should be maintained according to procedures specified in the operations manuals of the facilities.

c. NPDES Permit Requirements. Comply with the requirements of the National Pollution Discharge Elimination System permit for the airport dated June 30, 1994, as may be revised from time to time.

d. Ground Water. Because of concerns with alternate site usage and possible ground water/aquifer contamination, the Port will not excavate material from borrow source site 5 until a specific site design has been developed and coordinated with the Seattle Water Department.

(3) **Wetlands**.

- Avoid potential impacts to wetlands by transporting fill from off-site borrow sources rather than using fill from on-site Borrow Site No. 8 (as identified in the FEIS) which will avoid potential impacts to approximately 16 acres of wetlands at Borrow Site No. 8.

- In cooperation with the U.S. Army Corps of Engineers and the state Department of Ecology, prepare and implement final compensatory wetland mitigation plans for construction/enhancement of wetlands at the lower Green River Valley site identified in the FEIS. The plans shall be in general conformance with the Natural Resource Mitigation Plan set forth at Appendix P to the FEIS, subject to revision based on discussions with permitting agencies.

(4) **Plants and Animals**. In cooperation with the state Department of Fish and Wildlife, prepare and implement final plans for the relocation of those portions of Miller Creek and its tributaries necessary for construction of the new runway. The plans shall be in general conformance with the Natural Resource Mitigation Plan set forth at Appendix P to the FEIS, subject to revision based on discussions with permitting agencies.

(5) **Earth**.

- The FEIS identifies two seismic hazard areas on the site of the new runway, referred to as "relatively small areas of loose shallow sediment". Removal of the sediment and replacement with compacted fill, or other appropriate engineering approach to stabilizing these areas, should be included in the final engineering plans.

- Prepare a landscaping plan for the new runway area, including plans for seeding and planting of vegetation to stabilize areas of fill that will not be covered by impervious surface.

(6) **Construction Impact Mitigation**.

- Prepare Interim Fill Material Transport Guidelines relating to the acquisition of free or low cost fill material to be hauled by trucks and placed on existing airport property as authorized in Resolution 3212, As Amended. The Interim Guidelines should include a process for designating preferred haul routes and specific conditions such as hours of operations, traffic control changes, and route mitigation. Depending upon the selected contractor(s) haul routes, such controls could include: provisions that restrict truck traffic during AM and PM peak periods; provisions that require the contractor to cover all loads to reduce debris and dust loss from the transport activities; and provisions for street cleaning and pavement repairs during the construction process. The Interim Guidelines are intended to govern the initial stages of acquisition and placement of fill material at the airport, and they will remain in effect until completion of the Construction and Earthwork Management Plan referenced below.

- Prepare a Construction and Earthwork Management Plan to govern the acquisition and placement of fill material for Master Plan Update development actions. In addition to the transport matters covered by the Interim Guidelines referenced above, the Plan should address the methods selected for acquiring and transporting fill material to the airport development sites. The Plan's contents will depend on the methods ultimately selected and may include such topics as construction of temporary access ramps and roads, shoreline dock facilities, conveyor systems, and/or rail facilities.

- Prepare a construction acquisition plan, to mitigate the disruption that could occur in the general vicinity of the proposed new runway construction. This acquisition plan should consider inclusion of about 70 residential and commercial properties located east of Des Moines Memorial Drive between SR 509 and SR 518.

ATTACHMENT E TO PORT COMMISSION RESOLUTION NO. 3212, AS AMENDED

Puget Sound Regional Council (PSRC) Metropolitan Transportation Plan (MTP), Appendix G - Air Transportation Noise Reduction Measures and Implementing and Monitoring Steps

I. The Port of Seattle

The Port of Seattle will pass a Port Commission resolution affirming that it agrees to:

A. Evaluate and upgrade its existing noise monitoring system to include the use of approximately 25 noise monitors, develop a schedule for completion by the end of 1998, and thereafter disseminate regular reports to the public using data from the new noise monitoring system to include DNL, SEL and Time Above metrics.

B. Work with the FAA and/or airlines to:

1. Analyze the potential for reducing the use of thrust reversers.

2. Voluntarily minimize the number of flights in the middle of the night (1:30-5:30 a.m.).

3. Continue to enforce Airport Rules and Regulations to minimize the number of variances for the Nighttime Limitations Program.

4. Work with foreign air carriers to gain cooperation in ensuring that Stage 3 aircraft continue to be used for nighttime international flights.

5. Work with the owners/operators of Stage 2 aircraft under 75,000 pounds to voluntarily limit or eliminate their use.

6. Continue to work to enforce Airport Rules and Regulations to minimize nighttime engine run-ups.

C. Modify its existing contract with noise experts to specifically include the need to review methods of mitigating the impacts of low frequency noise and vibration, and to supply such information to the Port.

D. Design and implement a noise compatible land use plan for Port properties within its current acquisition zone.

E. Complete the "sensitive use" public buildings insulation pilot studies.

F. Seek a public commitment from FAA to evaluate actions needed to prevent apparent violations of the North Flow Nighttime Departure Noise Abatement Procedures to the extent that safety and efficiency allow.

G. In carrying out the Part 150 Study:

1. The Port of Seattle will invite the Regional Council, the FAA, and affected parties to participate, and ensure that they are able to participate actively and constructively, in the Port's upcoming Part 150 study, which will commence in the fall of 1996 and is expected to take two to three years.

2. Part 150 Study participants will be invited to take part in developing the scope of the study, consultant selection, and in all other milestones and products of the project, such as development of noise exposure maps; development of noise reduction and land use compatibility measures; and Port consideration and approval of the program.

3. Items to be considered in developing the scope of the Part 150 Study will include but not necessarily be limited to:

   a. Relocation of run-up areas where daytime engine run-ups occur, to reduce ground-related noise.
   b. Evaluating the potential net benefits of preferential runway use during low activity periods.
   c. Evaluating benefits and impacts of changes to departure climb profiles.
   d. Analysis of need to adjust Noise Remedy Program boundaries to include those in 65 DNL by the year 2000, provided that the Port will not reduce its established Noise Remedy Program boundaries for currently eligible properties.
   e. Evaluating scope, boundaries and funding for public use and multi-family buildings.

4. If, as a result of the Part 150 Study, a proposed noise reduction strategy results in a net improvement but causes a transfer of noise impacts to other communities, the Port of Seattle, Regional Council, FAA and communities affected by airport noise will seek agreement on guidelines or other equitable procedures for dealing fairly with conflicting views and needs of different communities.

5. The Port of Seattle will ask the FAA to include within its Record of Decision on the Master Plan Update Final Environmental Impact Statement the requirement to conduct a Part 150 Study with the goal of assessing needed additional noise abatement and mitigation.

H. School Insulation

1. The Port of Seattle will commit up to $50 million for school insulation.

2. The Port of Seattle will meet with the Highline School District to try to reach agreement on a plan for insulating the District's schools. If direct talks between the District and Port fail to produce agreement on a noise insulation program for the District's schools, the Port may request that the PSRC assist the parties in selecting an independent mediator.

3. The Port will initiate the Highline School District school insulation program consistent with an agreement reached by the District and Port.

4. Once the Port of Seattle completes the sound insulation program for schools affected by aircraft noise exposure of 65 DNL from Sea-Tac International Airport, it will investigate feasibility and funding for insulating schools affected by then current 60-65 DNL aircraft noise exposure from Sea-Tac. Sound insulation must comply with FAA eligibility criteria to achieve measurable noise benefit.

I. Deliver to the Regional Council on or before September 5, 1996, a detailed timetable for carrying out the steps specified in subsections A through H of this section, including (a) defined milestones against which the Port's progress toward completion of those steps may be measured, and (b) a schedule for progress on planning, design, and construction of a third runway at Sea-Tac Airport.

II. Highline School District

The Highline School District will:

A. Meet with the Port of Seattle to try to reach agreement on a plan for insulating the District's schools. If direct talks between the District and the Port fail to produce agreement on a noise insulation program for the District's schools, the District may request that the PSRC assist the parties in selecting an independent mediator.

B. Initiate its school insulation program, consistent with an agreement reached with the Port of Seattle.

III. Puget Sound Regional Council

The Puget Sound Regional Council will:

A. Seek funding to (a) actively participate in the Port's upcoming Part 150 Study; (b) undertake a study to evaluate a financing mechanism for the acquisition of incompatible uses as noted in III-G, below; and (c) conduct surveys as noted in III-H, below.

B. As part of its Policy and Plan Review process, the PSRC will:

1. Conduct an initial review of land use plans for areas that are within the 65 Ldn contour, and provide annual review of future changes;

2. Offer assistance to jurisdictions in finding ways to minimize the introduction of incompatible land uses;

3. Provide facilitation services, if requested by the Port of Seattle and jurisdictions in the vicinity of Sea-Tac Airport, to reach agreement on ways to redevelop currently incompatible land uses.

C. Upon receipt of a Resolution approved by the Port of Seattle that contains all the items noted under Port of Seattle Resolution, above, the Executive Director of the PSRC will notify the Executive Board that the Metropolitan Transportation Plan amendment including a third runway at Sea-Tac Airport has taken effect.

D. Encourage King County to continue its efforts to eliminate the two nighttime Alaska Airlines Stage 2 flights from Boeing Field.

E. Seek support for state legislation for state policies regarding land use compatibility around commercial airports, and will seek support for federal legislation to allow use of federally approved funding for insulation and acquisition programs beyond the current federal constraints.

F. Annually convene representatives of the Port of Seattle, FAA, communities affected by airport noise, and other interested parties, to coordinate efforts by all parties to alleviate issues that are undercutting the effectiveness of current noise reduction efforts and eliminate roadblocks to resolving issues, then report on progress to the Executive Board.

G. Undertake a study which evaluates use of a state-financed revolving fund, or other financing mechanism (such as a public/private partnership) for the acquisition of incompatible uses within the 65 DNL to the 75 DNL contour, for conversion to noise compatible non-residential uses. Any such funding mechanism must demonstrate a balance between long-term costs and revenues. The results of the study should be presented to the Executive Board by June 30, 1997.

H. Conduct statistically valid surveys, during and after construction of the third runway, to assess Sea-Tac Airport's effects on such items as noise, transportation/circulation, and land uses in the surrounding communities.

I. Recommend that the State, in cooperation with appropriate local jurisdictions and regional transportation planing organizations, implement a comprehensive process for evaluating all options to meet the State of Washington's long-term air travel and inter-regional ground transportation needs, including high speed rail.

IV. Washington State Department of Transportation and Transportation Commission

The Washington State Department of Transportation and Transportation Commission will:

A. Seek funding for acceleration of efforts to provide improved higher speed rail service in the I-5 Corridor.

B. Seek legislation similar to what was approved for general aviation airports during the 1996 session, to provide state policies for land use compatibility around commercial airports.

V. Monitoring Compliance

To ensure that measures contained in this Appendix G to the 1995 Metropolitan Transportation Plan are implemented as described, several mechanisms for tracking success and assuring accountability will be implemented. They include:

A. The Port of Seattle will report to the Regional Council twice yearly on progress toward all the efforts encompassed in this action, and

B. King County will report to the Regional Council Executive Board every six months on progress toward eliminating nighttime Stage 2 flights at King County International Airport, and

C. Regional Council staff will report annually to the Executive Board on its participation in the Part 150 Study and, based on its Policy and Plan Review Process, on progress toward minimizing the introduction of incompatible land uses within the 65 Ldn contour.